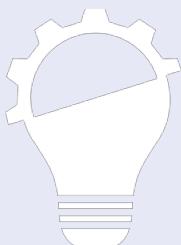


Industrial Design Engineering

Project Booklet

Design for Fibromyalgia and Fibro-Fog



Group 21

Ciara Bates
Rory Bateman
Barbara Guth

Our Team

Introduction of team members and roles within the project

1



Barbara Guth

Chief Technical Officer

As CTO I am in charge of outlining the technical research plan and making sure that the analysis is carried out in the correct way.

Later on in the project I will oversee the regulatory product labelling, warnings, user guide requirements and risk analysis. It is also my responsibility to collect CAD data, and outline the prototyping process plan, evaluation and selection. This will involve material and component specification research, considering design for manufacture / assembly.



Rory Bateman

Chief Operations Officer

As COO I oversee the team's timetable, making sure internal and external deadlines are met. I will record attendance for collaborative working sessions, making sure that communication between team members and users is consistent.

I will also be in charge of the budget management & recording, and overall project planning through the use of Gantt chart tracking. I will oversee decisions about task delegation and record this information centrally for everybody to access.



Ciara Bates

Chief Creative Officer

As CCO I oversee the team's graphic style, defining colour scheme, fonts and formatting. I will also be in charge of making decisions about branding development (eg. name and logo) and videography, including storytelling and narrative structure.

For the product design, I will focus on colours, materials and finishes, informed by analysis of market design trends. It is my responsibility that the packaging design, user interface and visual product renders are completed for marketing materials.

As a team we will share the role of Chief Information Officer

This involves gathering and synthesising information. In order to share this role effectively, all our data and research findings will be kept on a group Miro board.

What is Fibromyalgia?

An introduction to our project theme, summarising our initial secondary research and justification of why we picked our chosen user group.

2

Fibromyalgia, also known as 'Fibro' is a chronic condition that causes **muscle pain, fatigue and cognitive issues**. There is no known cure or definitive cause, and can effect almost anybody in any demographic. The symptoms can range from **moderate to extreme** and often interfere with personal and work life.



Common trigger point : neck

Pain in major joints of the body

Stiffness / pain in knuckles and fingers joints

Common trigger point : knee joints

What causes fibromyalgia?

The exact cause of fibromyalgia is unknown, as the topic is very underresearched. It's thought to be related to changes in brain chemistry and the way that the central nervous system processes pain stimuli.

Fibromyalgia can be triggered by an emotionally or physically stressful event, such as :

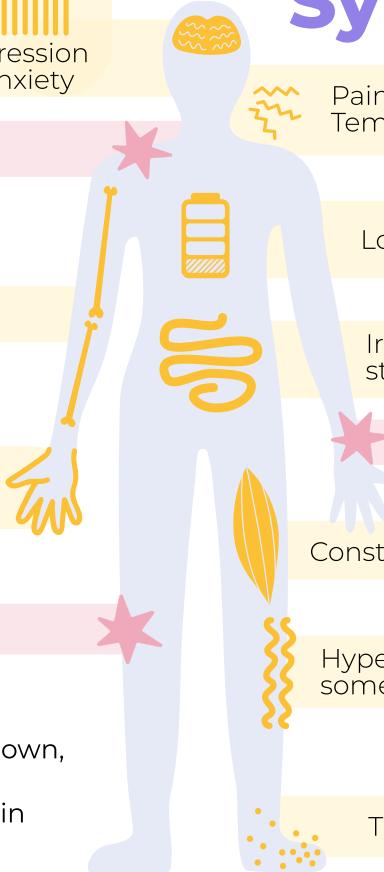
- An injury or infection
- Giving birth
- Having an operation
- The breakdown of a relationship
- The death of a loved one

Who's affected ?

Anyone can develop fibromyalgia, although it affects around **7 times as many women as men**. The condition typically develops between the **ages of 30 and 50**, but can occur in people of any age, including **children** and **the elderly**.

It's not clear exactly how many people are affected by Fibromyalgia, although research has suggested it could be a relatively common condition. Some estimates suggest **nearly 1 in 20 people may be affected by fibromyalgia** to some degree.

Common Symptoms



Pain in the face or jaw, also known as TMJ, or Temporomandibular Joint Syndrome

Low energy to perform daily tasks.

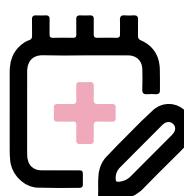
Irritable bowel syndrome (IBS), which causes stomach pain and bloating.

Common trigger point : wrists

Constant muscle pain and stiffness

Hypersensitivity in the skin, meaning it can sometimes hurt to be touched in any way

Tingling or numbness in the hands and feet



How is Fibromyalgia diagnosed?

Due to the lack of medical research, the rate of diagnosis is very low. There is no specific test for the condition, and the process can take years. Usually the only way that someone can get an official diagnosis is by ruling out every other possible cause for their symptoms.

Our user group

We decided to focus on women with Fibromyalgia, because the disease is more prevalent in women, although our insights and product opportunities could be applicable for men and non-binary people as well.

We picked this user group because although Fibromyalgia doesn't affect a large percentage of the population, the majority of people can relate to the symptoms to an extent.

References

NHS - www.nhs.uk/conditions/fibromyalgia

CDC - www.cdc.gov/arthritis/basics/fibromyalgia.htm

Research Plan

Outlining our research steps, identifying the best ways to gather information and our methodology regarding how we treat users

3

Our Research Aims

Understand the major problems that Fibromalgia patients are faced with.

Gain insight into their everyday life & understand the subtle aspects of life with chronic illness.

Receive guidance on product development through recurring user interviews.

Our Research Methods

Background Research

We first need to get a baseline understanding of Fibromyalgia, including common symptoms and context. This is information that user shouldn't be obligated to teach us, as it is widely available online. This way we can use the correct terminology during interviews and have a more informed understanding of what questions we should ask.

Primary Research

This is where we can gain more unique and sensitive insights into the lives of people with Fibromyalgia. We will contact 3 users (some of which we already know) to have in-depth interviews and recurring feedback on products. Sympathetic communication is key, making sure to consider what is most convenient for them, usually video calls. We will also make sure to get official consent to use their personal information.

Targeted Secondary Research

Informed by our user interviews, we will continue secondary online research, using both expert opinions and exploring the various blogs and social media pages where patients share their experiences. This can increase our range of insights and will allow us to cross-reference for a more accurate picture

What information do we need to gather from user interviews?

To make the interviews as easy as possible for our users, we have predefined a list of questions to ask, making sure to not push our users to share anything that they're uncomfortable with.

We can then explore any tangents that come from these initial discussions.

Background Information

General information such as age, gender identity, and occupation

How and when was the user diagnosed? What was this process like?

Is the user aware of what initially caused their condition?

How have the user's symptoms changed over time?

Day-to-day Experiences

What symptoms do the user experience on a daily / weekly basis?

What are the user's biggest problem areas / activities that we can design for?

How does the illness affect the user's social life, are they more reliant on a support group?

When and where do symptoms flare up/ affect daily life most significantly?



Treatment & Products

What fibro-Specific products are used and how are they helpful to our users?

What are the user's ideal forms of interaction with products?

What generic products are currently used that are a cause or relief of pain?

What are the current methods of mitigating symptoms i.e. what are common activities that help manage symptoms?



User Profiles PART 1

We interviewed our 3 users, initially collecting general information about their diagnosis and symptoms

4



Imogen

Age: 20

Pronouns: she/her

Works a 9-5 office job
as a media apprentice

DIAGNOSIS

Her Fibromyalgia was diagnosed by a GP in late 2021, but **not officially diagnosed by a specialist yet**.

In 2020, she was also diagnosed with ME (aka Chronic Fatigue Syndrome), which is a commonly paired with Fibromyalgia.

Fibromyalgia was only considered as a possible diagnosis **when all other options** (e.g. vitamin deficiencies) were ruled out.

Cause of condition: unknown

She suspects that her Fibromyalgia and ME were both caused by the same thing.

SYMPTOMS

Experience every day	General widespread pain in muscles & joints General fatigue & trouble sleeping Temperature regulation - feeling too cold
Experience most days	Fibro Fog & time blindness Stiffness in knuckles and painful thumbs when typing
Experience occasionally	Temperature regulation - feeling too hot Hypersensitivity - it hurts to be touched



Andrea

Age: 40

Pronouns: she/her

University teacher,
writer and Youtuber

DIAGNOSIS

Andrea was diagnosed **6 years ago** by her family doctor that she had known for over 15 years.

She started getting **pains when she was a PHD student**. She already had multiple conditions: thyroid condition, POS, and anxiety/depression so the individual symptoms were never very clear.

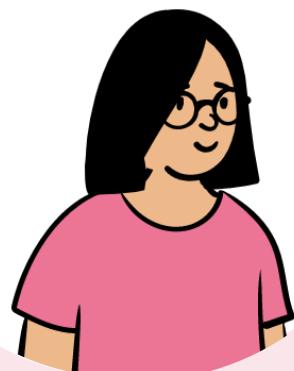
Her **doctor listened to her** when she said she knew there must be something else.

Cause of condition: unknown

She thinks the Fibro may have been a result of her other conditions as well as the intense grad student life.

SYMPTOMS

Experience every day	Brain fog, inability to concentrate, easily distracted Growing pains and stiffness throughout the day Constant fatigue
Experience most days	Pain in lower neck and back Head aches Sore knees after a walk
Experience occasionally	Intense brain fog with gaps in memory for a couple of seconds Fibro Flare- all symptoms accentuated and occur at the same time



Emma

Age: 20

Pronouns: she/her

University student at Kings College London

DIAGNOSIS

Diagnosis occurred in 2018 however she had been **experiencing symptoms for six years prior**.

Growing up she became **reliant on family members for support**, which has put serious strain on family relationships.

Currently she is capable of supporting herself day to day.

Cause of condition: Viral Infection

Symptoms began at 11 years old after a serious viral infection causing her to be in hospital for 3 weeks.

SYMPTOMS

Experience every day	Fatigue Nausia and sickness when standing Short term memory loss and brain fog
Experience most days	Upper neck and back pain Difficulty concentrating
Experience occasionally	Migraines Feeling ill which can cause further sadness

User Profiles PART 2

The next part of the user interviews involved getting more in-depth information about how these users experience life with Fibromyalgia. The more anecdotal information will be able to provide more sensitive insights.

5



Imogen

Age: 20

Pronouns: she/her

Lifestyle & Habits

Hobbies - Creative tasks give her joy which tends to improve all symptoms. She enjoys photography and costume design

Work - She works from home and goes into the office a few days a week. If symptoms are worse she may need to cut back on hours or take midday naps to replenish her energy.

Exercise - Intense workouts can be very difficult, but she tries to go on runs when possible.

Social Life - It's sometimes difficult to keep up with friends, although connecting with people is very important to her. She finds gaming is a good way to relax and socialise.

