



by Conor Brophy

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## Introduction

This project, Design Against Arthritis, focuses on the issues surrounding the disability and the impact it has on someone's daily life. Having observed and spoken to a number of experts and people suffering with the condition, it is clear to see the need for certain products that can have a long term effect physically and also mentally within certain therapeutic and assistive devices.

The main theme running throughout is exercise and daily life. What someone with Arthritis may come across or struggle with going about their average day. Designing and making solutions that fit within this, whilst also appealing to the user emotionally and physically. Developing objects which encourage the user to pick them up, therefore encouraging basic but vital exercise which otherwise they may lack.

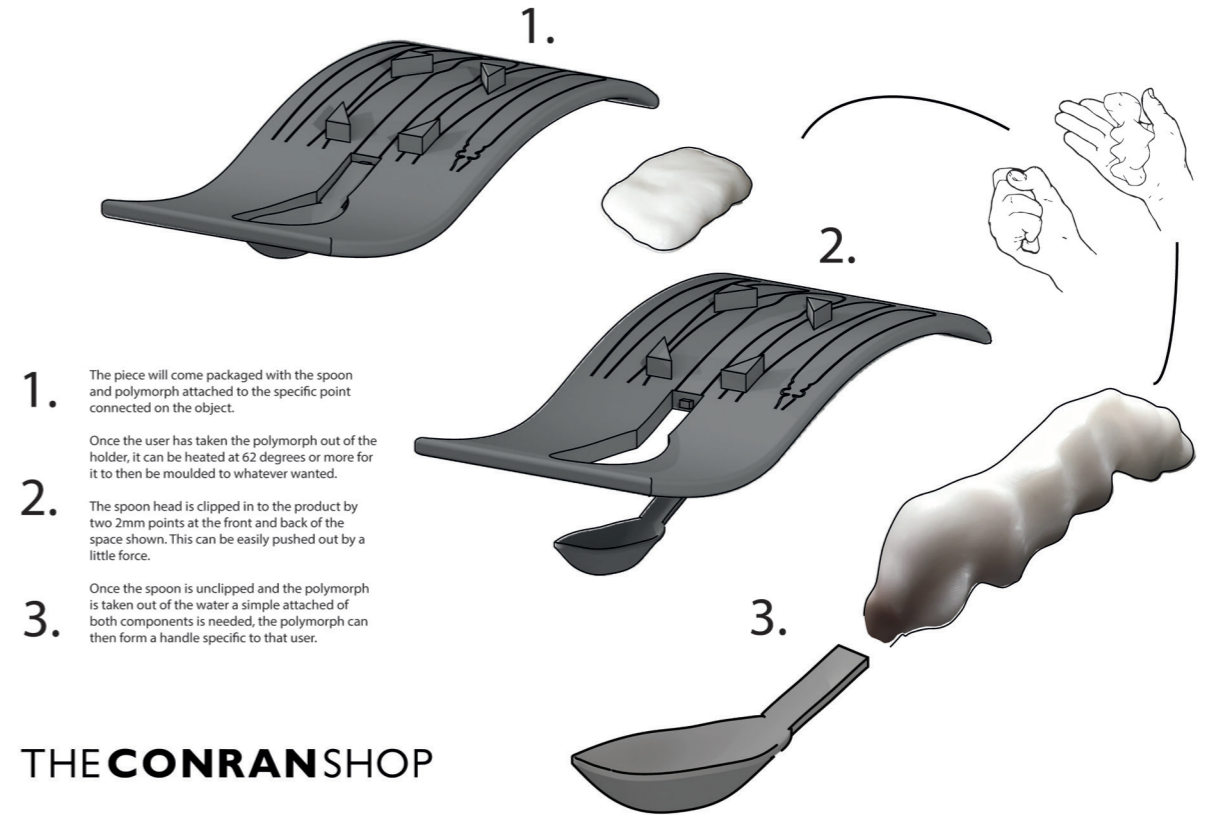
By getting involved with organisations such as Remap and Versus Arthritis and also going on valuable research trips, I have delved into the life of someone suffering with the condition as much as possible, without physically feeling the pain that they may have to endure. Each solution I have come up with is a direct response of this research. Whether it being through questionnaire feedback or observation, I believe each object I have designed and made will fulfil the goals I set myself at the start of the project.

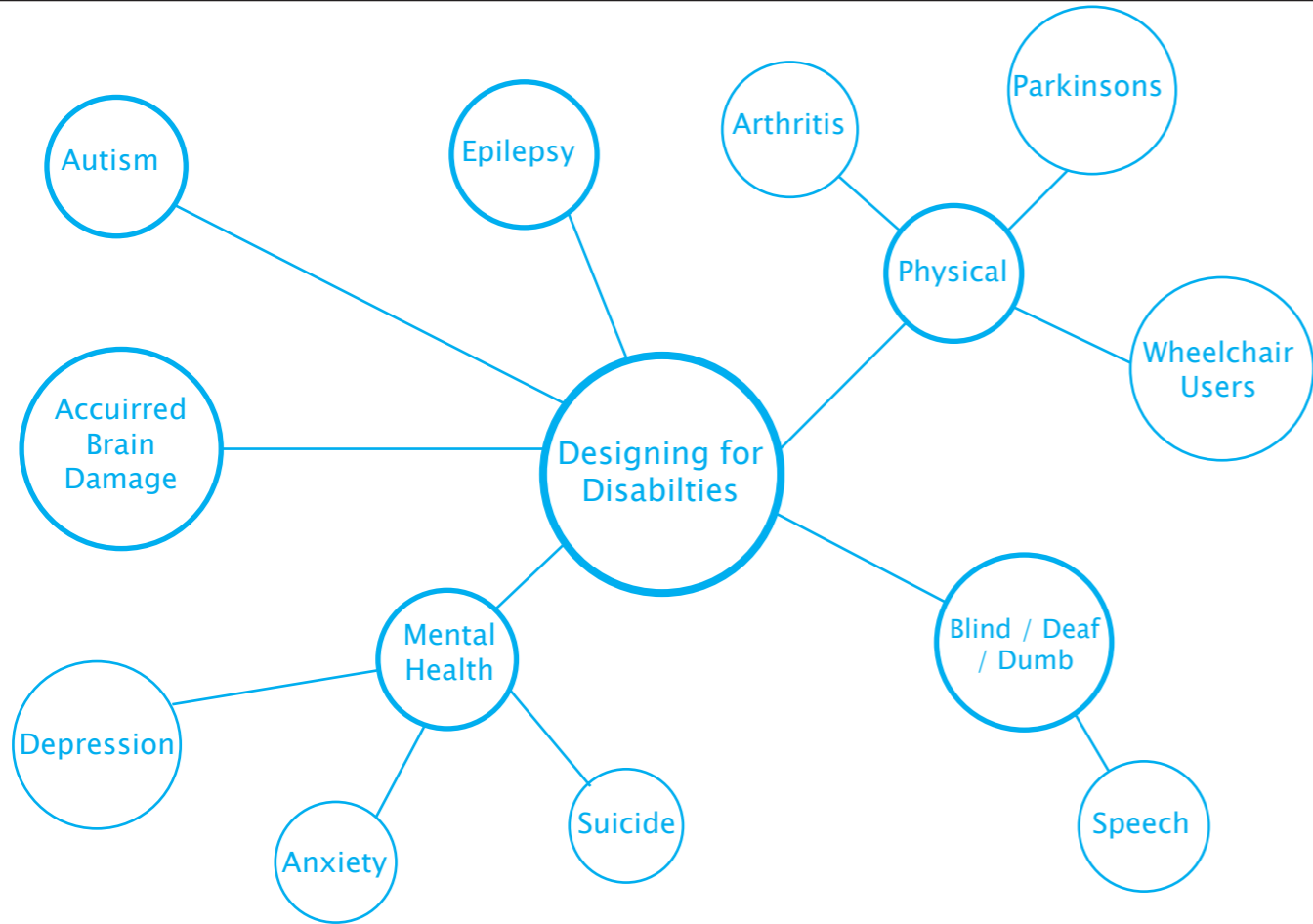
However, I don't believe this project started exactly at the start of this academic year. Coming to the end of my second year and also small periods during year 1, my projects have mainly focused on touch and the way we as humans interact with the same objects but in a different way.

The photo on the right, is a project I completed for the Market project last year. I devised a piece of cutlery that can conform to a specific person's hand, creating a deeper emotional connection with the object for the user whilst also increasing comfort and compatibility.

It was never designed to fit a specific user groups needs, but as the project came to an end and with input from my tutors, it was clear that it should have been. As this project was 10 weeks long, I knew that I didn't have as much time as I needed and knew that would be needed to fulfil a project like this out successfully. I knew from this point that my final years studies would be based around designing objects to fit within a specific social environment and this is where 'Design Against Arthritis' officially started for me.

This document shows you the journey I have taken throughout this academic year, showing you the research, designing and making I have completed to get to my final outcomes.





### Designing for users on the autistic spectrum

Do...	Don't...
use simple colours	use bright contrasting colours
write in plain English	use figures of speech and idioms
use simple sentences and bullet points	create a wall of text
make buttons descriptive	make buttons vague and unpredictable
build simple and consistent layouts	build complex and cluttered layouts

### Designing for users of screen readers

Do...	Don't...
describe images and provide transcripts for video	only show information in an image or video
follow a linear, logical layout	spread content all over a page
structure content using HTML5	rely on text size and placement for structure
build for keyboard use only	force mouse or screen use
write descriptive links and headings	write uninformative links and headings

### Designing for users with low vision

Do...	Don't...
use good colour contrasts and a readable font size	use low colour contrasts and small font size
publish all information on web pages	bury information in downloads
use a combination of colour, shapes and text	only use colour to convey meaning
follow a linear, logical layout	spread content all over a page
put buttons and modifications in context	separate actions from their context

- This image, gathered from the accessibility blog on GOV. com, shows some of the do and don'ts when designing for certain disabilities.

Disability design is such a broad subject area, with many options being done over and over. It was important for me when choosing to pick something that fits within my criteria of touch and human interaction. So this helped me when thinking of physical objects.

### Designing for users with physical or motor disabilities

Do...	Don't...
make large clickable actions	demand precision
give form fields space	batch interactions together
design for keyboard or speech only	make dynamic content that requires a lot of mouse movement
design with mobile and touchscreens in mind	have short time out windows
provide shortcuts	tie users with lots of typing and scrolling

### Designing for users who are Deaf or hard of hearing

Do...	Don't...
write in plain English	use complicated words or figures of speech
use subtitles or provide transcripts for videos	put content in audio or video only
use a linear, logical layout	make complex layouts and menus
break up content with sub-headings, images and videos	make users read long blocks of content
let users request an interpreter for appointments	don't make signposts the only means of contact with users

### Designing for users with dyslexia

Do...	Don't...
use images and diagrams to support text	use large blocks of heavy text
align text to the left and keep a consistent layout	underline words, use italics or write in capitals
consider producing materials in other formats (for example, audio or video)	force users to remember things from previous pages - give reminders and prompts
keep content short, clear and simple	rely on accurate spelling - use autocorrect or provide suggestions
let users change the contrast between background and text	put too much information in one place

## Gregor Timlin's Design for Dementia

"This project describes a two-year collaborative research project between the Helen Hamlyn Centre at the Royal College of Art and Bupa. It explores how better product and environment design can improve quality of life for care home residents with dementia. The design ideas developed are a practical response to the challenge of cognitive decline and can be retrofitted to existing care homes as well as applied to new developments."

Reading Gregor's research document really opened my eyes to how much research needs to be done for the project to be successful. This is something that I believe I had lacked during first and second year, so seeing a project as well put together as this, with clear simple outcomes, really motivated me to get out there and meet people suffering with Arthritis.



<https://www.rca.ac.uk/research-innovation/helen-hamlyn-centre/research-projects/2010-projects/design-dementia/>

## Ryan Kirkpatrick's Scoop Bowl -

“For people with muscular conditions or those who have only one hand, getting the last of the food out of a bowl can be a huge challenge. Designer Ryan Kirkpatrick addresses that problem with the Ceramic Scoop Bowl, a unique bowl with one flat edge that allows it to stand up and facilitate easier eating.”