Helpful Products

Mobility aids such as crutches for long days of walking

Pain Relief: wrist support, blankets, pillows medication

Coffee & energy drinks are very helpful

Good water bottle (with straw to minimise wrist strain)

Other Difficulties

Replying to people (texts, phone calls, emails) can be mentally exhausting

Co-workers are sometimes not sympathetic

Drying / styling hair can be very straining

Strangers ask why you're using mobility aids - it's none of their business



Andrea

Age: 40

Pronouns: she/her

Lifestyle & Habits

Exercise- Tries to go walking every day. Exercise makes the biggest difference for her. Yoga on bad days, good for mental wellbeing, breathing and stretching is very beneficial.

Diet- Very important to have a healthy diet, keeps her mood and energy up. Has cut most gluten.

Tracking and Planning- Keeps track of sleep and blood pressure. Plans her days well making sure she can stop when she is tired.

Covid- This is a big source of stress. Arizona has little/no restrictions, very few masks and no tests. This is a mental strain knowing she has to be the one to be careful.

Helpful Products

Notebooks

Post-its

Pain Relief: Massaging tools, heated pads/blankets, TENS units.

Apple Watch

Ipad Stand

Comfort: Scented candles, blankets and pillows.

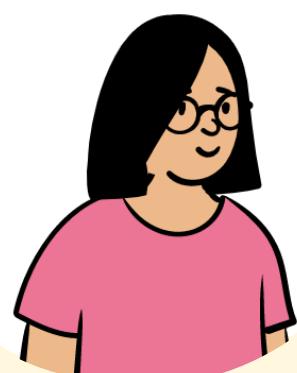
Other Difficulties

Typing on phone and making typos

Using track pad for a long time

Hand-eye coordination and fine motor skills

Running errands after a long day



Emma

Age: 20

Pronouns: she/her

Lifestyle & Habits

Routine- Finds sticking to a routine helpful especially a sleeping one. However when a good day arises they tend exhaust themselves. A new technique they are following is **spoon theory**.

Yoga- Allows her to consolidate her days, as well as giving her a sense of accomplishment.

Social Life - Finds that talking about it is the easiest way for her still remain socially active without doing activities that bring her pain. I.e. means that it is easier for people to understand why she may not be able to come out drinking.

Helpful Products

weighted blanket

Ipad

Back and neck relief: laptop and ipad stands.

THC and CBD

Scented candles

Other Difficulties

Pillows

Standing up while performing tasks

Walking can be harder

Pens and pencils

Temperature regulation

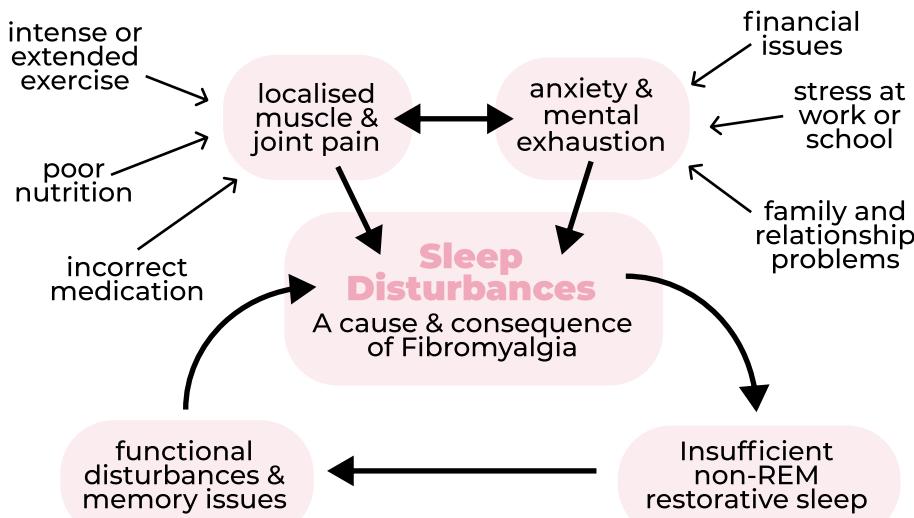
Cant stay up late

Secondary Research

Further information gathered from online resources

6

Many factors are linked to a cycle of symptoms that can perpetuate one another



Information from Fibromyalgia Specialists

- **Low-impact consistent movement** can alleviate stiff joints and muscle pain. This involves going on **short walks** and **stretching** after a period of inactivity.
- Some patients struggle **more with anxiety and lack of sleep** than widespread pain. This can be much more difficult to treat.
- A relationship between **chronic stress and Fibromyalgia** has been confirmed. Stress caused by the condition may **perpetuate symptoms** even more.
- Physical pain treatments include massages, **acupuncture**, **applied heat** and **hydrotherapy** have all been shown to reduce pain and stiffness.

Fibro Community

The online community for Fibromyalgia is very strong, vocal and supportive. Because it is a relatively unknown and invisible condition, people get a lot of comfort and validation from sharing their experiences online.

Through YouTube channels, blogs, Instagram accounts and TikTok, we were able to collect further insights about our user group. We found this a very good way of gathering information; it puts less pressure on our users as they can share information on their own terms.

Quotes and Insights

"There is a big frustration from people **not recognising our condition**"

"Comfort and massage tools are often **very expensive**"

"What I find most useful are **mindfulness** and **meditation techniques**"

"Writing and listening to podcasts makes me feel **relaxed** and **in control**"

"Relying on somebody else for your chronic pain management can be difficult, unreliable and a lot to ask from someone. It also **takes away your independence**"

"Since we suffer with pain every single day, it's a **worry** for us to **rely on medication**"

Spoon Theory

A popular analogy used by people with chronic conditions. A spoon represents a finite amount of energy which is used up doing daily tasks.

8AM - 9AM



Get up, dress & shower - **2 spoons**
These can all be very physically demanding tasks, especially if the individual has not had sufficient sleep

9AM - 10AM



Travel into work / school - **1 spoon**
Driving, or using public transport can be very stressful and requires a lot of concentration

10AM - 5PM



Work / school - **5 spoons**
Working and interacting with colleagues & classmates can be very mentally exhausting

5PM - 6PM



Go shopping - **1 spoon**
Getting groceries is essential, but can take a toll on muscles due to heavy lifting.

At the end of the day, **only 1 spoon is left**. The individual must pick what task to spend that spoon on before going to sleep, whether that is making a good meal, spending time with their friends / family, or cleaning. **If more than 10 spoons are used in one day, then they will have less spoons the next day.**

Research Insights

Fibromyalgia is a very complex condition, but the symptoms can be loosely categorised into 2 groups : **physical pain / exhaustion and 'fibro fog'**. It is fitting to group our insights similarly, with an extra emphasis on the more subtle aspects life with Fibromyalgia.

7

Physical Pain / Exhaustion

Independance is very difficult when it comes to muscle pain; users tend to rely on other to help relieve the muscle stiffness - giving them massages and helping them perform tasks when moving is more painful. It is important to keep a close support network but some users report that they would like to gain more independance. **Self-operated pain relief tools can help with gaining independance, but existing products tend to be not specific enough.**

Some fibromyalgia patients don't want to rely too much on pain medication in order to avoid addiction and to keep the effectiveness high for when they're most needed.

Pain intensity varies day to day and is difficult to predict. We should therefore **consider what the user experiences on the worst days** in order to make it functional no matter what the pain levels are

Hypersensitivity can flare up when using specific materials or touching things that are cold. We should test out **how our users react to different material textures.**

The weight and general ergonomics of the product **should be tested by our users** as it's difficult to mimick or fully understand how their pain makes them feel.

Fibro Fog

Brain fog / fibro fog is a group of symptoms that all of our interviewees and the majority of the Fibromyalgia community report as one of the largest challenges to overcome in daily life. Some patients go as far as to say that the **effect of fibro fog is more disruptive than the physical pain** that they feel.

Communication

Both online and in-person communication can be very difficult, especially with an inhibited working memory. People experiencing brain fog can forget their point mid-sentence and have trouble remembering what has just been said.

Memory Problems

Most of the fibro fog symptoms are related to memory, whether that is short term or long term.

If we can help users with retrieving and storing important information, then many of these symptoms could be targeted simultaneously.



Time/Task Management

Long lists of important tasks can be difficult to follow or complete fully as brain fog can cause people to be easily side-tracked.

A physically or mentally exhausting task is often put off or forgotten about completely.

Users need a reliable way of predicting when tasks can and cannot be completed so as to communicate this to others.

Basic daily tasks (eg. taking medication) can be easily forgotten)

Concentration

Focus is another difficult area to improve upon, as loss of focus can be a signal that the user needs a break rather than pushing through and exahsting themsleves.

This can be simple things like forgetting a train of thought when changing locations.

Other Design Considerations

- Many people with chronic illnesses don't necessarily want people questioning why they're using certain products. This is often a consequence of using products that look too clinical.
- A product must be very inclusive and target an area of fibromyalgia that many users experience similarly, or should be adaptable so that it can target many specific symptoms. Users could cater the product to what they need.
- Some users would rather use products that don't have a medical-type aesthetic

Hero Board

Introducing our chosen project focus and what we aim to achieve with the product concepts that we develop

8

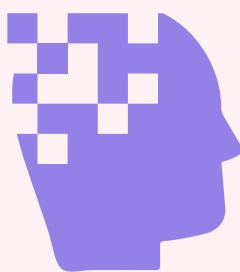
Area of focus : Fibro Fog & Productivity

How might we lighten the effects of fibro fog by aiding users with daily task management?



Potential Areas of Exploration

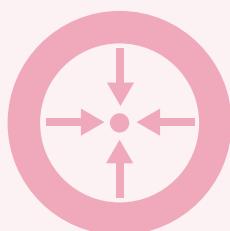
Short-Term Memory Loss



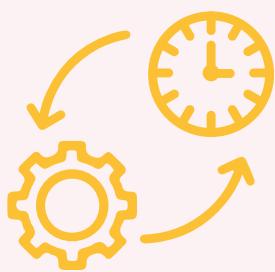
Energy Levels



Loss of Concentration



Time Management



Lifestyle



Planners and Reminders



Our Project Aims

Improve the lives of our users with products that do not mentally or physically drain them.

Help users organise their day-to-day tasks and obligations in order to free up time and mental effort for other things.

Remove pre-existing barriers that may inhibit our users from completing everyday tasks.

Initial Market Research

Gathering information on demographics and their common symptoms, triggers, and behaviours to understand the market that we're designing for

9

Alike Ailments

There are many conditions that have similar symptoms to Fibromyalgia. By looking at methods of management and products to treat these conditions, we can gain more ideas as to what can work well.

Rheumatoid Arthritis

Similar in that people feel familiar pains in the joints. These pains can have sudden flair ups like fibro, as well as extreme fatigue being a symptom too.