This set of tableware grabbed my attention instantly due to the simple and minimalistic approach. Additional features to the set of bowls are a rubber base at the bottom which keeps it from sliding around on the table and also a slightly sloped dinner bit which helps the food naturally shift to the flat side. Muscular conditions are very common and this simple design could help a lot of people within their homes.



<https://dornob.com/whats-the-scoop-flat-edge-bowl-stands-up-to-help-eating/>



## Michael Boulay's Transitions Fork Set -

"The project description: Can we grow the motricity of a disable hand step by step? Transitions is a set of cutlery which aims to stimulate the motricity of a handicaped hand, step by step. Through steps, the function of the fork (holding, pricking, scooping) and the way of holding it (from the main muscles of the hand to the tip of the fingers) are growing together, in parallel. And step by step progress is generated. As we can become handicaped, we could also «unbecome» handicaped ..."

This project is the one that really got me completely focused on designing for disabilities. Cutlery design is what I wrote about for my dissertation and seeing projects like this, which make the user feel more comfortable by touching and also mentally, inspires me to do the same.

<https://www.designboom.com/design/cutlery-that-aids-dexterity-transition-by-mickael-boulay/>



## Bilge Nur Saltik's Share.Food -

“Share.Food’ is a ceramic tableware series thinking through the dining etiquette of the 21st century. I am focusing on the best manner of sharing food. Plates and cups designed to give the user the option of opening their plates to others. With the angled cups and plates it is a balancing game around a dining table. My aim is to encourage people to share their food. Open your plate to others to initiate conversation. I believe sharing will encourage communication between people.”

This project appealed to me, once again, due to my dissertation being focused on Cutlery design and also dining etiquette in the 21st century. The way people interact with different objects has been one of my main themes throughout each year on the course and this is a really interesting take on it, even though its not as focused on disabilities as some other projects I’ve looked at, the encouragement of user engagement is something I wanted to get across within my project.



## First meeting with Tom Ainsworth -

On the 5th October, I had my first meeting with Tom Ainsworth. Tom, completed his PhD on the development of persuasive design and engagement between therapeutic devices within people suffering with RA. The conversation we had was recorded on my phone with his permission and was done before I chose to focus my project on Arthritis.

Having been told about Tom's previous studies into the field of Arthritis, I decided to get his opinion on what to do and not to do when working within disabilities. Quickly after meeting him, I could see how passionate and educated he was on the matter, therefore motivating me to chose arthritis as my main point of enquiry.

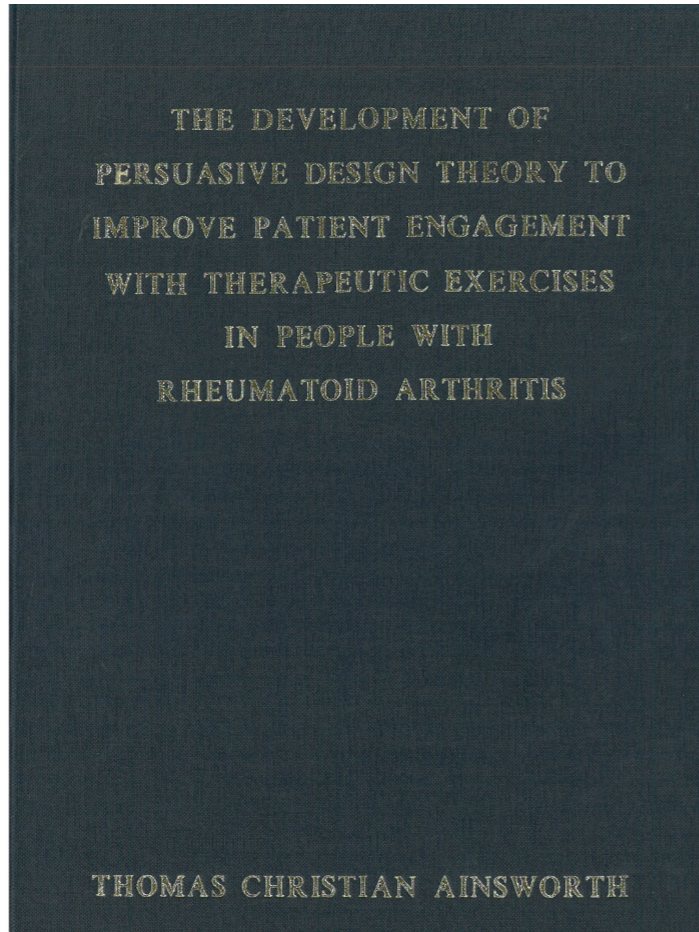
### Key Points:

-Focus on daily routines

-Not average arthritic/ergonomic products

-Product review, look at good and bad.

- Look into ways of making a product or object that doesn't make the user go out of their way to use it.



## Initial contact with Versus Arthritis & Remap -

After meeting with Tom, it was clear that I was going to be designing and making my products for users suffering with Arthritis.

The first thing that I did after was research charities and organisations that I could either volunteer with or find users to meet and work with to help aid my research study.

Versus Arthritis (VA) was the first organisation that I contacted, VA were very quick to respond and after a couple of emails put me in the right direction. By giving me a number of other contacts I was then able to meet with members of the Remap organisation and also a focus group in Reigate, which I then worked more closely with.

Here are three emails that I either sent or received following my enquiries.

Hi Conor

Thanks for your time on the phone, it was good speaking with you.

#### Local branches and groups

##### Reigate & District Branch

Contact Geoff Hinkley, Reigate Branch Chair, to enquire about holding a session at a Branch meeting. Geoff is a very knowledgeable, longstanding volunteer with the charity and has been successfully leading the Reigate Branch for many decades.

You can reach him on 01737 246 358.

##### Worthing & District Branch

Contact Margaret Coleman, Worthing Branch Chair, to find out more about holding a session at their Branch.

You can reach her on 01243 544 198.

#### Online community moderator

Please see the link to the online community moderator role here: <https://www.versusarthritis.org.uk/web/involvement/volunteer/volunteer-opportunities/100/volunteer-online-community-moderator>

#### Other organisations

As mentioned, it might be useful for you to get in touch with REMAP Here's their website:

<https://www.remap.org.uk/>

If you have any questions, please feel free to get in contact.

Best wishes

Cats

Hello,

I am currently in my third year of 3D Design and Craft at Brighton Uni, and for my final year I am focusing on designing for disability with Arthritis being the main theme for my project at the moment. I recently spoke with Cassandra from Versus Arthritis (Arthritis Research UK) and she told me to get in touch with you at Remap. I was just wondering if it was possible to come and have a chat with someone from Remap about my project. It would add greatly to my research and give me an insight of what I should focus on in while working with different people with different needs.

Hope to hear back from you soon.

Thanks,

Conor

Hi Conor,

I am back in circulation and have checked with our (Professor) Fred Maillardet about meeting you. It is on his 'to do' list so you should be hearing from him before long. He is the ideal person to help as he was Dean of Mechanical Engineering at Brighton University before retirement. Our next panel meeting will be on 26th November at 6.30pm at Brighton uni by the way. Advanced Engineering Building AEB G3. You would be welcome to attend, meet some of us and see what we are doing.

Best wishes

Alan

1.

2.

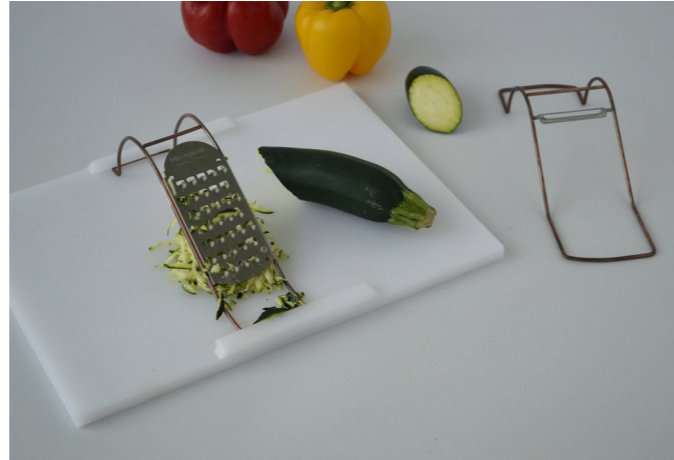
3.

## Simon Kinneir's Hand Healthy -

"Osteoarthritis is an age-related condition, although it affects people across the age-spectrum. It speaks between the ages of 45-64 with more women than men experiencing the condition.

Even for people with the condition who are aware that exercise is beneficial, maintaining their physiotherapy alongside daily life can be a struggle. This study focuses on cooking as an everyday activity at which therapeutic interventions can be targeted. Research was conducted in five London cultural centres with people from culturally diverse backgrounds."

Throughout his project, Simon Kinneir, focuses specifically on how older people that are suffering with Osteoarthritis (OA) use the kitchen. He looked at additional factors such as different cultural and ethnic backgrounds to then go on and make therapeutic devices. After my first conversation with Tom, he told me about this project, as Simon used Tom's PHD as a starting point for his research.



## Arthritis

Throughout this project I felt like it was important for me to look into both of the most common forms of Arthritis, Rheumatoid and Osteo, as much as possible. Within some of the already existing projects I have looked into, it is clear to see that the researcher/designer has focused on one specifically. Where as, for Design Against Arthritis, I believe it could be useful to design and make baring both of them in mind.

What is Rheumatoid Arthritis?

Rheumatoid Arthritis is a long term condition which causes pain, swelling and stiffness to different joints within the human body. The main areas for concerns within Rheumatoid are the hands, feet and wrists. There are many other factors within RA such as tiredness and weight loss. This is why exercise and healthy eating is essential for the best quality of life whilst suffering with the condition.

“Rheumatoid Arthritis is an autoimmune disease. This means your immune system, which usually fights infection, attacks the cells that line your joints by mistake, making the joints swollen, stiff and painful.”

At the moment, there isn't a cure for RA. However, to be able to lead a full life, it is proven that early diagnosis and early treatment lets people with RA have periods of months and even years without a flare up. This proves, that the right design, following the right daily task could have huge benefits to people with RA, whether that be at the start of their diagnosis or not.

What is Osteoarthritis?

The most common form of Arthritis is Osteoarthritis (OA). It is caused by the breakdown of joint cartilage, between the bones that rub together to form a joint. Like RA, Osteo causes joints to become stiff and painful. Different to RA, OA is classed as a degenerative joint disease, where as RA is autoimmune.

“For some people, the symptoms can be mild and may come and go. Others can experience more continuous and severe problems which make it difficult to carry out everyday activities.”

Information gathered from:  
[www.nhs.uk/conditions/osteoarthritis](http://www.nhs.uk/conditions/osteoarthritis)  
[www.nhs.uk/conditions/rheumatoid](http://www.nhs.uk/conditions/rheumatoid)

Even with these differences, it is clear for all that arthritis is an overall issue within society. Even with the huge amount of research and money spent on finding solutions, I believe that many of the objects or products which are specifically designed for the disability, do not hold a long enough benefit for the people suffering with the pain.

On the right and the next two pages are some statistics that show just how common Arthritis is.

Images 1-4 from:

- <https://www.arthritiscare.org.uk/about-us/media/1020-arthritis-statistics-infographic-did-you-know>  
 - <https://www.arthritisresearchuk.org/arthritis-information/data-and-statistics/state-of-musculoskeletal-health/what-is-the-scale-of-the-problem.aspx>  
 - <https://www.nras.org.uk/rheumatoid-arthritis-awareness-week-2013>  
 - <https://www.pinterest.co.uk/pin/525373112764272535/>

## rheumatoid arthritis facing the facts



An estimated **690,000** people across the UK have rheumatoid arthritis. *That's almost one in every hundred*



Onset most commonly occurs when people are in the **prime of their working life** or **with a young family**

Women are **three times** as likely as men to have RA



**£560 million** annual cost to the NHS in England  
**£4.8 billion** total cost to the UK economy, including the cost of treatment, care and lost productivity



You're not alone and support is available

If you are worried about rheumatoid arthritis, please call our freephone helpline 0800 298 7650 or visit our website [www.nras.org.uk](http://www.nras.org.uk)



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## Did you know...

**AROUND 10 MILLION**

people in the UK have a form of arthritis, of which almost **700,000** have rheumatoid arthritis.<sup>1</sup>

**STRESS & ANXIETY**

**7.5 MILLION**

working days are lost each year due to musculoskeletal conditions, second only to stress and anxiety.<sup>2</sup>

**50% INCREASE**

Projections suggest that the number of people with arthritis is set to increase by over 50% by 2030.<sup>2</sup>

Musculoskeletal conditions account for the **FOURTH LARGEST** NHS programme budget spend in England at about **£5 BILLION**.<sup>4</sup>

EACH YEAR ABOUT 20% OF THE GENERAL POPULATION CONSULT A GP ABOUT A MUSCULOSKELETAL PROBLEM SUCH AS ARTHRITIS. THAT'S OVER 100,000 CONSULTATIONS EVERY DAY.<sup>5</sup>

There are over **86,000** hip and over **90,000** knee replacements each year.<sup>6</sup>

There is a strong association between depression and musculoskeletal conditions.

**68%** of people with arthritis report depression when their pain is at its worst.<sup>7</sup>

Musculoskeletal conditions are the largest contributor to disability in the UK, accounting for **31%** of all years lost due to disability.<sup>8</sup>

**THE WORLD HEALTH ORGANISATION** describes musculoskeletal conditions as the 'leading causes of morbidity and disability, giving rise to enormous healthcare expenditures and loss of work'.<sup>9</sup>

**ARTHRITIS CARE**

REFERENCES:

1. www.rheumatology.org.uk/patient\_information/simple\_tasks/did\_you\_know.aspx 2. HL Select Committee (2013). Reading for Ageing? 3. Arthritis Research UK National Primary Care Centre, Keele University (2009). Musculoskeletal Matters: 3. NHS England Programme Budgeting Data (2012-3). Accessed at www.england.nhs.uk/resources/resources-for-cpg/budgeting/ 4. Health & Safety Executive (2012). Annual Statistics Report 2012/13. 5. National Joint Register for England, Wales and Northern Ireland (2014). 11th Annual Report. Part two including data on clinical activity online at www.njrreports.org.uk 6. Arthritis Care (2011). Arthritis Hurts: The emotional pain of arthritis. 8. World Health Organisation (2016). Chronic disease and health promotion: chronic rheumatic conditions: www.who.int/topics/rheumatoid/ 9. Murray, C. et al. UK health performance: findings of the Global Burden of Disease Study 2010. Lancet 381: 9871, 997-1020

## Ouch! Arthritis Hurts

22.7 million adults with arthritis experience **limitations in everyday activities.**

**walking**  
11 million

**climbing stairs**  
8 million

**stooping/bending/  
kneeling**  
14 million

**community and social activities like visiting friends and family**  
6 million

To learn more about managing arthritis, please visit [www.cdc.gov/arthritis](http://www.cdc.gov/arthritis).



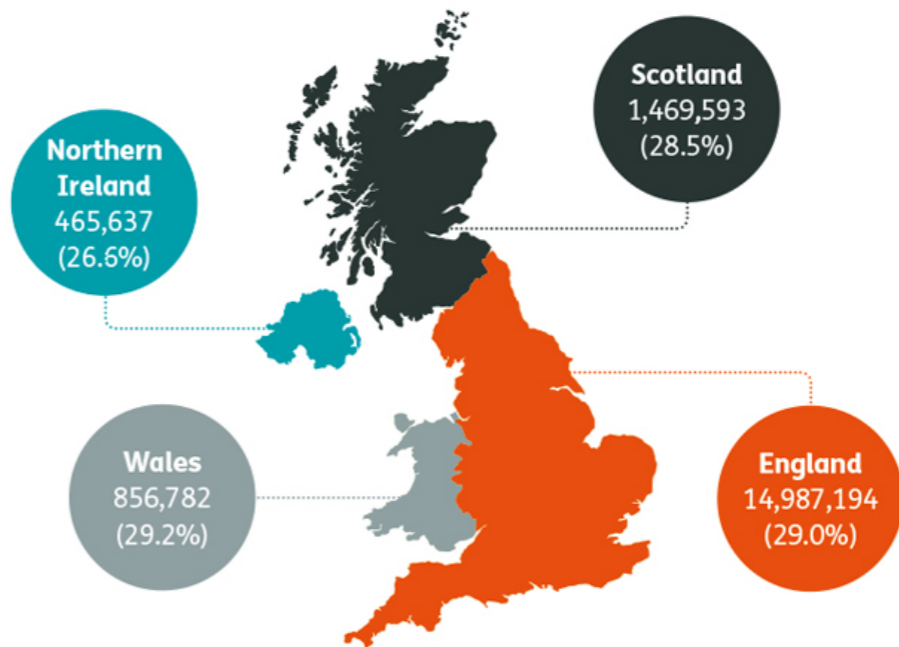
An estimated **17.8 million** people live with a musculoskeletal condition in the UK. That's around **28.9%** of the total population.



**7.7 million males** have musculoskeletal conditions (male prevalence **25.9%**).



**10.1 million females** have musculoskeletal conditions (female prevalence **31.8%**).



## Hassocks to meet Fred

After a few phone calls and emails, I managed to get in touch with Fred Maillardet. Fred is an expert on human joints, in particular the knee and hip joints. He has been a member of the organisation, Remap, and that is how I first got into contact with him. I then travelled to his home, which is located in Hassocks. We had a long chat about all things Arthritis and Remap. The conversation was recorded, with Fred's permission.

Key points from the conversation:

- Fred was actually the founder of the Brighton Remap branch.
- He was also the founder of the Product Design course at Brighton University, in which he still has links with.
- Whatever designed should be for the long run, a continuous amount of exercise/something of a certain emotional attachment needs to be ensured and encouraged.
- In his experience, Morning and Evenings are when people feel the most pain.
- Getting dressed is a huge issue.
- Look into other areas of the body, in which medical focus is less present.
- A lot of products that are "specialised" which aren't good enough.



## Ethics Tier 1 -

After both chats with Tom and Fred, it was clear that the best and most efficient way for me to gather information and start thinking of potential outcomes was by going out and meeting people. However, to do this, I had to complete an Ethics application. To accompany what I was intending to do this year I needed to complete a Tier 1 form. To be able to hand out anonymous questions and get photos without people's faces was the option. The form took longer than I first thought, on the first two hand ins a few things were missing and my questionnaire needed adjusting. The form was then signed off on the 18th of January, meaning then I was then all clear to hand them out and gather feedback.

I knew from the conversations I had already had, I needed to focus the questionnaire on daily life and daily struggles, with exercise at the front of my mind.



## First page

**Hello,**

I am currently a third year student at the University of Brighton.

For my final year project I am focusing on Arthritis and the effects it has on a daily basis.

It would be great if you could help aid my project by filling out this short questionnaire on the back, it's completely anonymous aswell!

Responding to this questionnaire is completely voluntary, however by responding you agree for the results to be used within my project.

**Thanks for your time,  
Conor**

18+

(Please circle or cross each option and write on the black line)

**1.** How old were you when you first started feeling the symptoms of Arthritis?

\_\_\_\_\_

**2.** How long have you been suffering with Arthritis?

\_\_\_\_\_

**3.** When it comes to your daily routine, which of these is the most challenging?

**Cooking    Washing**  
**Cleaning    Eating**

**4.** Which part or parts of your body is most affected by Arthritis?

**Knees    Hands    Shoulders**  
**Back    Elbows    Hip**

## Second page

**5.** Is there a specific time of day in which your Arthritis causes you the most pain?

**Morning    Afternoon    Evening**

**6.** Do you use any tools or adapted devices to help you do day to day tasks which you find difficult as a result of your arthritis?

**Yes    No**

If so, could you name what product/object this was and what area it was made for?

\_\_\_\_\_

How do they help you?

\_\_\_\_\_

**7.** Are there any other daily tasks you find particularly challenging which you don't have a solution for?

\_\_\_\_\_

## Questionnaire -

On the left is an example of the short questionnaire that I designed to give out to people within the Reigate group and also external people suffering with the condition. Focusing on daily tasks and daily routines, I wanted to find first hand what struggles people personally have, what products they are already using and whether these have any benefit in the short or long term.

The information that I was aiming to get back, would ideally help me start to progress more with my designing and making. I wanted to find out, roughly, how old the average person was when they first got diagnosed with the condition and also how long they had been suffering. Due to seeing many articles on how the age for diagnosis of Arthritis is dropping, this therefore means that more and more people are willing to recognise it and talk about it earlier than before.

Having looked into specific body parts that cause the most discomfort, I already knew the main areas. By adding the body parts question, I was hoping to find a correlation in the feedback, which could then help me later on when identifying certain objects that fit within that part of the body and closest joint and then identify a routine in which uses it.

Having looked at other projects, not only to do with Arthritis but other disabilities aswell, you could always see that each had a specific focal point. For example, with Simon Kinneir's Hand Healthy project, his focus was purely on the kitchen and cooking.

After speaking with Fred before, he had already mentioned to me that from his personal opinion, it is early in the morning and late at night when the pain is felt the most. By adding the time of the day question, I was hoping I'd gather the same response to back up earlier research. I believe that this question was vital for me for this project, as by finding specific points of the day means narrowing down certain daily tasks easier, such as breakfast and dinner, washing, getting changed etc.

I wasn't exactly sure what feedback I would get from the last two questions, as I had found many people used similar, short term beneficial products to help them. I wanted to find out exactly how many people were using existing products, what product(s) they were and how did they actually help. Question 7 asked the participant whether there was anything that was challenging to them in which they haven't got an aid for, this question was also vital too.



## First trip to Reigate -

My first visit to Reigate was on the 27th of November, I got the train from Brighton in the morning. It was my first time visiting the town and also the group, I wasn't sure how they would react to me intruding on their monthly get-together, however I was excited.

As I had previously been in touch with Geoff, the chair of the group, before making the trip to Reigate. He had already explained to me that as it was the last session before Christmas, that there wouldn't be an exercise class for me to observe at the start of the end. As I had to wait for my Ethics proposal clearance, I knew that I couldn't hand my questionnaire out or gather feedback. This trip was mainly for me to go, meet and talk to as many people with Arthritis as possible and see if they could give me any information at all that may help my practice.

The meeting lasted for around 2 hours, half of that was taken up by school children carol singing, however during that period, I was able to leave and talk with Geoff, one to one on his problems and also the wider picture. It's within this conversation in which the project name, Design Against Arthritis, came about. Due to Geoff believing that for was the term to have in the middle, he believed to tackle the issue head on, it's us against Arthritis.

On the next page's are some examples of the material Geoff gave me.

# VERSUS ARTHRITIS

## Material gathered from Geoff, in Reigate



Scans from brochures collected.

We chatted for about half an hour, sadly I didn't get chance to record this conversation. We went through his personal struggles with Arthritis, when he first starting feeling the symptoms and what exercises and products he uses to help ease the pain the best way for him.

After the conversation, he handed me a pack of leaflets, brochures and papers on the condition for me to take away with me and study. Some more fitting to my research than others, however they all included highly beneficial information that would inform my designs.