Long Covid

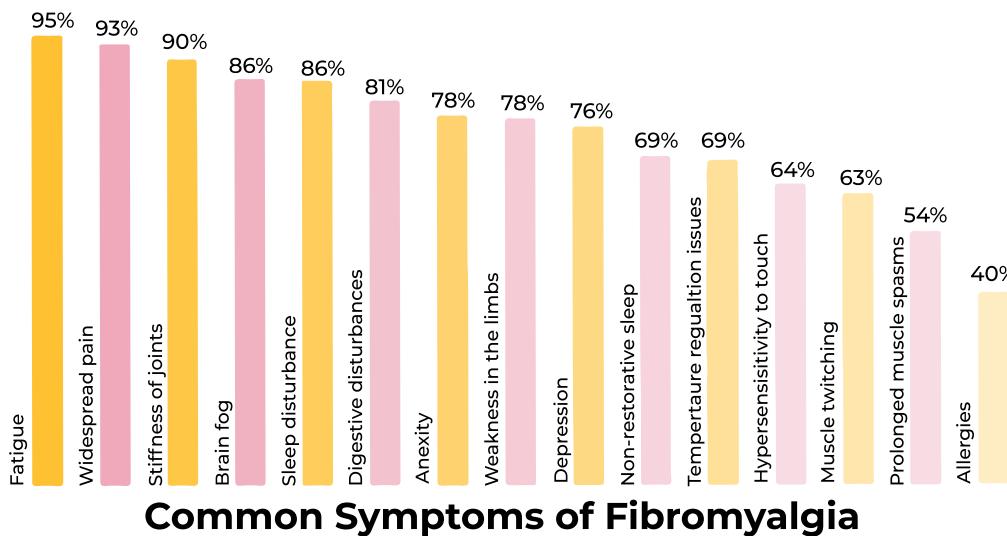
Extremely similar to fibro with high fatigue, headaches, dizziness, joint pain, depression, anxiety and brain fog being overlapping symptoms.

Lupus

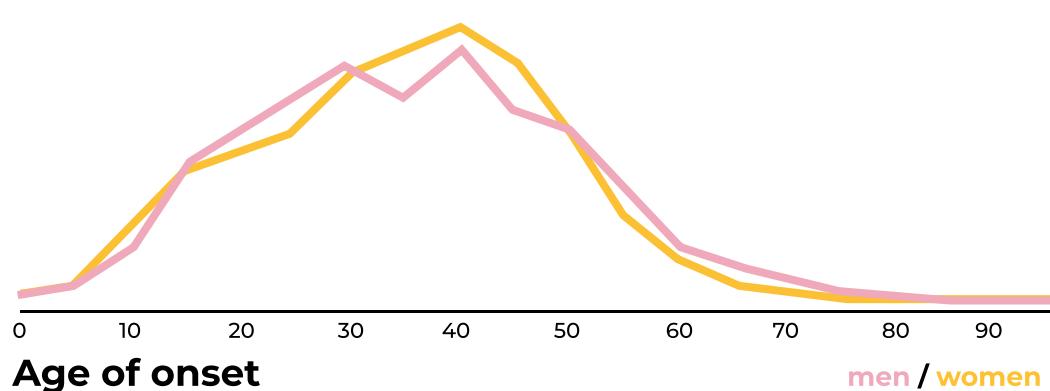
Experience joint and muscle pain as well as extreme fatigue. Lupus is more linked with organs.

Chronic fatigue syndrome (aka. ME)

Has overlapping symptoms with short term memory loss, high fatigue, trouble sleeping and issues with recovery after activity. The 2 conditions are very strongly linked

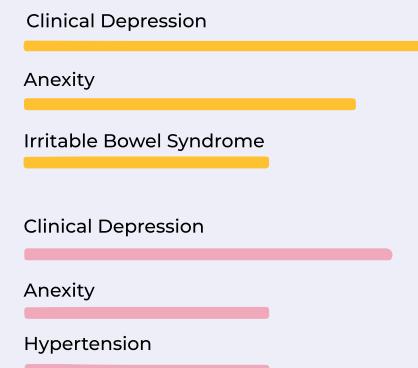


Common Symptoms of Fibromyalgia

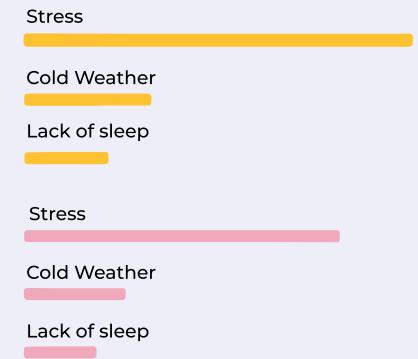


Age of onset

Reported comorbidities for men and women



Triggers for men and women



Common Treatments

Drugs

Drugs are the most common conventional form of treatment. They can be in the form of recreational or prescription drugs.

E.g. Canaboids, Kratom, magnesium, Low-dose Naltrexone

Diet and Exercise

Diets are highly recommended within the fibro community especially low carb high protein diets. Regular light exercise is also recognised to help.

E.g. Ketogenic, increased hydration, specific recipe books, yoga & pilates

Routine

Establishing a routine is the third major route for treatment. With an emphasis on reducing unnecessary stress and an uptake on task management theories

E.g. Regular sleep routine / sleep therapy, adjustable work schedule, pacing activities

Market Research & Products

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Looking at the overall market and what products have currently been developed to address fibro fog or similar symptoms.

Existing products used to alleviate fibro fog

All of our users struggling with fibro fog have come up with methods of coping. Things such as memory aids, task management and setting reminders are all very important for them in their daily life. Below are some products currently on the market they use to this effect:



Post-It Notes
Help remember small tasks.
Visual reminder.



Notebooks
Day planning, to-do lists, goals and achievements



Day Plan Water Bottle
Visual reminder to keep hydrated and track level.



Diffuser
Scent helps for mood and concentration control.



Notice Board
Visual queues and planning



Noise Cancelling Headphones
Helps concentration and general fatigue levels

Other Assistive Technology

There are various products that are used to address other cognitive chronic illnesses as a whole and not just fibro fog.

Below are some electronic handheld devices used by patients with:

- Memory loss
- Long-term chronic fatigue
- Dementia



Smart Watch
It can track heartbeat, routine, set reminders, and communication



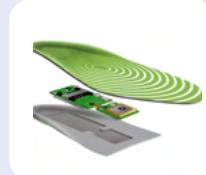
Loaction Tracker
Helps to locate items lost or forgotten during state of brain fog



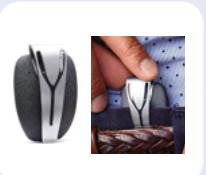
Motion Sensor
E.g. placed in kitchen doorway and sends an audio reminder to turn off the hob.



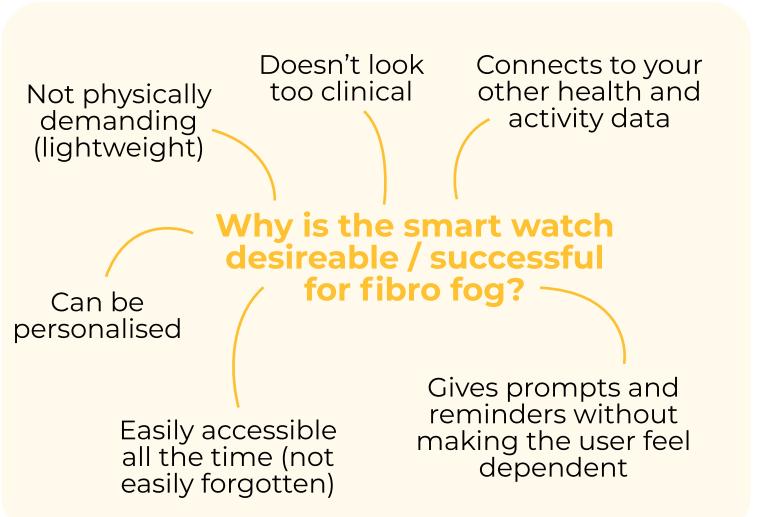
Memo Pen
Record vocal reminders. Helps with organisation and memory



Smart Insole
Senses amount of pressure on ankles, steps in a day, fidgeting when working.



Breath Tracker
Measures breathing patterns to help keep control and manage stress



Market trends for assistive technology : Sensors & tracking



With technology improving, sensors are becoming more and more precise and compact. The current market trend for many products includes implementing sensors and trackers into small gadgets/products. They are becoming much more reliable with a long-lasting battery life.

Tracking the body and activity is very useful for people with chronic illnesses as it allows them to learn more about their condition and to better manage the symptoms.

Market Opportunities

Where are there gaps in the market? What trends are positively impacting the market? What insights can we gain from existing products?

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Alleviating fibro fog through lifestyle changes

Market Opportunity

The majority of treatments for fibromalgia revolve around the user undertaking various lifestyle changes, such as creating a new sleep routine.

These changes can be daunting; they are often extreme and cannot be done all at once. Users need a way of monitoring how these changes effect them along with strategies to make good habits stick.

Existing Example:

*SleepScore
(a sleep tracking app)*



Many mobile apps exist to record habits and adjust your actions accordingly. However this process can be easily abandoned and involves a lot of additional initiative from the user.

Market Improvement

Existing products and services revolve around gathering and presenting information the user's behaviour, but it is still up to the user to assess and decide on what they should change and how. Apps tend to be limited in the sense that their physical interaction is very standard.

An opportunity would be to design a solution that guides the user more and involves a more engaging / unique interaction.

Improving task management and productivity

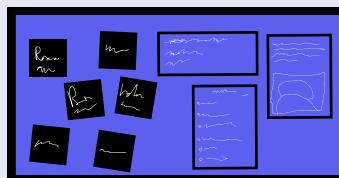
Market Opportunity

Some of the largest problems people with fibromalgia face is loss of concentration through fibro fog. This can result in poor task management.

A visual way of keeping track of tasks can alleviate stress and means that the user doesn't need to rely on their memory.

Existing Example:

Post-its & bulletin board



Task organising products exist however they are often chaotic in nature and can lead to further brain fog. They tend to blend into the surroundings if left too long

Market Improvement

Many existing products rely on the user being concise and consistent, which doesn't work well with brain fog.

There should be a way to keep the users focused on their current task to ensure it is completed properly and also visualise tasks in a less overwhelming way. It is also important with fibro fog to encourage more frequent mental breaks.

Improving accessibility with smart systems

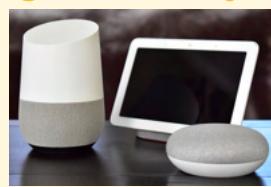
Market Opportunity

On particularly bad days, it can be very difficult to do basic things like turning on the radio, changing the heating or turning lights on and off.