Here are a few scans of the material that helped aid my project:



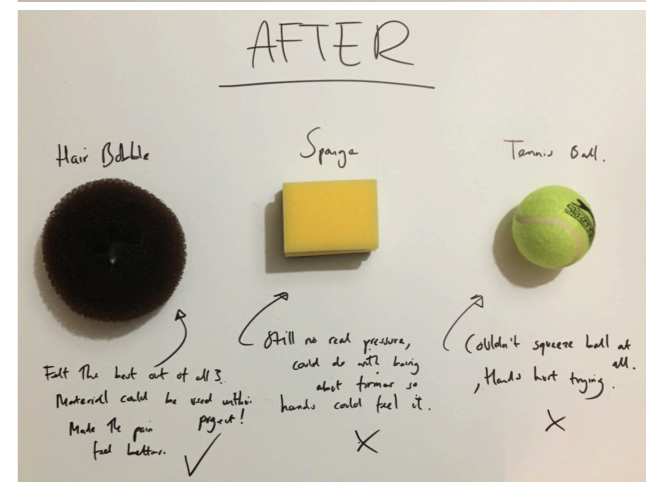
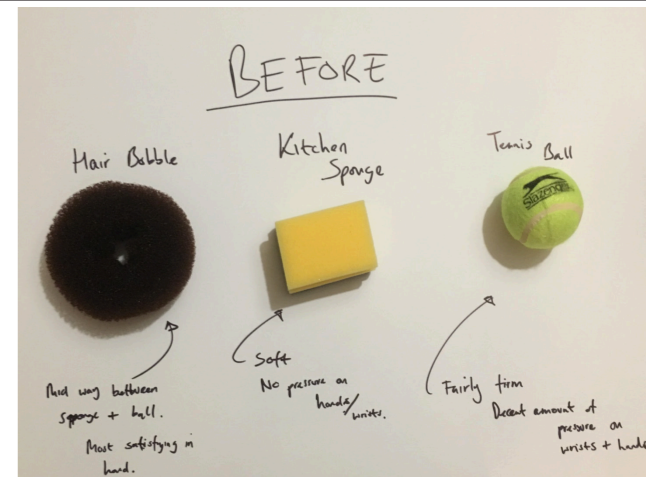


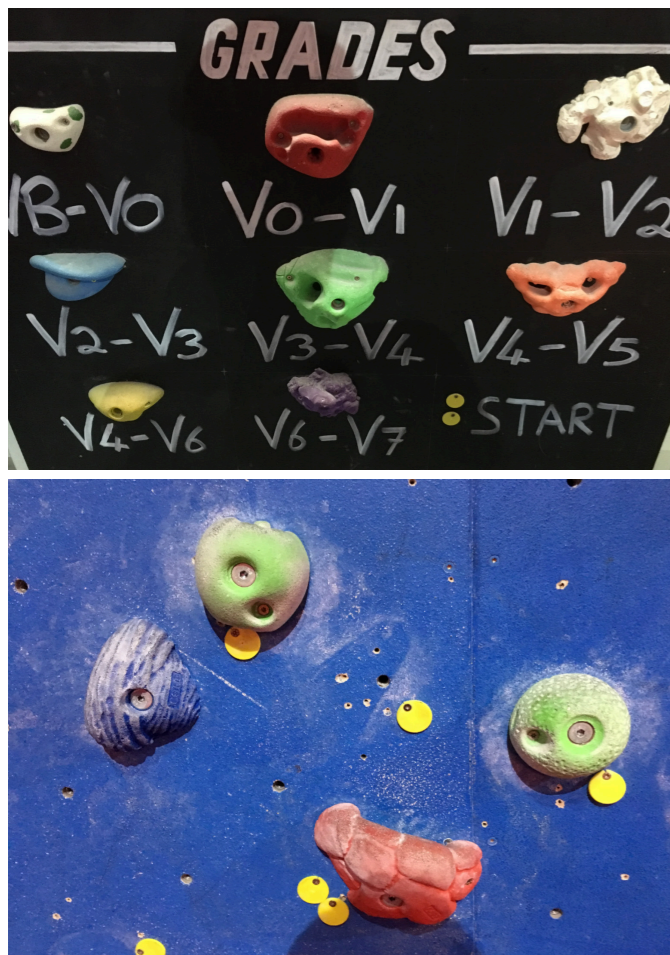


## Research Trip to High Sports -

To try and gain a more in depth, personal understanding of the physical aspect of having Arthritis, I decided to go bouldering. The reason's for this was to feel the strain on certain parts of my body in which a normal Arthritis patient would occur.

I decided to not only climb the walls for a certain amount of time, but I also picked up three very different objects from my local poundland that all added a slightly different resistance when squeezed by either hand. Here are the materials and also the before and after effects of using them.





The pain felt during and also for a long period after was a lot different to what I first expected. Both the upper body and lower body felt similar effects, my hands were sore and my knees and ankles ached. The only other way I felt best described the pain in my hands was when you go to a super market and walk home carrying a heavy bag. It felt like my hands were not completed at ease. This could be the effects of having Arthritis but it could also not be.

One other aspect that I took away from this research trip was the colour, as you can see from the images on the left, the colour used for each of the wall mounted grips was to do with the difficulty level of holding onto it. The forms were also interesting, compared to the forms I had made from polymorph, they differed massively. Afterwards, I decided to have a look into coloured pain, I came across an interesting study which was called “The Colour of Pain” which happened to focus on people suffering with Arthritis.

Colour is something that could prove to be really important to my overall project and final outcomes.

## “The Colour of Pain”

### RESEARCH ARTICLE

#### The Colour of Pain: Can Patients Use Colour to Describe Osteoarthritis Pain?

Vikki Wylde\*, Victoria Wells, Samantha Dixon & Rachael Gooberman-Hill

Musculoskeletal Research Unit, School of Clinical Sciences, University of Bristol, Southmead Hospital, Bristol, UK

#### Abstract

**Objective.** The aim of the present study was to explore patients' views on the acceptability and feasibility of using colour to describe osteoarthritis (OA) pain, and whether colour could be used to communicate pain to healthcare professionals.

**Methods.** Six group interviews were conducted with 17 patients with knee OA. Discussion topics included first impressions about using colour to describe pain, whether participants could associate their pain with colour, how colours related to changes to intensity and different pain qualities, and whether they could envisage using colour to describe pain to healthcare professionals.

**Results.** The group interviews indicated that, although the idea of using colour was generally acceptable, it did not suit all participants as a way of describing their pain. The majority of participants chose red to describe high-intensity pain; the reasons given were because red symbolized inflammation, fire, anger and the stop signal in a traffic light system. Colours used to describe the absence of pain were chosen because of their association with positive emotional feelings, such as purity, calmness and happiness. A range of colours was chosen to represent changes in pain intensity. Aching pain was consistently identified as being associated with colours such as grey or black, whereas sharp pain was described using a wider selection of colours. The majority of participants thought that they would be able to use colour to describe their pain to healthcare professionals, although issues around the interpretability and standardization of colour were raised.

**Conclusions.** For some patients, using colour to describe their pain experience may be a useful tool to improve doctor-patient communication. Copyright © 2013 John Wiley & Sons, Ltd.

saturation was achieved, as in later interviews discussion and themes echoed those that had already emerged. However, it is worth noting that the study aimed to explore whether colour could be used to discuss OA pain and, if so, how people with OA described those connections. As such, the study did not aim to explore gender, cultural or ethnic differences. As discussed later, future studies could work towards this, especially in light of known cultural variation in colour symbolism. Emergent themes are described below, using participant quotations to illustrate key points (Table 3). An overview of colours chosen by participants to describe their OA pain is provided in Table 4.

#### Participants' views about using colour to describing pain

Initial reactions to the concept of using colour to describe any kind of pain included the sense that the idea was novel to participants, most of whom had not previously considered thinking about their pain in terms of colour. One participant (Mr K) had previously related his pain to the colour red, although he said that he did not know

why he perceived pain in this way. In spite of some initial concerns about inability to relate their pain to colour, all participants except one (Mr L) used colour to describe their OA pain during the interviews. However, even as the groups progressed, the ease with which participants could relate their OA pain to colour varied, with some participants finding it easy to do but with others experiencing difficulty. By the end of the interviews, some participants who initially could not easily associate pain with colour had become engaged with the idea of using colour. One participant (Mrs H) discussed the advantages of using colour over more conventional pain assessment methods, such as numbers, explaining that she thought that colour was more suited because of the many shades of colour. However, other participants said that they remained unlikely to associate colour with pain and would not use it to talk about their pain in the future. One participant (Mrs N) preferred to use words rather than colour to describe her pain, explaining that this may have been because she was not an 'arty' person. The group interviews showed that although the idea of using colour was generally acceptable, it did not suit all participants.

After the research trip bouldering, I decided to dig a little deeper into the colour of pain. I found an article, which was linked to arthritis. Titled 'The Colour of Pain' it was a study into patients being able to describe the pain they were feeling to different colours. Here are two screenshots showing an overview of the study and some findings. I then used this question on my final trip to Reigate.

After going to Reigate in November and also getting my Ethics clearance back from the committee, I went back for a second visit to Reigate, on the 28th of January. However, this time after my ethics was approved, I was able to finally take my questionnaire's. I handed them out just before the start of the meeting and left the members some time to fill them out and talk amongst themselves. I gathered all of them back just before people went home.

After receiving 30 questionnaires back from either Reigate or sending them to others, the findings turned out to be significant, here are some examples of the ones that helped me in my journey.

(Please circle or cross each option and write on the black line)

- How old were you when you first started feeling the symptoms of Arthritis?  
QUITE YOUNG
- How long have you been suffering with Arthritis?  
A LONG TIME (1993)
- When it comes to your daily routine, which of these is the most challenging?  
**Cooking** ✓ **Washing**  
**Cleaning** ✓ **Eating**
- Which part or parts of your body is most affected by Arthritis?  
**Knees** ✓ **Hands** ✓ **Shoulders** ✓  
**Back** ✓ **Elbows** ✓ **Hip** ✓

5. Is there a specific time of day in which your Arthritis causes you the most pain?

**Morning** **Afternoon** **Evening** ?

6. Do you use any tools or adapted devices to help you do day to day tasks which you find difficult as a result of your arthritis?  
**Yes** **No**

If so, could you name what product/object this was and what area it was made for?  
walker

How do they help you?  
TO STOP FALLING

7. Are there any other daily tasks you find particularly challenging which you don't have a solution for?

(Please circle or cross each option and write on the black line)

- How old were you when you first started feeling the symptoms of Arthritis?  
58
- How long have you been suffering with Arthritis?  
26
- When it comes to your daily routine, which of these is the most challenging?  
**Cooking** **Washing** **Getting Dressed**  
**Cleaning** **Eating**
- Which part or parts of your body is most affected by Arthritis?  
**Knees** **Hands** **Shoulders**  
**Back** **Elbows** **Hip**

5. Is there a specific time of day in which your Arthritis causes you the most pain?

**Morning** **Afternoon** **Evening**

6. Do you use any tools or adapted devices to help you do day to day tasks which you find difficult as a result of your arthritis?  
**Yes** **No**

If so, could you name what product/object this was and what area it was made for?  
PAINKILLERS

How do they help you?  
EASE THE PAIN

7. Are there any other daily tasks you find particularly challenging which you don't have a solution for?

(Please circle or cross each option and write on the black line)

- How old were you when you first started feeling the symptoms of Arthritis?  
2010
- How long have you been suffering with Arthritis?  
8 years +
- When it comes to your daily routine, which of these is the most challenging?  
**Cooking** **Washing** **Getting Dressed**  
**Cleaning** **Eating**
- Which part or parts of your body is most affected by Arthritis?  
**Knees** **Hands** **Shoulders**  
**Back** **Elbows** **Hip**

5. Is there a specific time of day in which your Arthritis causes you the most pain?

**Morning** **Afternoon** **Evening**

6. Do you use any tools or adapted devices to help you do day to day tasks which you find difficult as a result of your arthritis?  
**Yes** **No**

If so, could you name what product/object this was and what area it was made for?

How do they help you?

7. Are there any other daily tasks you find particularly challenging which you don't have a solution for?  
Walking

(Please circle or cross each option and write on the black line)

- How old were you when you first started feeling the symptoms of Arthritis?  
50
- How long have you been suffering with Arthritis?  
25 YRS
- When it comes to your daily routine, which of these is the most challenging?  
**Cooking** **Washing**  
**Cleaning** **Eating**
- Which part or parts of your body is most affected by Arthritis?  
**Knees** **Hands** **Shoulders**  
**Back** **Elbows** **Hip**

5. Is there a specific time of day in which your Arthritis causes you the most pain?

**Morning** **Afternoon** **Evening**

6. Do you use any tools or adapted devices to help you do day to day tasks which you find difficult as a result of your arthritis?  
**Yes** **No**

If so, could you name what product/object this was and what area it was made for?  
CARPENING TOOLS

How do they help you?  
EASIER TO HANDLE

7. Are there any other daily tasks you find particularly challenging which you don't have a solution for?  
GETTING UP FROM CHAIR OR FLOOR

(Please circle or cross each option and write on the black line)

- How old were you when you first started feeling the symptoms of Arthritis?  
5 years ago
- How long have you been suffering with Arthritis?  
5 years ago
- When it comes to your daily routine, which of these is the most challenging?  
**Cooking** **Washing**  
**Cleaning** **Eating**
- Which part or parts of your body is most affected by Arthritis?  
**Knees** **Hands** **Shoulders**  
**Back** **Elbows** **Hip**

5. Is there a specific time of day in which your Arthritis causes you the most pain?

**Morning** **Afternoon** **Evening** all day

6. Do you use any tools or adapted devices to help you do day to day tasks which you find difficult as a result of your arthritis?  
**Yes** **No**

If so, could you name what product/object this was and what area it was made for?

How do they help you?

7. Are there any other daily tasks you find particularly challenging which you don't have a solution for?  
WALKING UP STAIRS

(Please circle or cross each option and write on the black line)

- How old were you when you first started feeling the symptoms of Arthritis?  
65 YEARS
- How long have you been suffering with Arthritis?  
2 YEARS
- When it comes to your daily routine, which of these is the most challenging?  
**Cooking** **Washing** **Getting Dressed**  
**Cleaning** **Eating**
- Which part or parts of your body is most affected by Arthritis?  
**Knees** **Hands** **Shoulders**  
**Back** **Elbows** **Hip**

5. Is there a specific time of day in which your Arthritis causes you the most pain?

**Morning** **Afternoon** **Evening** ALL THE TIME

6. Do you use any tools or adapted devices to help you do day to day tasks which you find difficult as a result of your arthritis?  
**Yes** **No**

If so, could you name what product/object this was and what area it was made for?  
PLY NAILS TO HOLD THE BAGS + EGGS

How do they help you?

7. Are there any other daily tasks you find particularly challenging which you don't have a solution for?

(Please circle or cross each option and write on the black line)

- How old were you when you first started feeling the symptoms of Arthritis?  
60 years
- How long have you been suffering with Arthritis?  
21 years
- When it comes to your daily routine, which of these is the most challenging?  
**Cooking** **Washing** **Getting Dressed**  
**Cleaning** **Eating**
- Which part or parts of your body is most affected by Arthritis?  
**Knees** **Hands** **Shoulders**  
**Back** **Elbows** **Hip**

5. Is there a specific time of day in which your Arthritis causes you the most pain?

**Morning** **Afternoon** **Evening**  
✓ NIGHT

6. Do you use any tools or adapted devices to help you do day to day tasks which you find difficult as a result of your arthritis?  
**Yes** **No** ✓

If so, could you name what product/object this was and what area it was made for?

How do they help you?

7. Are there any other daily tasks you find particularly challenging which you don't have a solution for?  
HIGH/LOW COPBOARDS  
KNEELING

(Please circle or cross each option and write on the black line)

1. How old were you when you first started feeling the symptoms of Arthritis?

69/70

2. How long have you been suffering with Arthritis?

7 or 8 years

3. When it comes to your daily routine, which of these is the most challenging?

- Cooking
- Washing
- Cleaning
- Eating

4. Which part or parts of your body is most affected by Arthritis?

- Knees
- Hands
- Shoulders
- Back
- Elbows
- Hip

I have rheumatoid and osteo arthritis both things

(Please circle or cross each option and write on the black line)

1. How old were you when you first started feeling the symptoms of Arthritis?

24

2. How long have you been suffering with Arthritis?

48 years

3. When it comes to your daily routine, which of these is the most challenging?

- Cooking
- Washing
- Cleaning
- Eating

4. Which part or parts of your body is most affected by Arthritis?

- Knees
- Hands
- Shoulders
- Back
- Elbows
- Hip

5. Is there a specific time of day in which your Arthritis causes you the most pain?

Morning Afternoon  Evening

6. Do you use any tools or adapted devices to help you do day to day tasks which you find difficult as a result of your arthritis?

Yes  No

If so, could you name what product/object this was and what area it was made for?

SPARKLE BATH CHAIR SEAT  
FINE OPEN SCREW DRIVER

How do they help you?

ENABLES ME TO GET UPSTAIRS  
EASIER TO HAVE A BATH  
PREPARE TO WASH JARS

7. Are there any other daily tasks you find particularly challenging which you don't have a solution for?

MAKING ROOMS BE HOUSE  
DRESSING & MOBILITY IN GENERAL

5. Is there a specific time of day in which your Arthritis causes you the most pain?

Morning  Afternoon  Evening

6. Do you use any tools or adapted devices to help you do day to day tasks which you find difficult as a result of your arthritis?

Yes  No

If so, could you name what product/object this was and what area it was made for?

'Grabby Stick'

How do they help you?

Helps me pick things up.

7. Are there any other daily tasks you find particularly challenging which you don't have a solution for?

I can't have a bath (Shower)

Judy Cartwright

N. 3 Sometimes getting out of bed or walking are the most challenging things.

N. 4. When I have a flare up it might be in one part (eg hands) or it might be my whole body which is affected. Sometimes I feel depressed - can I recommend you read 'The Inflamed Mind' by Edward Bucknori. Or google him - very good Youtube videos.

N. 6 • Devices for opening bottles and cans.  
• My electric blanket helps me relax and sleep.

Here is a selection of 10 questionnaires I gathered that had the most impact on my designing and making. However, all 30 returns put me in the right direction and gave me valuable information, it was these 10 that meant the most.

Findings:

Age Range of Participants was 55-85.

The lowest age that someone started to feel symptoms was 30 years old.

Most common times of the day in which pain was felt was Morning & Evening, however nearly half of the returned Q's had ticked all three options.

Hands, Knees and Back was the most common, which differs slightly to early research as Back wasn't mentioned at all. this could be due to weight/ not being able to support themselves whilst walking.

Most common daily struggle was that of walking, around 30% of all Q's returned mention balance or walking difficulty.

After speaking to a number of the group's members on walking, many said it was too difficult to get up from a seated position or pick something up off the floor.

Other ideas generated from the feedback were:  
- Tray for eating  
- Aid for opening post

- Pill holder  
- Cutlery  
- How to factor these into morning & afternoon routine.

## Polymorph tests Mine vs Arthritis -

After using Polymorph at the end of second year, I knew how quickly and accurate it was to create forms. When I was home over the Christmas period I asked my mum and nan if they had any local friends who had Arthritis. My Grandma's neighbour had.

She had been suffering with the condition for 13 years, I asked her if it was okay for me to bring some Polymorph round one evening to do a short 20 minute test with her. I got her to place the Polymorph in the pan full of hot water and asked her to play around with it in her hand until it went solid. It was then that I found that the Polymorph process held a therapeutic aspect to it, which also getting the user to move and exercise valuable muscles with the hand and wrist joints, it also gave very personal forms, personal only to that person's hand.



My photo's taken of my grandma's neighbour, 6th Jan.

## Third and final visit to Reigate -

My third and final visit to Reigate before the end of Uni was probably the most rewarding. Different to the other two trips, this meeting which was on the 27th February, started off with a 45 minute exercise class. Only half the members had arrived by this point, whether the others knew the class was on and didn't want to get involved i'm not sure, this user engagement within exercise is vital for people with Arthritis. However it is proven that a large percentage will not get involved with premeditated regimes.

The exercise class started by the external physio at the front playing slow tempo music with all the participants sat down. feet on the floor, a straight back were the first commands, focusing on the hands, fingers and wrists. the physio kept reiterating the important of consistent breathing throughout also. It then slowly moved onto neck movements, with the physio asking the participants to move their ear to their shoulder whilst also moving their feet and knees simultaneously.

The class moved this way for the next 10 minutes, continuing to move to different body parts. Once this part was done, the physio continued to change the track playing, increasing the tempo each time. With this came quicker movements of the body parts, with more body parts moving simultaneously.

Around half way through, the participants were asked to stand up. Starting with light stretches it then moved to the participants having to stretch their legs out or to the side of them. This is when I could really see the struggles some were having, many needed to hold onto the chair next to them for balance and some even had to sit back down again. Obviously the age of some was higher than other and some were more mobile than others, however the tiredness and aching was clear to see. The class finished by the participants sitting down again but this time stretching using polystyrene floats and suit ties.





## Lecture by Paul Jairaj -

Once the class was over and more people had turned up I was able to have some conversations with people I had already met and also new members. After looking into the colour of pain and also the different aspects of hand crafted vs mass produced, I wanted to find out what the group thought.

- Only one person that I spoke to out of 30 gave a valid response to being asked about colours and pain, the woman said that she had seen "colours like red and orange" and said that she associates softer, pastel colours like blue and green to points without inflammation in her joints.

- Everyone but two people said that they would use whatever was cheapest, when considering hand crafted and mass produced. One woman still uses her old wooden walking stick with a taped handle as she'd had it for so many years however. Which was encouraging when I started to design my life stick set.

After the short break, it was then left to Paul Jairaj, a private surgeon and expert on knee and hip joint replacements, to give a talk to the group.

The main focus and point Jairaj was getting across was the knee replacement. He said that there is 100,000 joint replacements each year in the UK with over 9 million suffering with Arthritis.

He also mentioned how important regular exercise was and to also not let the condition get people down, to live the best life you possibly can. The more that you do this the better you will feel physically and mentally.

He also mentioned on a few occasions about the younger generation and how people as young as 35-40 were having knee and hip replacements and the number was ever increasing.

I'm not sure whether he was trying to gain customers, however the information backed up my earlier research and more.

# Product Review -

I decided to follow what Tom had told me in the first meeting we had and to use some of the material gathered by Geoff, to look into already existing products made for disabilities.

As I already had the Life Stick and Tea Spoon concepts, I had a look into existing products that fit around the same theme. Mobility and Touch.

Looking at the Independent Living brochure, I looked into the prices for existing products and also whether they would have an long lasting value to someone who would need them. As you can see by the scans on the right, nearly all of the cutlery designed didn't have any visible exercise system or mechanism built within that would have any long term benefit for the user, the continued use of a little larger than normal handles was a main theme throughout nearly all the product within the brochure. For the mobility pages, there was nothing on their that promoted any personal aspect and there wasn't any use of wood. All the walking sticks looked the same and all looked very basic. The forms used were all the same as well, just being a straight stick with a handle at the top. There is definitely a gap in the market for something different within both fields but it has to be affordable.

### 4 Mobility

**1 Rollz Motion Rollator - Blue**  
Rollz is a rollator and wheelchair in one! Comes with a wheelchair seat and a rollator frame. The rollator frame is made of aluminum and is very sturdy. The rollator frame is made of aluminum and is very sturdy. The rollator frame is made of aluminum and is very sturdy.

**2 Heavy Duty Rollator - Blue**  
Designed to seat larger users, this sturdy aluminum rollator is very strong and has a large seat. It has a large seat and a large seat. It has a large seat and a large seat.

**3 Roomba Indoor Rollator**  
Extremely lightweight chair developed for indoor use. It is very light and easy to use. It is very light and easy to use.

**4 2 in 1 Rollator & Transit Chair**  
Simply flip down the footrests to turn this rollator into a transit chair. It is very light and easy to use. It is very light and easy to use.

**5 Fischer Handle Folding Walking Stick**  
Fischer style handle provides pressure evenly. It is very light and easy to use. It is very light and easy to use.

**6 Folding Coloured Walking Stick**  
Lightweight folding walking stick with comfortable handles. It is very light and easy to use. It is very light and easy to use.

**7 Tetrapod Walking Stick**  
Walking stick with 4 feet. It is very light and easy to use. It is very light and easy to use.

### 5 Mobility

**1 Buckingham Walking Frame - Easy**  
Ideal for walking frame users. It is very light and easy to use. It is very light and easy to use.

**2 Folding Walking Frame**  
Handy for users who need to fold the frame. It is very light and easy to use. It is very light and easy to use.

**3 Comfort Hand Pads**  
Memory foam pads for gripping to chairs, sticks, walking frames, rollators, foot levers and toilet frame handles. It is very light and easy to use.

**4 Walking Stick Adjustable Height**  
Height adjustable, lightweight walking stick. It is very light and easy to use. It is very light and easy to use.

**5 Dash Lite Wheelchair**  
Aluminum wheelchair available at an attendant. It is very light and easy to use. It is very light and easy to use.

**6 Ultra Lightweight Aluminium Wheelchair**  
The most and lightest aluminium wheelchair to date. It is very light and easy to use. It is very light and easy to use.

### 76 Kitchen and Dining

**1 Thermo Mug**  
Lightweight, insulated mug. It is very light and easy to use. It is very light and easy to use.

**2 Thermo Safe 2 Handled Mug**  
Similar in design to item 2 but with two large handles. It is very light and easy to use. It is very light and easy to use.