A simple change in temperature or lighting can be very beneficial to cognitive abilities

Market Example:

Google home system



Integrated home systems can be voice-activated and allows the user to control their environment from their phone / other smart device

Market Improvement

These systems may not be catered to differently-abled people and their various mobility aids.

It is also a worry to some people that these systems are connected to the internet and are constantly collecting data rather than simply just trying to improve their lives.

Product Review

PART 1

Although the product that we are analyzing isn't used to manage Fibromyalgia symptoms, there is still a lot that we can learn from its design, e.g. manufacturing and assembly, ergonomics and mechanical functions.

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Product Name : Distance Measuring Wheel 0-9999 meters
Manufacturer / designer : STREND PRO

The measuring wheel is a device for measuring large distances, often used by surveyors. Above all, it is used to measure the length of traffic routes, routine measurements in construction work, measurement of homes and gardens, sports ground dimensions, distances between power lines, tree distances when planting, counting steps, etc.

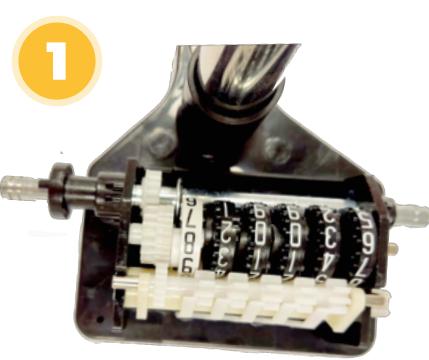
Product Specs

Max. Measuring range:	99999.9 m
Wheel diameter:	318 mm (12.5 ")
Accuracy:	± 0.5%
Measuring units:	cm
Item Weight:	1.89 kg



Features and Mechanisms

1. Gear box and measurement display
2. Collapsible design for easy storage
3. Reset lever
4. Stand to hold the instrument upright

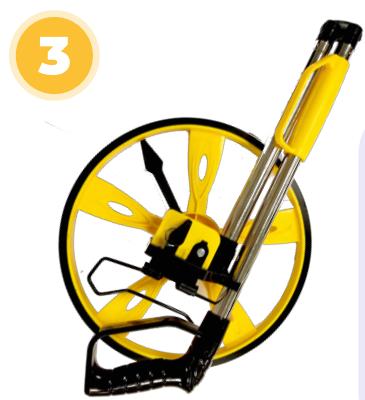


0.1m is the precision of the stick. The axle rotating causes a direct increase in that wheel.

After an entire rotation of this wheel a 10th of a rotation is transferred along the transfer shaft to the meter wheel increasing the measurement by 1 meter. This then scales up all the way to the 10 Km wheel.



Pushing the lever releases the spring holding the transfer shaft in place and once released it will set the measurement shaft returns to zero.



Handle has two functions. It can be used to hold the tool more comfortably when in use, and it can slide along the main handle shaft to reveal the hinge which allows the arm to collapse.

This allows for better portability and more efficient storage.



A snap fit keeps the stand open or closed. It is able to support the weight of the entire instrument when it is momentarily not in use.

Product Review PART 2

13

Teardown, bill of materials and assembly methods

Dissassembly Method

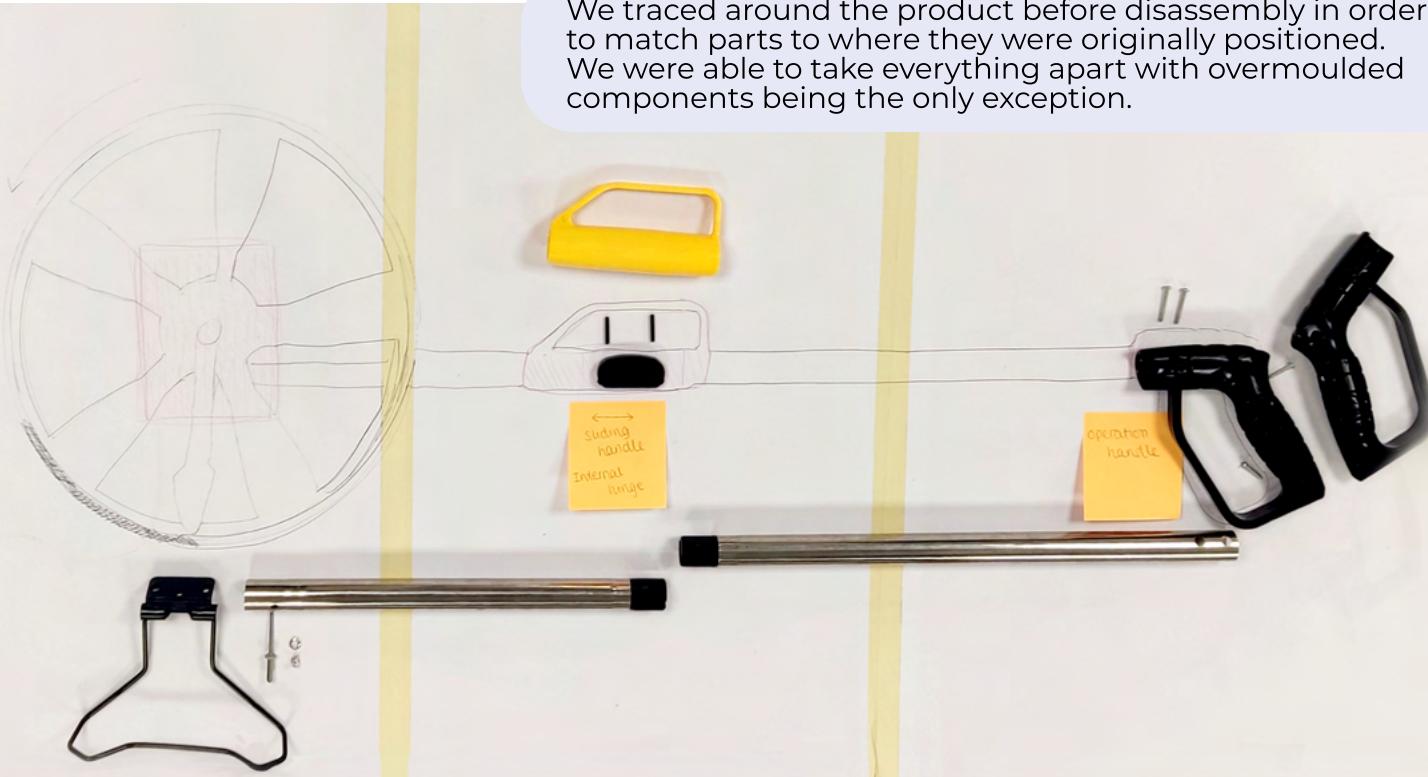
- Removing all the screws
- Detaching components and gear box
- Pulling the shafts out of the hinge
- Removing the rivet
- Taking apart gear box

Difficulties

- Hinge shafts were permanent and very difficult to pull out
- Rivet had to be drilled through



We traced around the product before disassembly in order to match parts to where they were originally positioned. We were able to take everything apart with overmoulded components being the only exception.



No.	Part	Material	Manufacturing
1	Carry Bag	Canvas	Weave
1	Wheel	ABS and PVC	Injection moulding and overmoulding
1	Sliding Handle	ABS	Injection moulding
2	End handle halves	ABS	Injection moulding
2	Hollow Shafts	Stainless steel	Extrusion moulding
4	2cm screws	Low/Med carbon steel	Extrusion and die rolling
7	<1 cm screws	Low/Med carbon steel	Extrusion and die rolling
1	Hinge Link	ABS	Injection moulding
1	Collapsible stand	Medium Carbon Steel	Extrusion
1	Gear box base	ABS	Injection moulding
1	Gear box Casing	ABS	Injection moulding
1	10 cm shaft	Low carbon steel	Extrusion
6	Numbered gears	ABS	Injection moulding
8	White gears	ABS	Injection moulding
1	Circular spring	Low carbon steel	Extrusion
2	5 cm shaft	Low carbon steel	Extrusion
2	Washer bolt	Low carbon steel	Sheet metal shearing
1	Rivet	Aluminium	Extrusion moulding
2	Hinge shafts	High carbon Steel	Extrusion
1	Numbered gears casing	ABS	Injection moulding
1	Other gear casing	ABS	Injection moulding
1	Black lever	ABS	Injection moulding
1	Horseshoe washer	Low carbon steel	Sheet metal shearing
TOTAL	49		

Bill of Materials

The tool is comprised of 49 parts, with the majority of them being injection moulded ABS and extruded steel.

Assembly methods include:

- Screws
- Rivets
- Toleranced fits (snap fit or lose fits)
- Overmoulding

A full list of components and their manufacturing methods can be seen to the left.

Product Review PART 3

Discussing how this product can be improved and what aspects we can use to inform our concept development.

14

How could this product be improved?

The user group is people needing to measure long distances, such as surveyors. This job often involves noting down the important measurement values. This tool could be made smarter and actually store values on an electronic system. This would be much more convenient but would make the tool much more expensive and complex. Instead, it could simply integrate a feature that holds a notepad and pen.

The folding mechanism, although useful for storage, isn't very intuitive. It's not obvious that the handle half way down the arm is meant to twist and swivel to reveal the hinge. An improvement could include an arrow embossed into the plastic handle that would be noticed by the user as they go to grab it.



What can we learn from this product?

Choice of colour should be deliberate, considering function as well as aesthetic.

Contrasting black and white numbers on the display are easier for the user to read from a distance.

Plus, the bright yellow colour makes the tool more visible, not only helping it be located by the user easily, but makes them more visible to others when using the tool.

Surveyors can be hazard when working along roads so the brighter colour increases safety.

Use less material where possible

This is especially useful when designing for differently abled users, as less material decreases weight alongside reducing wastage and cost. The wheel is not one solid disk, but rather has spokes which make it rigid enough to be functional.

We should consider how information is collected and outputted to the user

The gear system is simple yet effective, there is no need for electronic sensors as it increases the complexity for no good reason. This type of mechanical system should be considered as an option when designing our product.

Match product features to the target user group, and the conditions in which they are likely to use the product

Aspects like dimensions (like arm length), weight and colour are matched to the user group (abled average height adults who are likely to use this product outside). Features like the stand and the starting point arrow would be consistently used and are intuitive to the user group.

Consider what the product does when it is not in use

There are different stages of use for a product like this. Both long term storage (compact bag) and momentary lack of use (upright stand) have been designed for. This can be applied to any product, as convenience of use also involves times when an item isn't actively functional.

Project Plan

Breakdown of progress, contributions & learnings from the first stage of work

15



Gantt Chart January - March 2022

We defined the red and orange bars first. From the advice given to us around the page structure and weeks to complete them in

We then used the predefined dates and pages as targets to get work done by. Setting tasks and deadlines week by week. With meetings every Monday and Friday to check in on progress.

The research pages were treated as individual work where one person would research a particular area and write a page about it.

We continued to discuss our findings in our group meetings, changing the scope and research topics where necessary.

For our individual design pages we tried to work in unison so that we could exchange designs to show to our individual users. This meant we could get simultaneous feedback on all of our individual work

We encountered some problems that resulted in a deadline extension. Our project plan had to be altered in the last few weeks to accommodate this.

Before we got our deadline extended Rory and Barbara worked exclusively on our solo work until a decision had been made about our group's mitigating circumstances.

- | | | | |
|--|--|--|---------|
| ■ | Group pages | ■ | Rory |
| ■ | Individual pages | ■ | Ciara |
| ■ | Work to be completed together as a group | ■ | Barbara |

Project Plan

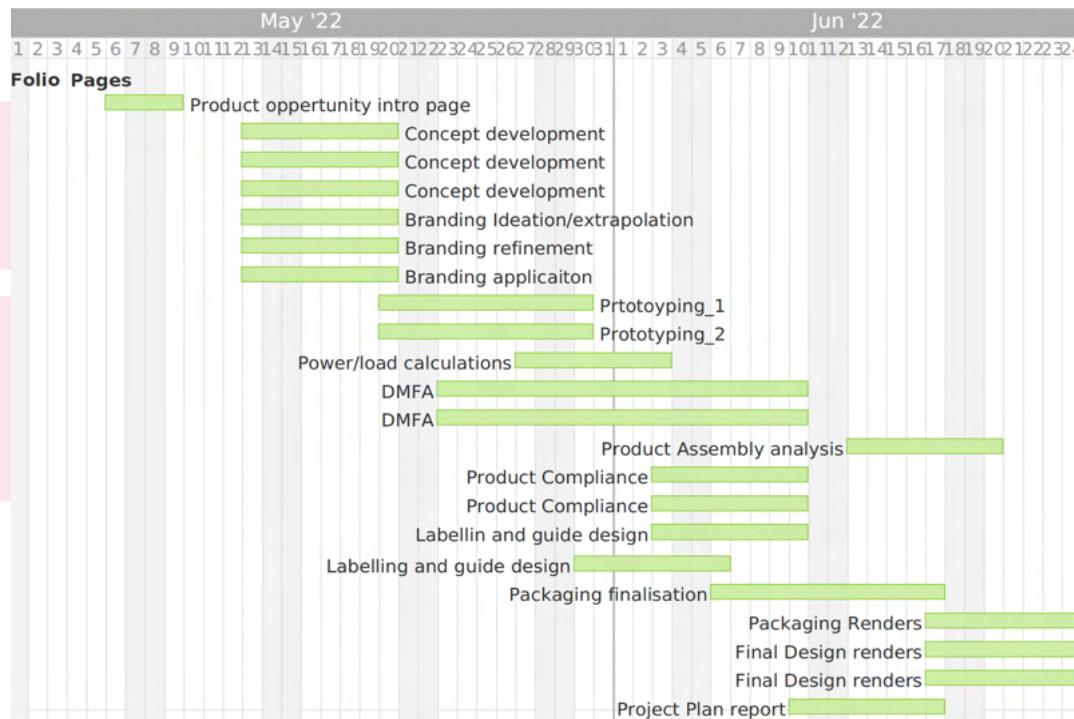
Using what we learnt from our previous term to plan out the next stage of work.

16

Portfolio Pages

The portfolio pages are planned to work alongside the work as it occurs as a basic diary of our progress.

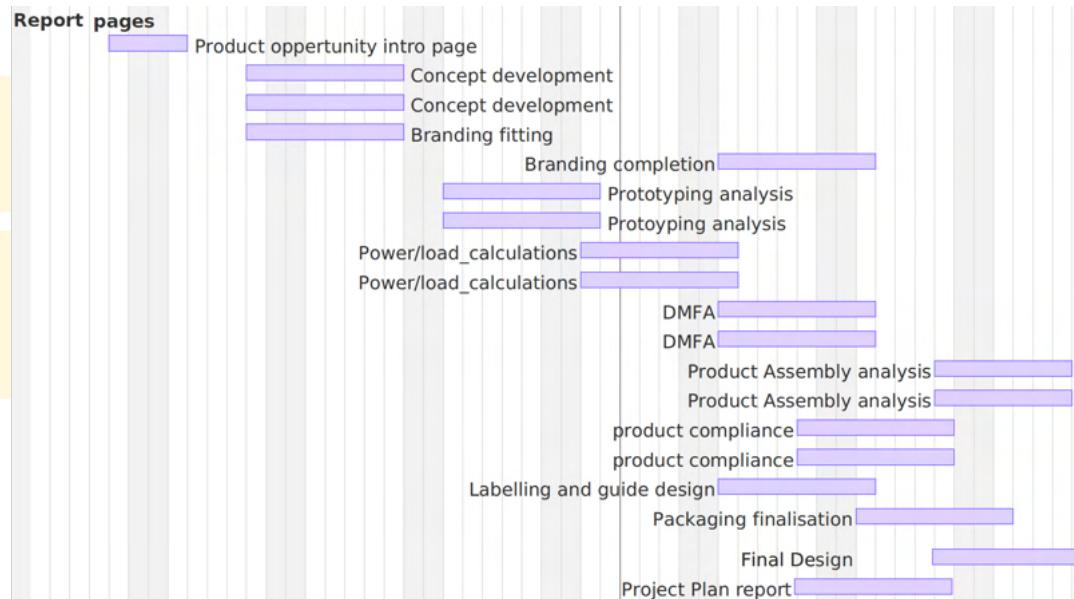
Therefore the plan is to frontload the term with the portfolio work in opposition to the report pages, which backload the term.



Report Pages

The report will be written using the preexisting portfolio pages.

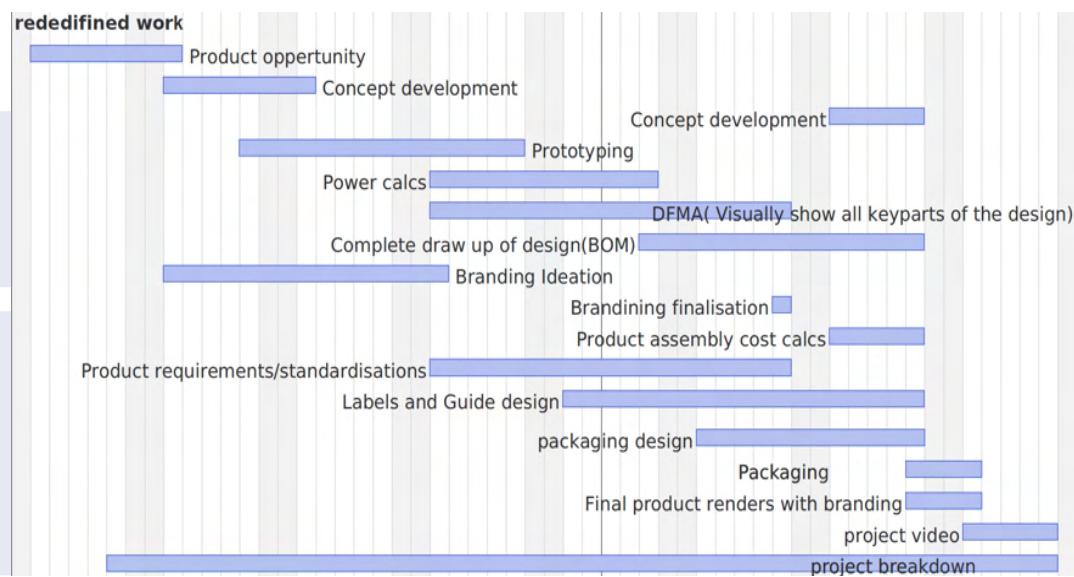
The report pages are to be done once the majority of work surrounding that topic is complete.



Redefined Work

The work was redefined to try and spread out the workload across the term

These are the topics we should be covering as a team and then go away individually to make up the pages and do further work upon.



Concept Development

Individual work - Ciara Bates

Fibro Fog & Memory

Further research into how Fibro Fog effects memory. Detailed insights & data from patients and leading experts on the cognitive effects of Fibromyalgia.

37

How does Fibromyalgia effect different types of memory?

There are three types of memory that can be effected by Fibro Fog : working, semantic & episodic. These all involve slightly different process but are used in conjunction with eachother in everyday life.

Working Memory

Learning and processing facts in the moment, used when memorising information for short-term use.

Inhibiting this type of memory results in difficulty retaining information that has just been told. Fibro patients can therefore have issues with mental maths and memorising longer lists of information

Common Fibro Fog symptom :
Losing track of speech

Difficulty remembering the first half of their sentence

whilst...

working memory

Trying to find the words for the second half of the sentence

semantic memory

=

Needing to pause mid-sentence to find clarity

The effect of distraction

The memory problems associated with Fibromyalgia are quite profound, in some ways they can mimick aging up to 20 years, but in conventional memory tests, patients perform similarly to the control group.

Research by Dr. Frank Leavitt and Robert Katz MD found that the **prevalence of distraction is the key to understanding fibro fog**. They found that when distractions are introduced to memory tests, the fibromyalgia patients will perform considerably worse than the control group.

Fibromyalgia patients **lost 44 % more information due to the distractions**

Insight : focus is the cognitive process that Fibromyalgia patients suffer with the most.
It is likely that this is then what causes the memory problems, so creating a product that encourages focus may aid in memory retention & recovery

Episodic Memory

Awareness of one's own memory. Aids in making informed decisions by referring to previous experiences

Repeatedly making the same mistakes can be common due to a lack of access to episodic memory

Semantic Memory

Recalling general knowledge & facts that have been committed to long term memory

Fibro patients can temporarily forget semantic knowledge such as vocabulary or names

Quotes from Fibromyalgia Patients

Through looking at interviews & reports, it can be seen that many users are concerned with how to effectively cope with Fibro fog. Many say that it has a larger effect on their life than the physical joint or muscle pain.

"The physical symptoms weren't as frightening as the memory problems."

"The most devastating effect for me has been the cognitive impairment."

"I can forget my train of thought in mid-sentence, and often struggle to retain detailed information"

REFERENCES

<https://www.healthline.com/health/fibromyalgia-fog>

www.pathways.health/what-is-fibro-fog-and-how-does-it-feel

www.fmaware.org/cognitive-function-fibromyalgia/

Research papers on www.fmaware.org by Jennifer Glass, Ph.D Denise Park, Ph.D, Frank Leavitt, PhD and Robert Katz, MD

A day in the life

Presenting the anecdotal examples of fibro fog in the form of a user journey map to empathise & understand where opportunities occur

38



Scenario: A particularly bad day for somebody with Fibromyalgia. These experiences were collated from online forums, a user survey and then informed further from an interview with our user Imogen.