**3 Thermo Mug Lids**  
Choose of lid for use with the mugs on this page. It is very light and easy to use. It is very light and easy to use.

**4 Thermo Mug Lids**  
Choose of lid for use with the mugs on this page. It is very light and easy to use. It is very light and easy to use.

**5 Good Grips® Cutlery**  
Large cutlery handles with soft, flexible foam. It is very light and easy to use. It is very light and easy to use.

**6 Knork® Fork**  
Knork® is a fork with a web, rounded outer edge. It is very light and easy to use. It is very light and easy to use.

**7 Dyna Fork**  
Designed for one-handed eating, this fork has an extra wide end which is designed to make the fork to be used for eating. It is very light and easy to use.

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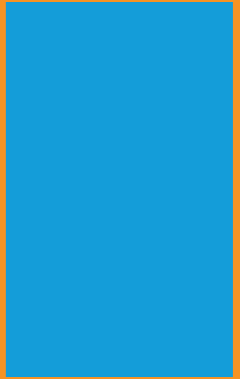


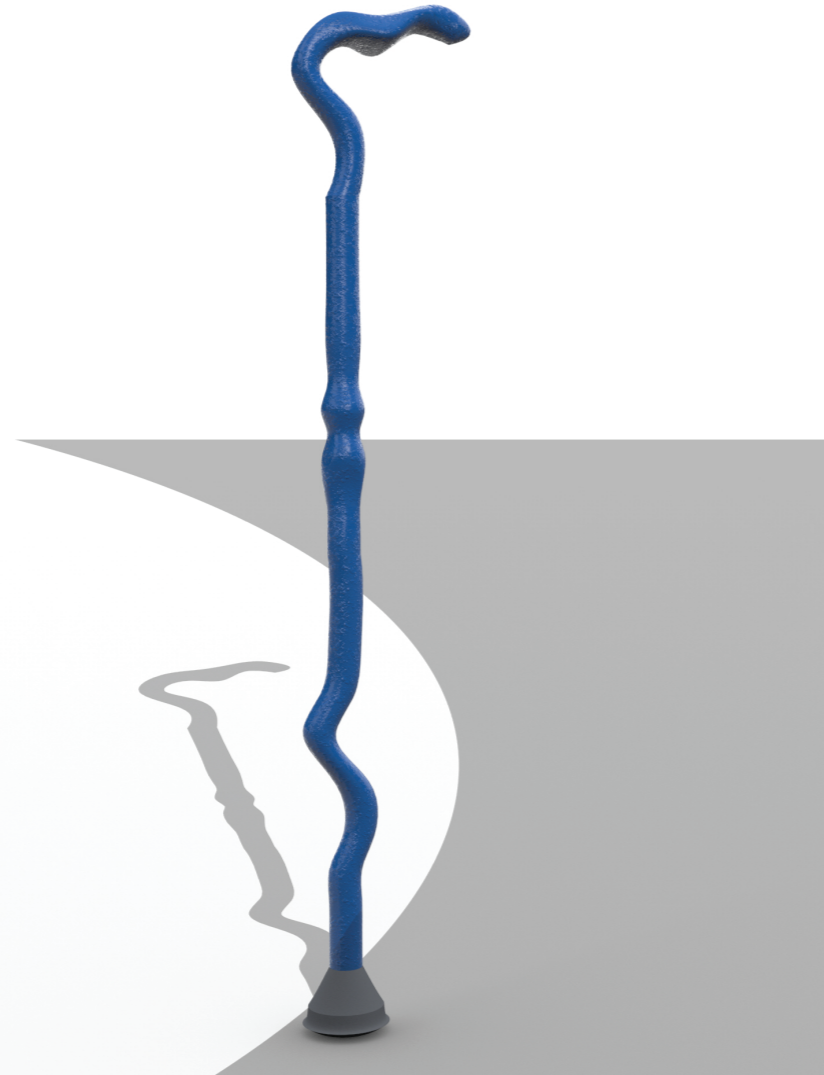
## Conclusion -

After meeting with numerous people, both with Arthritis and not, it is clear that their needs to be more innovative, engaging objects and products that do more. Too many existing 'specialist' products aren't proving to have a long lasting positive affect on the body.

Due to both my primary and secondary research, I managed to narrow down exactly what areas I was going to focus on. I knew, from my questionnaire feedback, that the most common points of the day for inflammation was in the morning and in the evening and the most common struggle was balance and walking, specifically moving around the house freely and getting up from a chair or the floor. That is why I chose to develop both the 'Life Stick' and also the 'Tea Spoon', as they both fit into the findings and also my theme.

Having both Osteo and Rheumatoid arthritis at the front of my mind, it was very important for me to design for both types of the condition. The Life Stick was planned to focus a more overall audience of people with all types of arthritis, pitched as something for the user to have for life. Where the Tea Spoon was designed for people with rheumatoid arthritis, who are in need of vital movement and exercise within their hands.





## Life Stick -

Walking is something most people are fortunate enough to be able to do. It is one of the most important daily tasks we have. However, due to some disabilities, people are not always able to get around as freely as they once were or would like.

The 'Life Stick', is designed to help people with Arthritis physically and also mentally. I decided to call it the Life Stick, due to the connection the user will be able to have with the object, hopefully being able to use it for life. The use of locally sourced hazel, with colourful ergonomic 3D printed components makes this piece different. A personalised, colourful and bespoke stick that is made to help the user with every day tasks. Designed for use around the house and also outside.

After my first trip to Reigate one of the first things I saw was the amount of walking sticks being used. At first, I wasn't sure if it was because of the age of some of the members or whether it was solely because of the condition. Speaking to a few of the group members using the sticks, it was clear to see a mixture of both. Comfortability for the hand and support for the wrist was the first major point, taking weight off badly effected and important joints such as the knee and hip and also the trouble of getting up from a low position or the floor.

After leaving that trip I continued to look into existing arthritic and ergonomic walking sticks. Due to most of the people I had spoken too not interested in expensive, 'specialised' sticks. It was clear to see that if i was going to persue this design, it would need to be afforable, interesting and personal to the user.

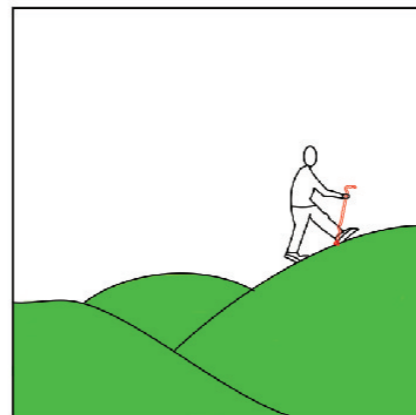
Creating an emotion attachment is something I believe will be achieved with this piece. Due to the use of hazel and the personal be-spoke elements. When it came to designing each stick, i wanted the user to be encouraged to use it differently. Walking at different angels and using as many muscles in the lower body is extremely important for someone with Arthritis. After the final visit, and sitting through Jairaj's lecture, it was shocking to hear the amount of hip and knee replacements that are carried out yearly.

The stick's final shape is a slight arc, due to supporting the wrist more whilst also holding it in a certain way, The bottom of each is a design done to accompany that, flexible, rubber like material helping with grip and cushioning. With either grips being made by the user themselves with Polymorph plastic or a personalised scan and print made from a material of their choice. Either being firm or flexible, depending on how their arthritis affects them.



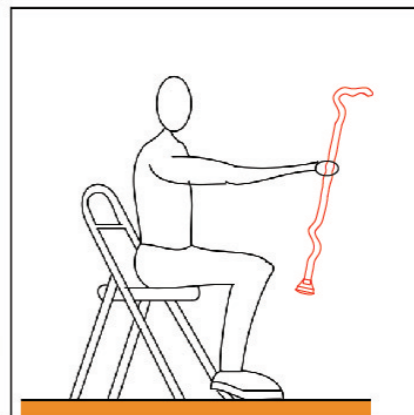
1.

Long distance walking



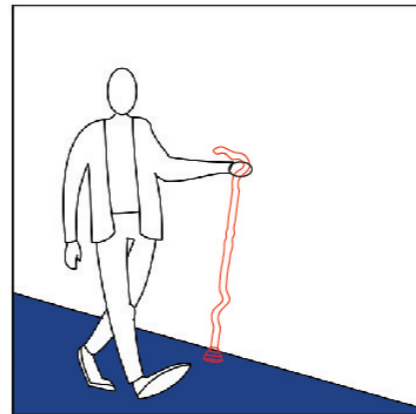
3.

Getting up from a chair/ the floor



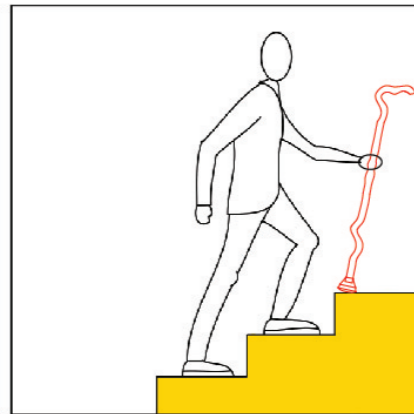
2.