Wake up : sore feet, ankles, and neck make it difficult to get out of bed. 15 minutes of stretching can alleviate this slightly

Making breakfast : Ran out of milk due to accidentally leaving it off the shopping list

Need a high-caffeine drink to gain the energy to have a shower and get ready for work

Travel to work : falling asleep on the train due to high level of exhaustion. sitting too long on public transport can cause severe neck pain

At work : co-workers are frustrated because of a missed deadline

Midday : having a nap during lunch so as the stay alert in afternoon meetings

After work: unable to go out with friends due to particularly high pain and exhaustion

At home : realises that medication was forgotten in the morning

Design process insights

During the entire design process, we will still keep in mind the physical pain and sensitivity that Fibromyalgia causes. These symptoms will be important to consider when deciding on sensory aspects of the design, such as material choice, how it sounds and ergonomics.

Physical interaction uses different areas of the brain so it aids in the creation of different neural pathways. This in turn helps with memory and focus. This is also likely to reduce dependence on phones / blue light screens which decrease focus and inhibits proper sleep.

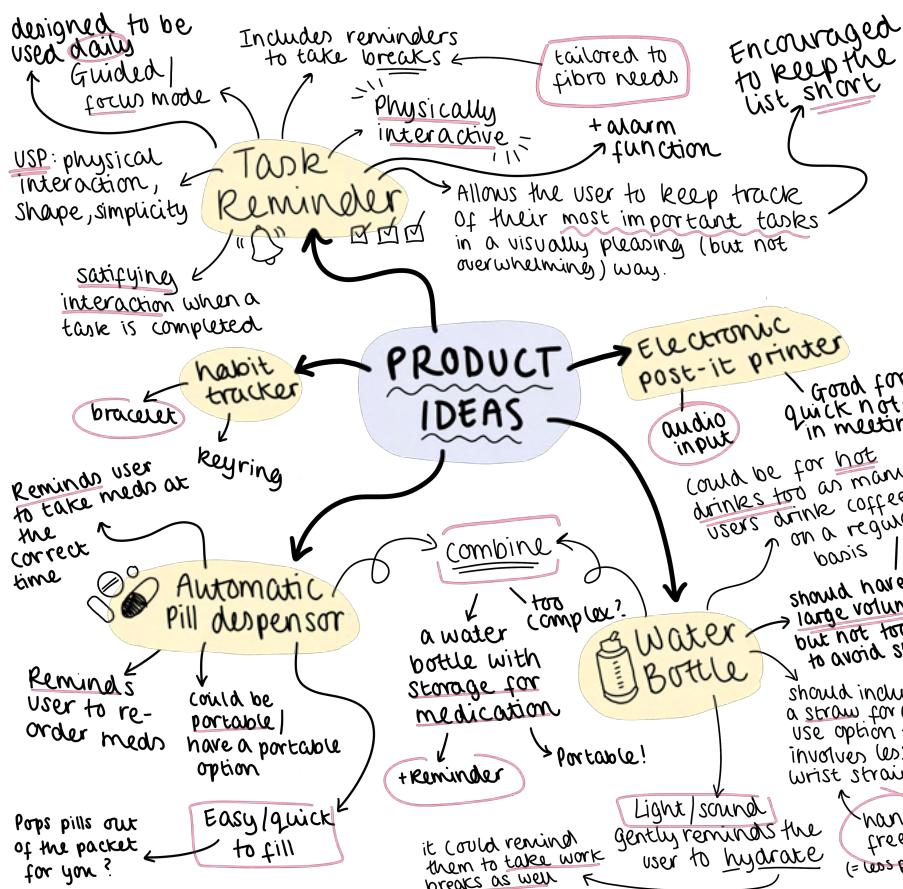
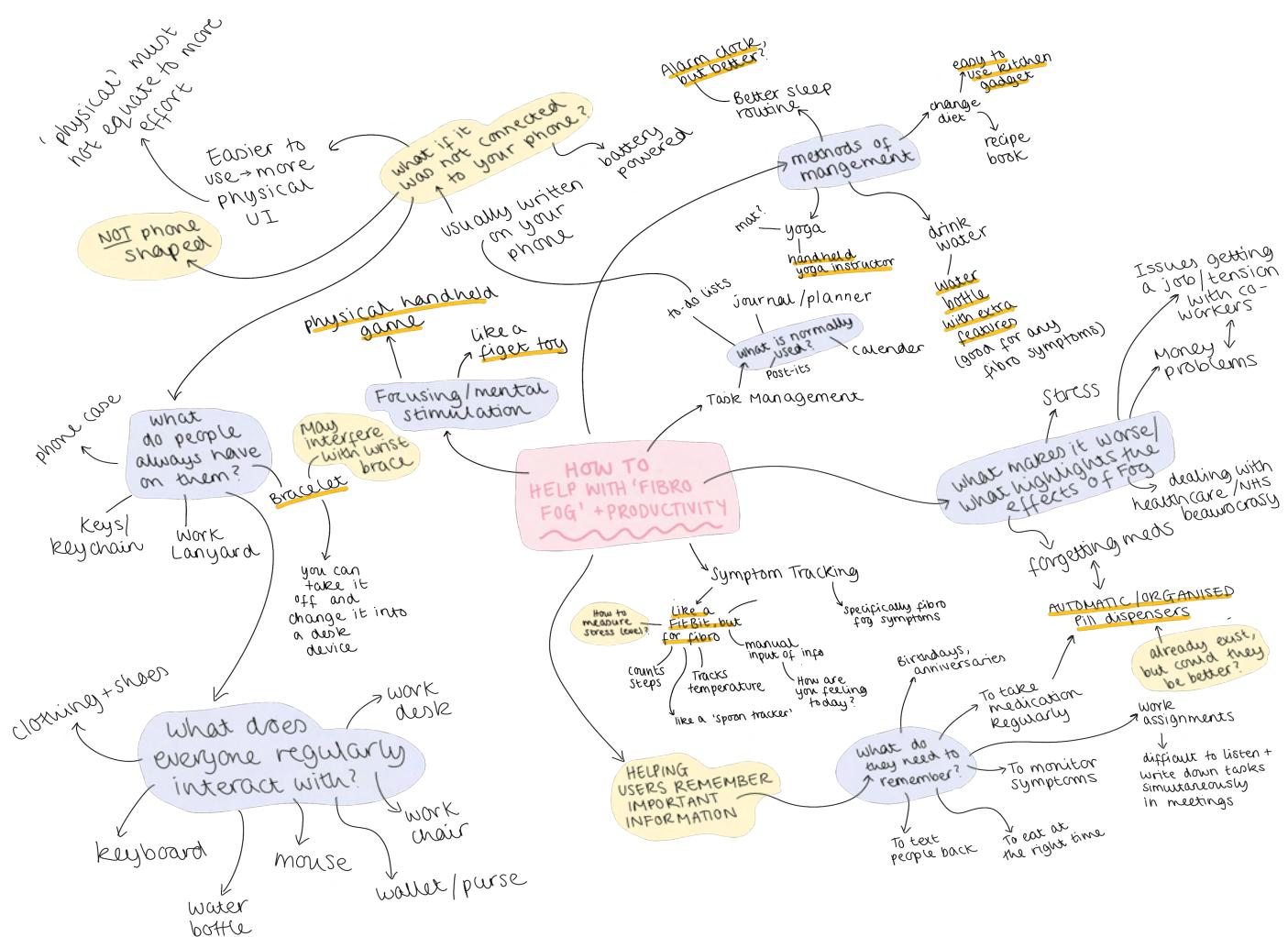
Additionally, this product could have much more potential beyond just people with Fibromyalgia, as the majority of people experience a 'foggy' headspace from time to time, although not as severe. By focusing on people with fibromyalgia as a vulnerable user group, we can unlock more subtle insights that may be applicable to the general population as well

Ideation

Much of the ideation was done collaboratively to explore as many different ideas as possible. Individually, these ideas were refined & organised into mind maps and concept opportunities, with a focus on concepts that aid in memory & focus.

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Initial Mindmapping



Converging ideation 3 main product ideas

1 Task management device

Aiding the user in focusing on each individual task on a to-do list through unique physical interaction and visual reminders. This will build more neural pathways for better concentration.

2 Water bottle & pill holder

Using sensors and visual indication to create a consistent routine of drinking water and taking medication, aided by the convenience of having water & pills in the same place.

3 Electric sticky note printer

Making self-reminders as quick and easy as possible without the need for phone alarms. Re-thinking sticky notes for people who may not be able to hand write notes for themselves.

Design Inspiration

Benchmarking & analysing existing product / concepts that can be used to inform the aesthetics and the functionality of the 3 ideas defined previously

40

Related to idea 1 Task management with physical interaction



COMM - *Fountain Studio*

The simple screen faces the user, aiding in communication / calls without a mobile phone



Tilt Radio - *Luka Or*

The angle changes what type of signal it captures (AM / DAB). Tilting the radio is more engaging than a button.



Tamed Digital - *studioSFSO*

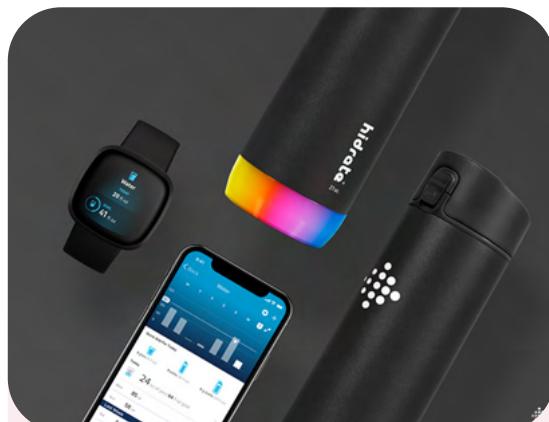
A range of product concepts that focus on creating a joyful haptic experience.

Related to idea 2 Water bottle & medication holder / reminder



Pilleve - *Vuk Dragovic*

Designed to combat the opioid crisis, the pills are tracked as they're dispensed.



Hidrate x Fitbit

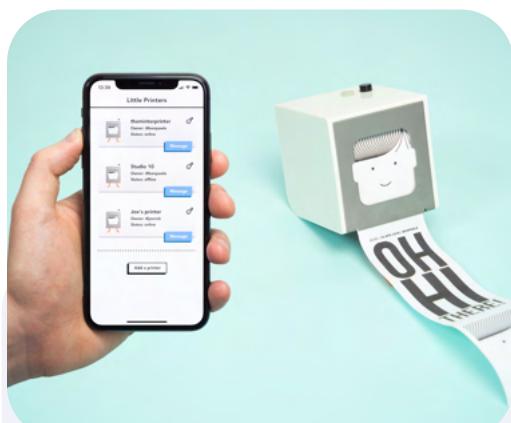
The bottle pairs to other devices to show data about the user's water intake & notify them.



Familia - *Studio Fantasio*

Designed for the elderly, this clock has a pill dispenser easily accessible in the centre.

Related to idea 3 Electric sticky note printer



Little Printer - *Nord projects*

This small printer connects to your phone and has a communication function between users.



Eco Pen

This pen combines physical writing and audio sensing to make note-taking easier & comprehensive



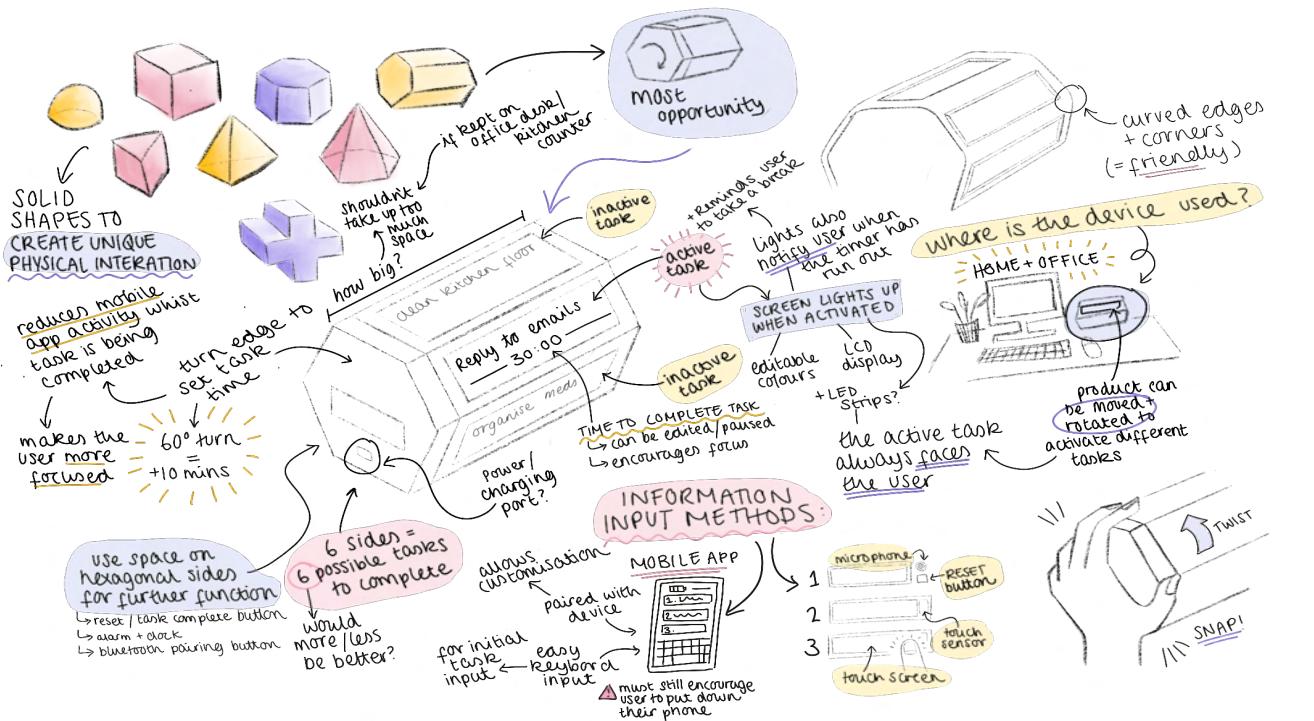
Instax Camera

The curved design of this polaroid printing camera makes it nice to hold & aesthetically pleasing

Concept Development

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Task management and focus device

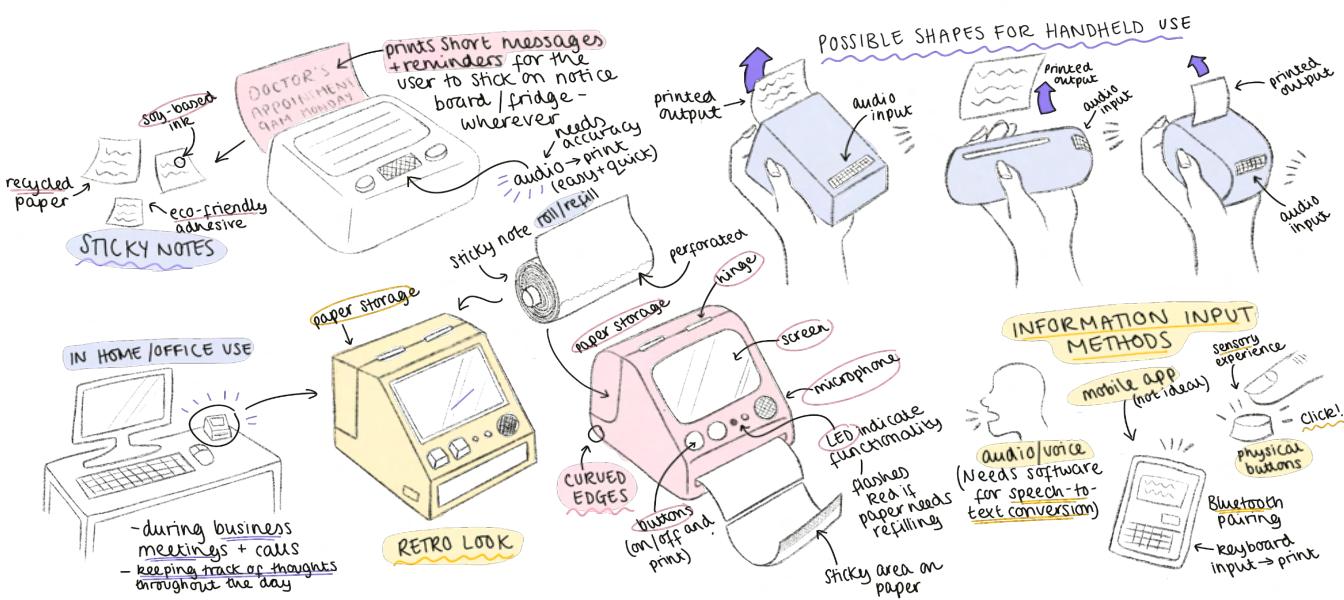


Smart water bottle and pill storage

2

Electric sticky note printer

3



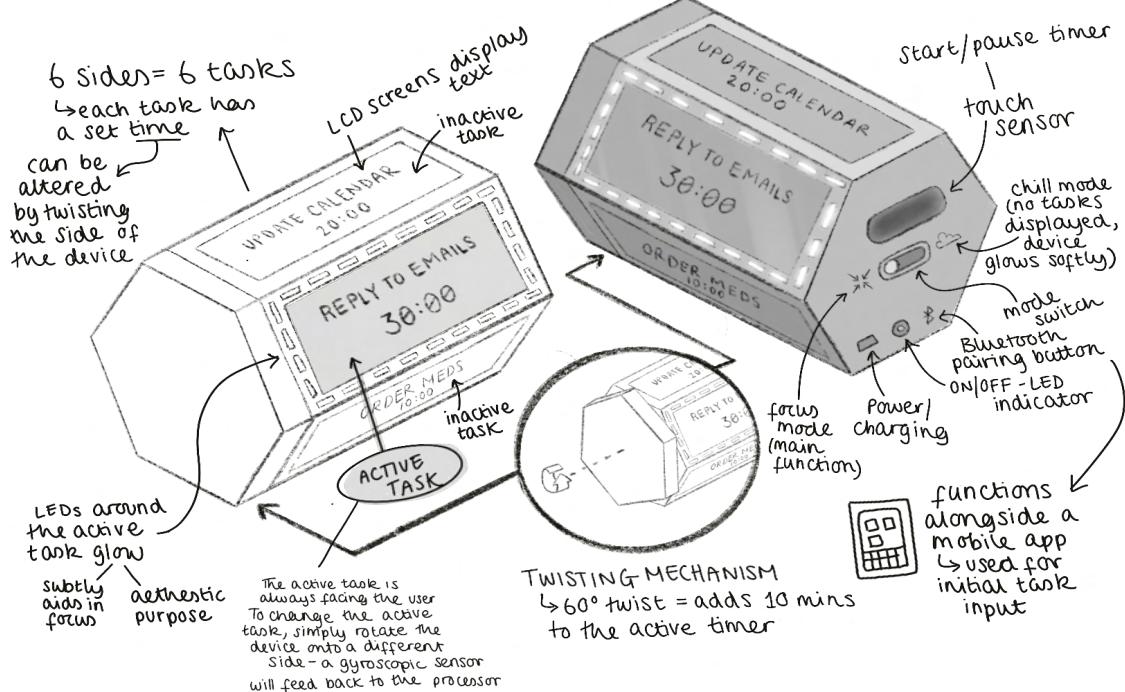
Concept Refinement

Sketching a more refined version of each of the 3 concepts, deciding on a possible combination of shapes, features & functionality from the options explored previously