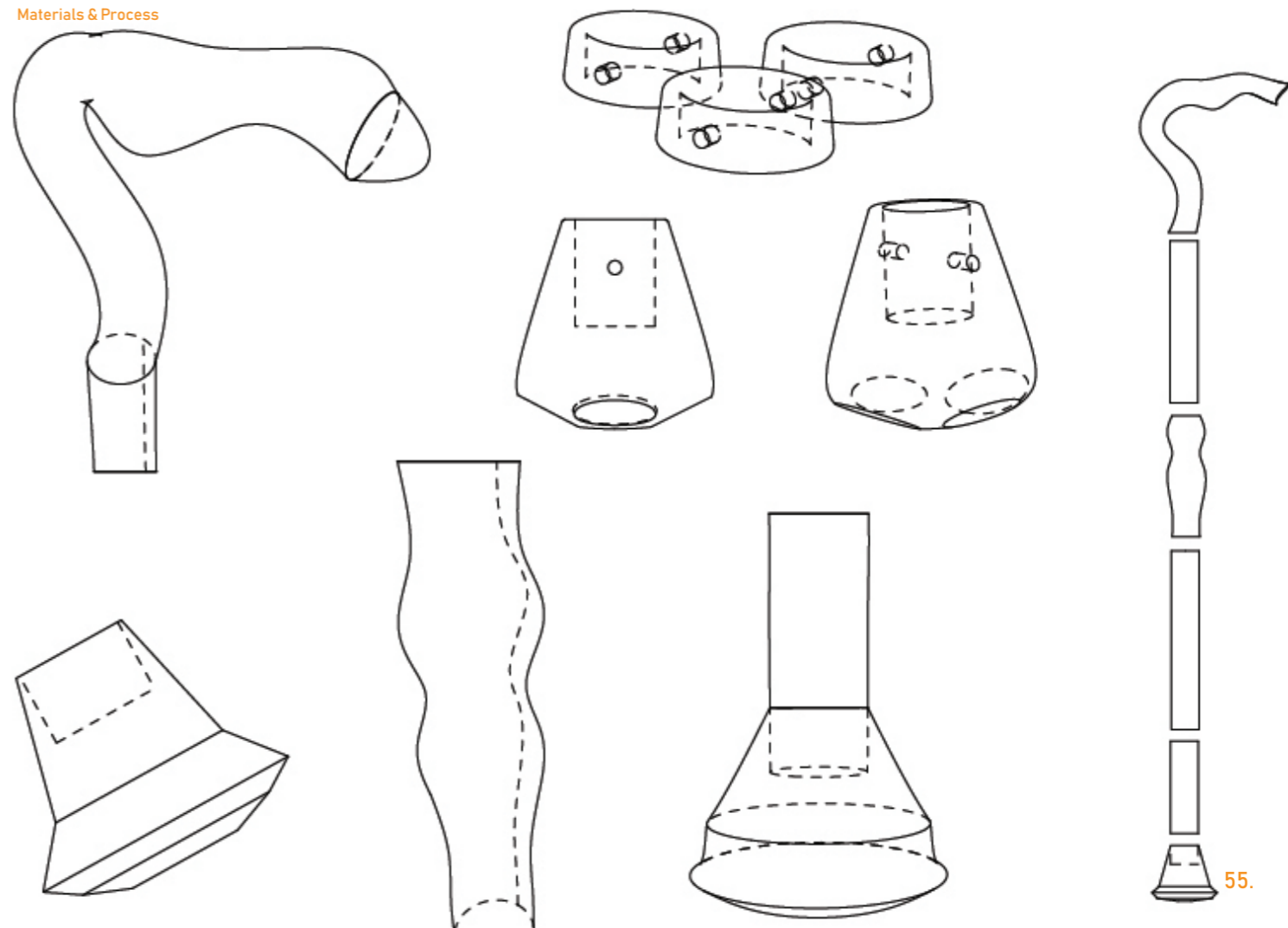
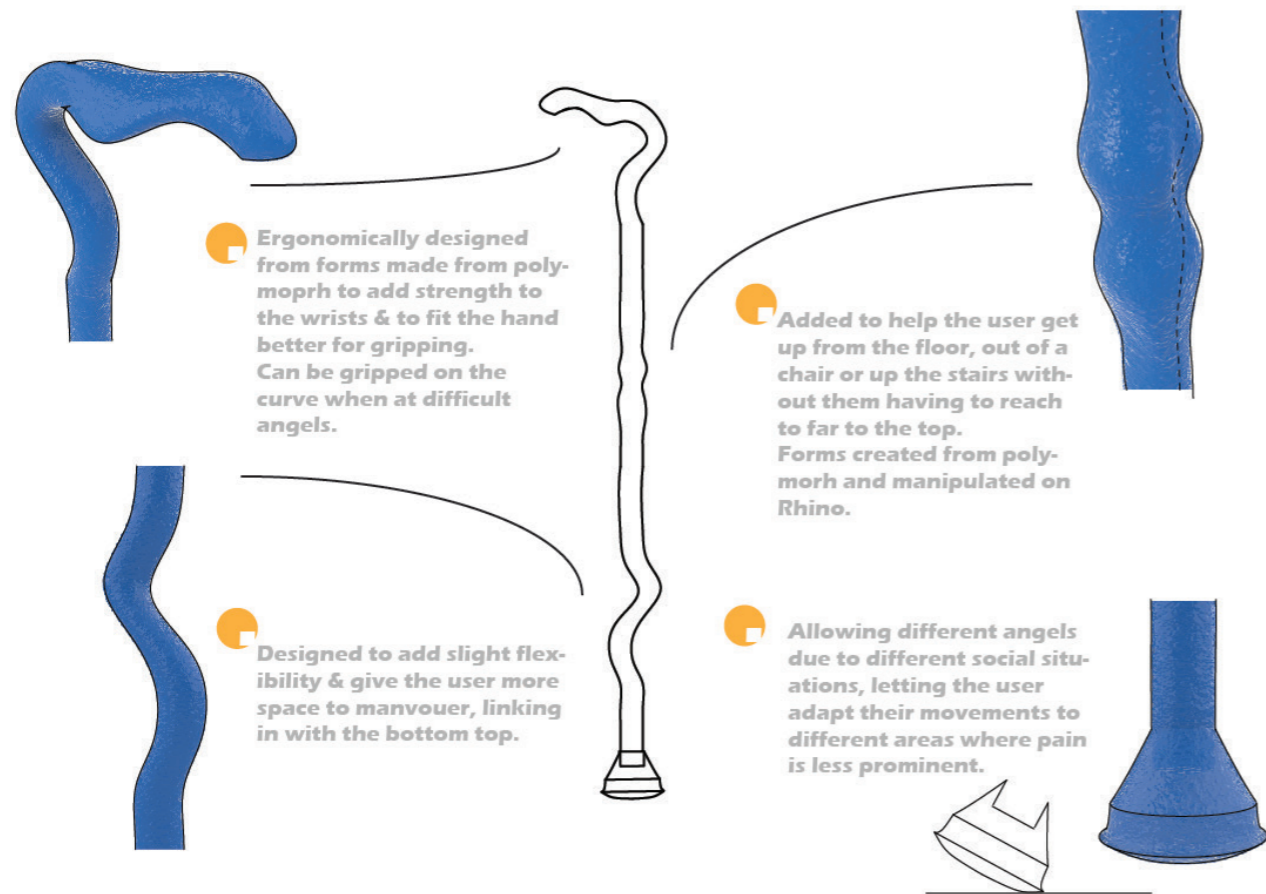
Short distance walking



4.

Walking up the stairs





## Bending and carving process -

These 7 photos show the steam bending process I took to get my final curved stick.



1. Cutting to size



2. The former



3. Stripping bark



5. Band sawing



6. Steaming for 1 hour



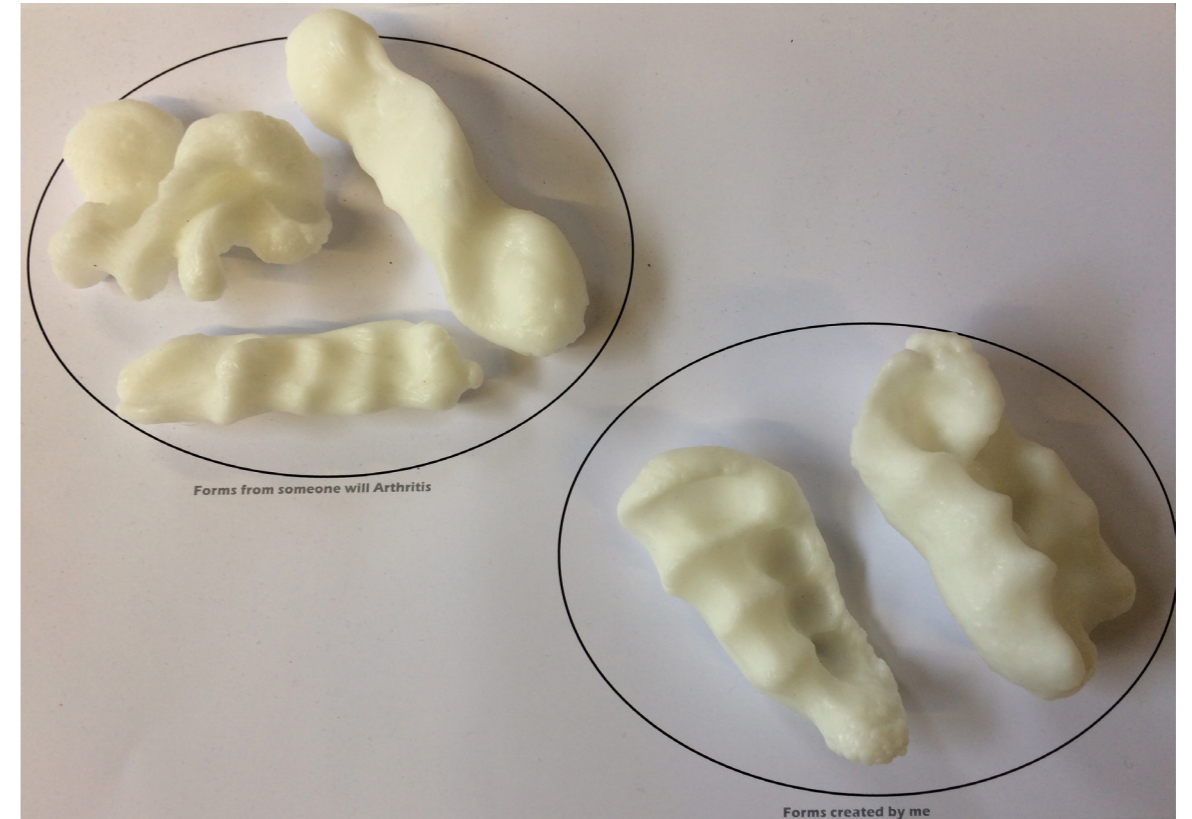
7. Bend in former to dry

### Mock up of a walking stick using Polymorph -

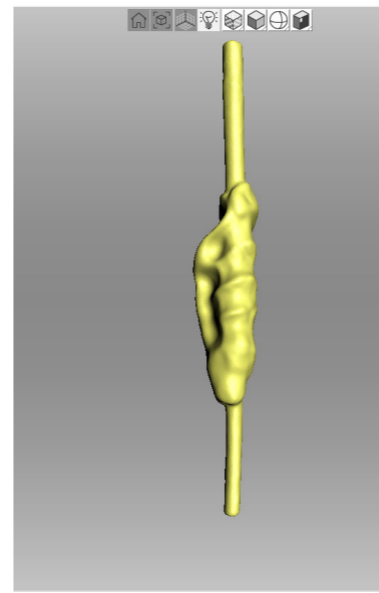


This was my first mock up of the Life Stick, taking a piece of an old tree branch and attaching Polymorph to the top, middle and bottom. Personal to my hand.

### My forms vs someone with Arthritis -

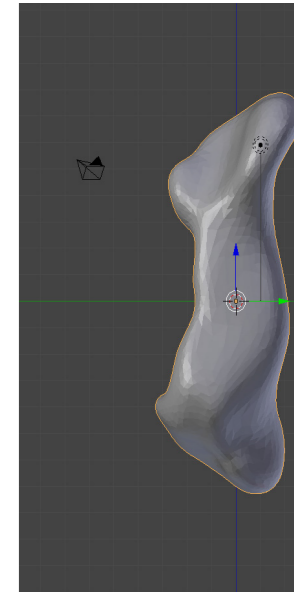
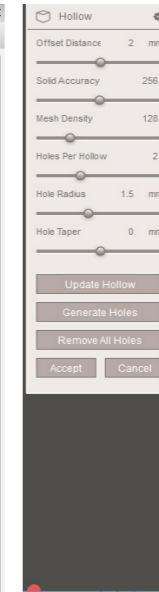


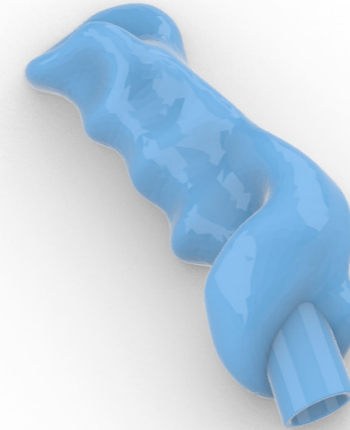
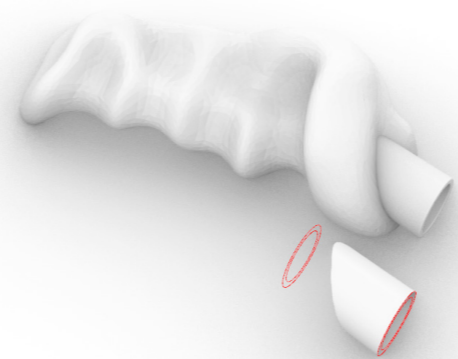
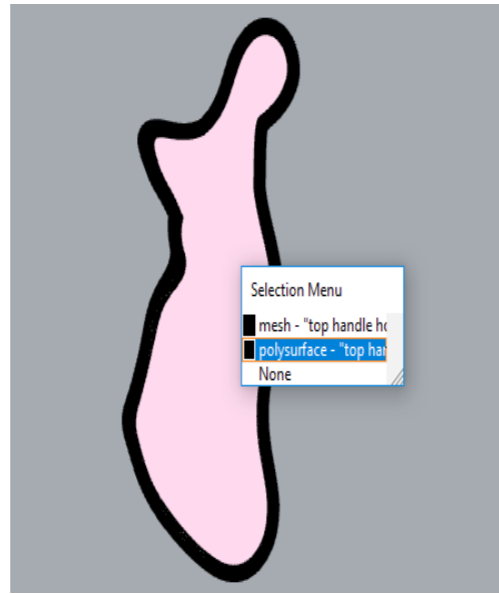
## Scanning and Rhino process.