42

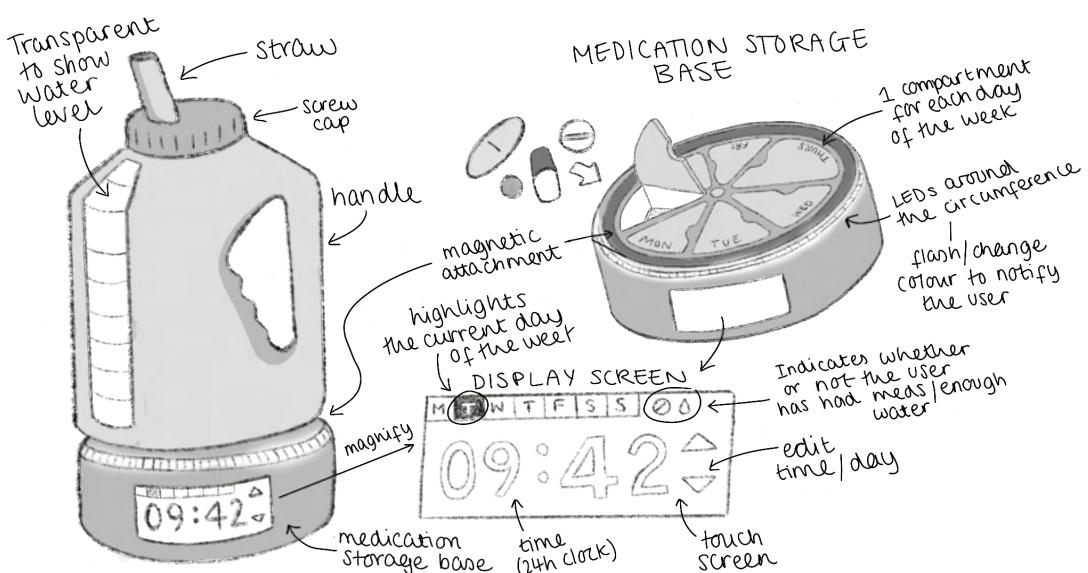
Concept 1

Focus & task management device



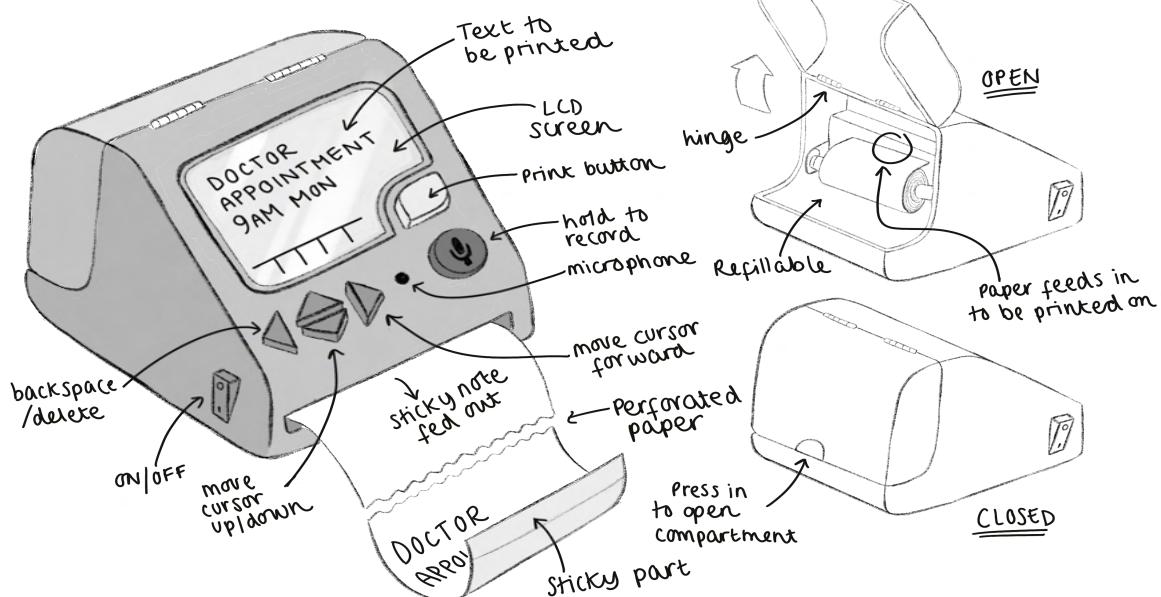
Concept 2

Smart water bottle & pill storage



Concept 3

Sticky note printer

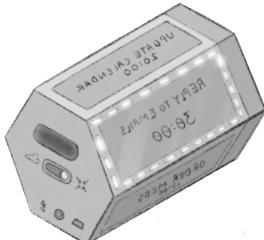


Concept Feedback

Fibromyalgia patients were surveyed to get honest and meaningful feedback on the 3 concepts. They were asked to give qualitative feedback and then vote on their preferred concept

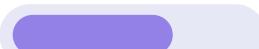
43

Task Management Device



9
votes

Feasibility



Usefulness



Innovation



Positive Points

- Unique idea
- Having both modes allows the user to be focused or relaxed, building a better relationship with the product
- Rotation of the entire device and subsequent LED / screen feedback could be very satisfying
- Touch sensor is easier to activate than a button

Smart water bottle & pill storage



12
votes

Feasibility



Usefulness



Innovation



- The straw is a good addition for users who are less mobile
- The smart tracking can take away the mental strain of remembering to take medication
- The LEDs are a non-invasive notification method
- Storage container will be easy to remove with magnetic attachment

Improvements

- All the different types of buttons is confusing, just stick to one type (maybe touch sensor)
- Does the device actually help user focus? User testing is needed
- The corners should be rounded out more
- The twisting interaction to add to the timer is not very intuitive

Sticky note printer



3
votes

Feasibility



Usefulness



Innovation



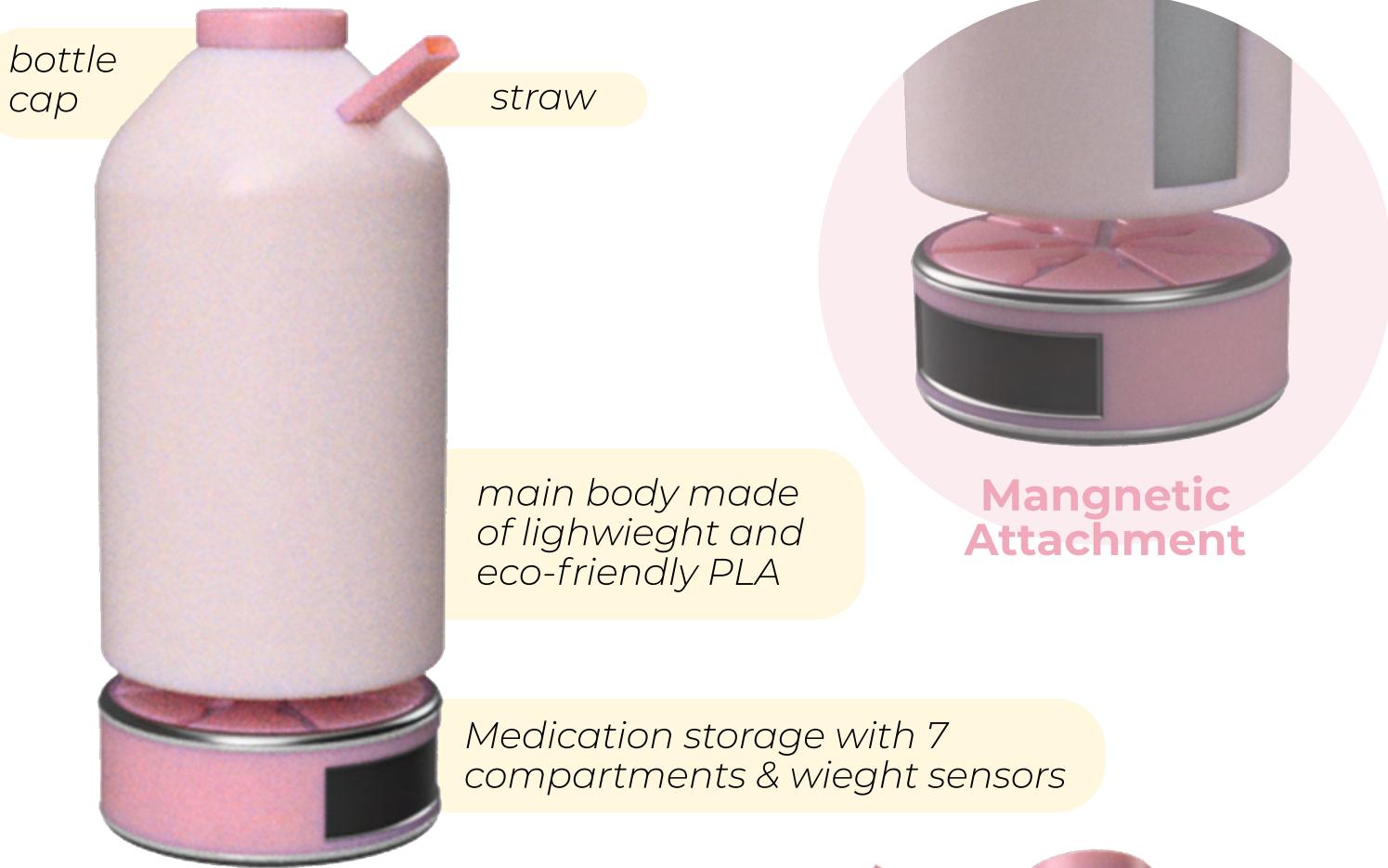
- The retro look makes it fun to use, meaning users are more likely to make it into a habit
- It can become an interesting & functional desk accessory
- The microphone input is good for people who don't like writing or find writing too difficult when multitasking

- Reinventing the post-it note isn't necessary
- A more complex interaction than simply writing something down
- Takes away the physical writing, which some people find is helpful for remembering
- There are many points for it to break
- Voice input and interpretation can be unreliable / inaccessible for people with accents

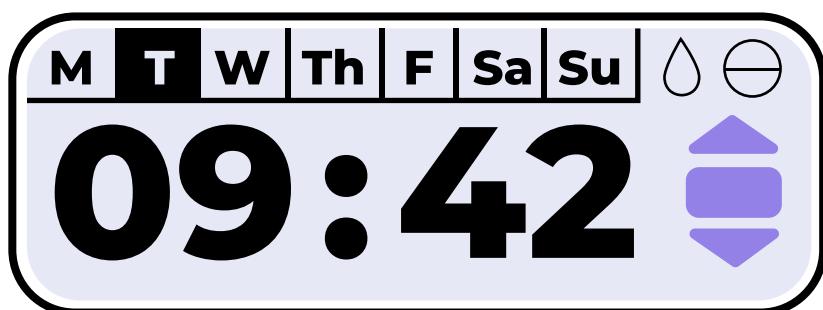
Final Renders

3D models created in Fusion 360 with appearances added to the surfaces for realism

44



Display Screen UI



The touch screen shows:

- time
- day of the week
- time / day adjustment buttons
- OK button
- meds / water reminder icons



Final thoughts

Exploring other colours that could possibly be mixed and matched to the user's liking. There is room for a logo / brand name to be put on the bottle if the concept is chosen to be refined further. The addition of an ergonomic handle can be explored, but would this be done best if informed by physical user testing aided by physical prototypes



Questionnaire for Users

Please fill in the following questions.

1 Order from worst to best, day to day **memory loss, lifestyle changes or memory in communication**, in terms of hindrance to your current lifestyle?

Worst Best

3 Which time frame most defines your daily life?

- Work schedules and deadlines
- Sleep schedule or hours of sleep
- Social life and meetings
- Meal times and diet

5 How much do you currently rely on lifestyle management applications on your phone?

- Very reliant, I use them every day
- Reliant, I need them to track certain aspects of my life
- Not very, I do like checking them sometimes
- I rarely use lifestyle management apps

7 In what ways do these apps not work well for you?

- They take up too much of my time
- There changes are too radical
- There changes arnt radical enough
- They become a for of distraction from my current tasks.

9 What aspects of your daily life would you like to improve the most?

- How much water I drink
- Organisation and work
- My diet
- Social activity

2 What is your top concern when buying a product in order to assist you with your fibromalgia?

- Price
- Visual aspect: eg. doesn't look too medical
- Use: is it amusing, entertaining, manual...
- Impact: alleviates my symptoms the most

4 Select which most applies to you:

- I would like to be able to take a product with me wherever I go.
- I dont mind wearables and porttables as long as they are useful
- Smaller less invasive wearables and protables are good
- I prefer items that are more fixed and dont have to be carried

6 In what ways do these apps work well for you?

- The data they track is useful
- They are simple and very low effort
- I can personalise them to my needs
- They sync up well to each other to combine all my data

8 When does fibro-fog most affect the way you live?

- During difficult manual tasks
- Outside the house, running errands
- Talking to people
- At home

10 Which of the following do you find the most difficult to live with?

- Forgetfullness
- Frequent loss of concentration
- Stress
- Overthinking