Workspace - conor 7 middle grip

ID	Title	Loaded	Total	Max er...
1	Scan 1	1044	1044 / 423Mb	0.4
2	Smooth fusion' 1		1 / 0Mb	
3	Scan 3	744	744 / 322Mb	0.4
4	Smooth fusion' 1		1 / 0Mb	
5	Smooth fusion' 1		1 / 0Mb	
6	Smooth fusion' 1		1 / 0Mb	
7	Smooth fusion' 1		1 / 0Mb	
8	Scan 4	833	833 / 357Mb	0.7
9	Scan 5	786	786 / 346Mb	Warning
10	Scan 6	723	723 / 314Mb	0.3
11	Scan 7	643	643 / 273Mb	0.3
12	Scan 8	657	657 / 274Mb	0.6
13	Scan 9	510	510 / 206Mb	0.3
14	Smooth fusion' 1		1 / 0Mb	
15	Smooth fusion' 1		1 / 1Mb	





After playing around with Polymorph, I decided that another option for the stick would be to have custom, bespoke grips made. I started off by making two forms, one that could be used at the top and one for the middle, I spray painted them both blue so that they would scan more detailed than if they were white.

I then scanned in each a number of times, making sure I got every angle I could into a program called Artec. After they were all in Artec I got all the scans to line up and fusion together (photo 4 and 5). I then opened the finished scans into Mesh-mixer and then hollowed them out to 2mm and 3mm thickness.

After the files were hollowed and reduced to a size that would load in Rhino, I opened them in the program and started to turn them into a grip. This was the longest process I had done so far, as you can see from the second last photo, the tube like grip was cut into the original hollowed scan and then joined together to give me my final outcomes. Both have been sent off to be printed using TPU Ninjaflex filament and are measured to fit onto my already bent Hazel stick.



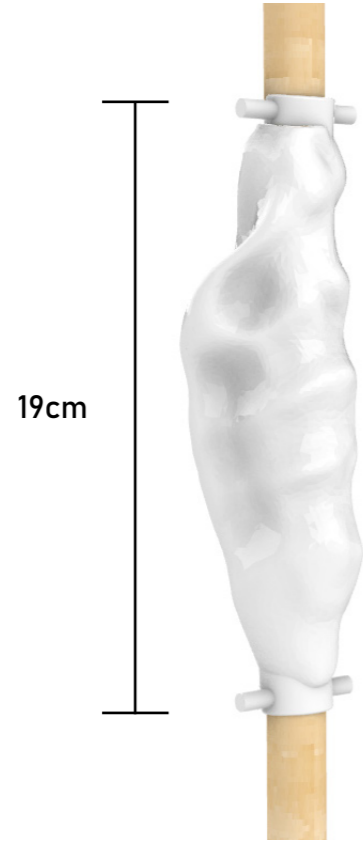
Mock up of how the sticks will look before Polymorph is attached.  
Component render -



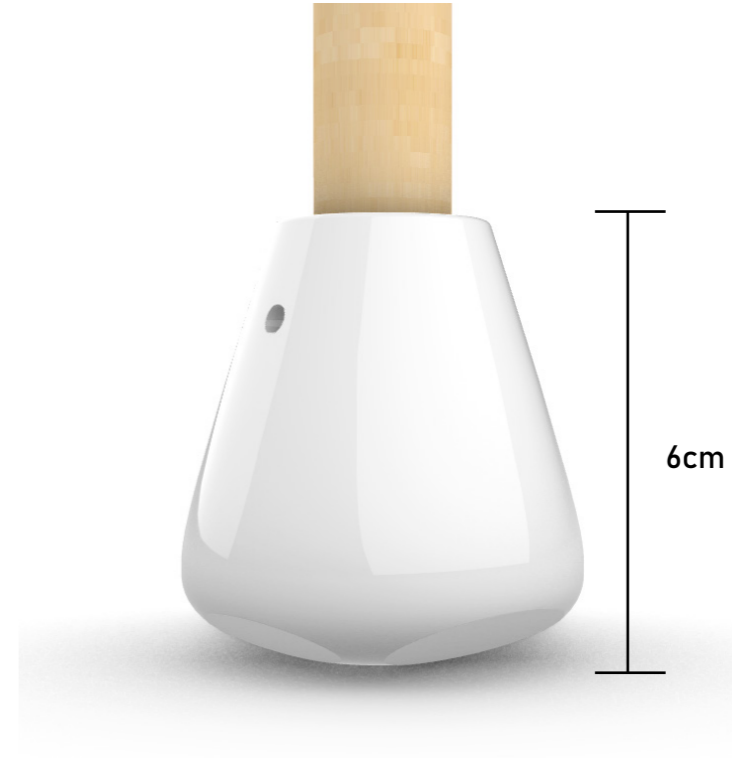
Top component render -



Middle component render -



Bottom component render -



(All components are going to be printed using Ninjaflex TPU)

## Summary -

During the development of this project, it started to go two ways. One outcome when finished was for the user to make the grips themselves using Polymorph and attach them to the already bent and cut sticks, adding a slight therapeutic aspect within using the polymorph which is a task they could carry out in their home. The other being personalised 3D printed, flexible grips that should add some resistance to the hand in which would come already attached for the user.

The shape of the sticks was decided during testing, I believe that having a stick that isn't completely straight, helps to exercise or at least use different muscles in the lower body. The bend will also help support the wrist and hand more. Whilst also allowing the user to manoeuvre easier around the house, get up from sitting position and walking up and down the stairs which were the main troubles people were having when I spoke to them and also what I found through the questionnaire.

I understand the 'walking stick' has been done over and over, however I haven't seen a service or brand designing them specifically for one person, in this case someone with Osteo or Rheumatoid arthritis. Nearly everyone that I met in Reigate used a walking stick, by using materials that are not normally used within this field, combined with a traditional walking stick material like wood, I feel like this product is unique, whilst also becoming unique to any user that uses it. The use of the different materials and processes contrast the new and the old nicely, with different colours adding something bright and vibrant.

## Tea Spoon

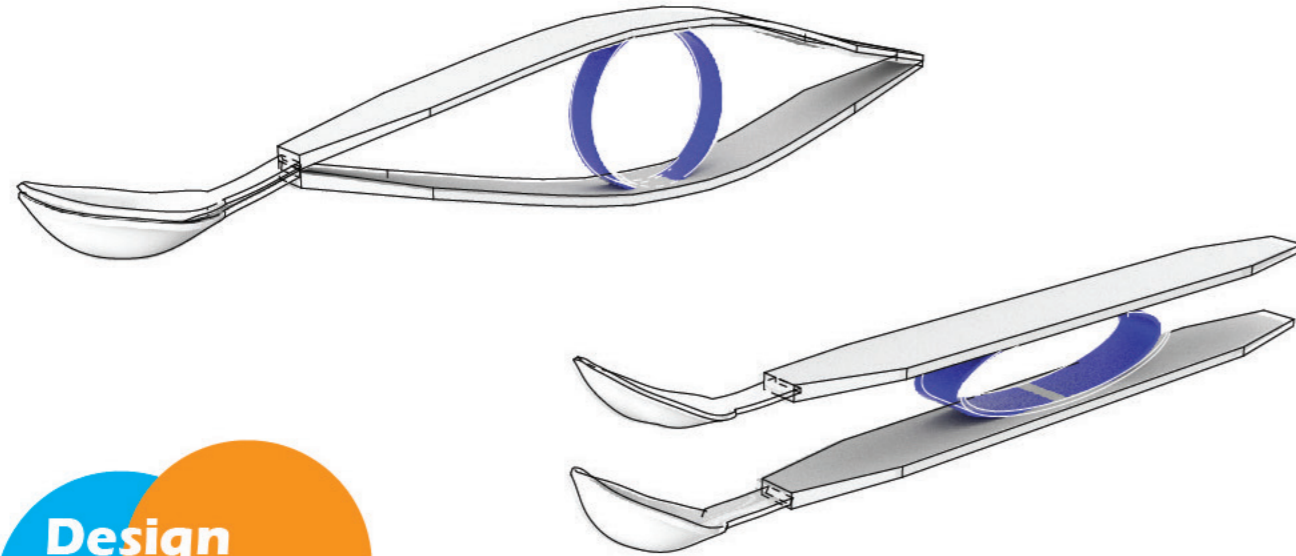
Almost everybody in the UK has a cup of tea in the morning, afternoon or evening. Whether that being before work, after or later on in life when retired.

After 3 trips to Reigate, it wasn't until the third trip in which this idea came to me. Before and after every session the group members would have a tea or a coffee. One woman, around 50 years old, would make everybody that wanted one a drink. Using two tea spoons to squeeze each tea bag as she quickly moved from cup to cup. After handing out my questionnaire and receiving the feedback, chatting to numerous people who have Arthritis, only one person mentioned the struggle of getting tea bags out of a mug.

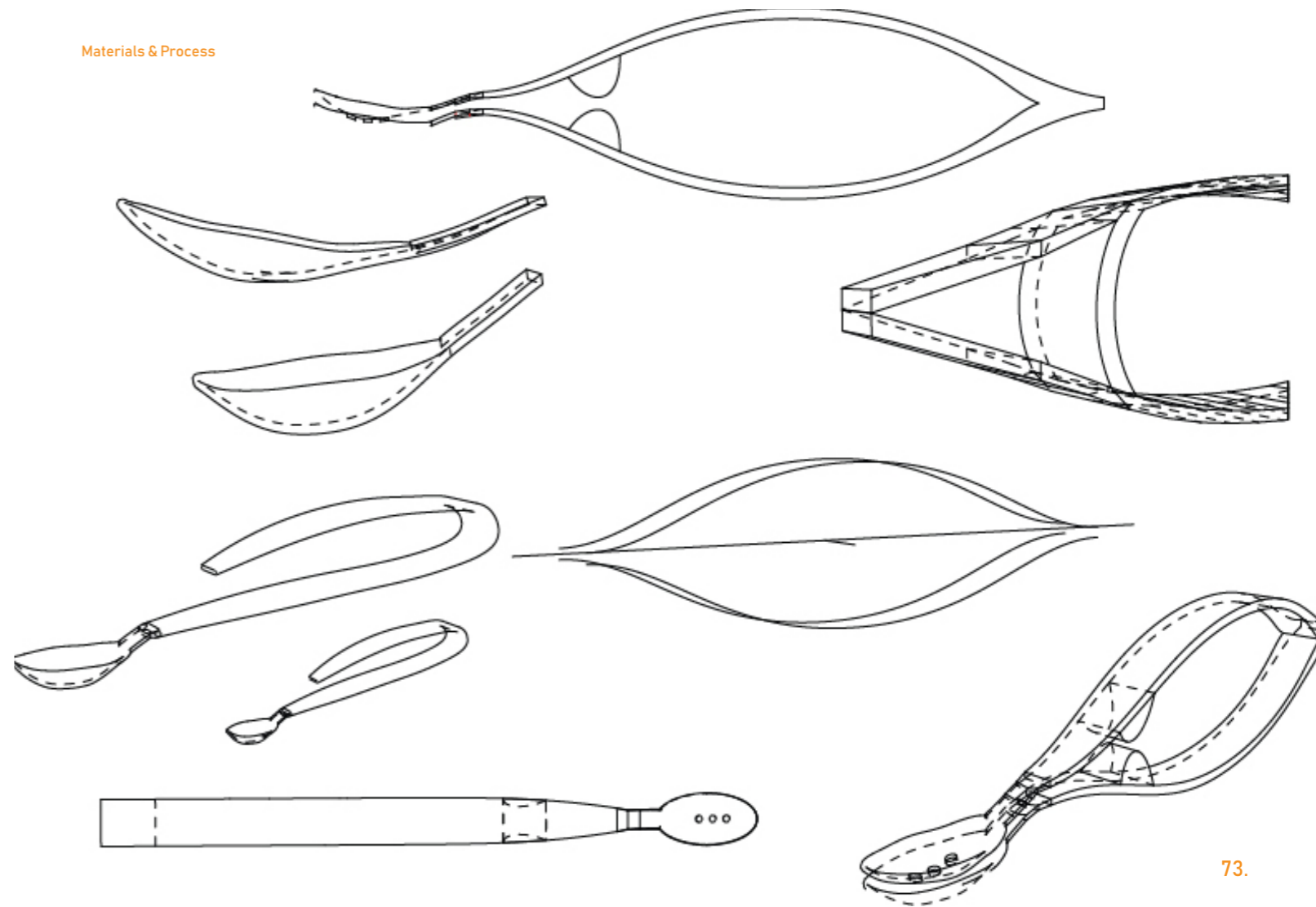
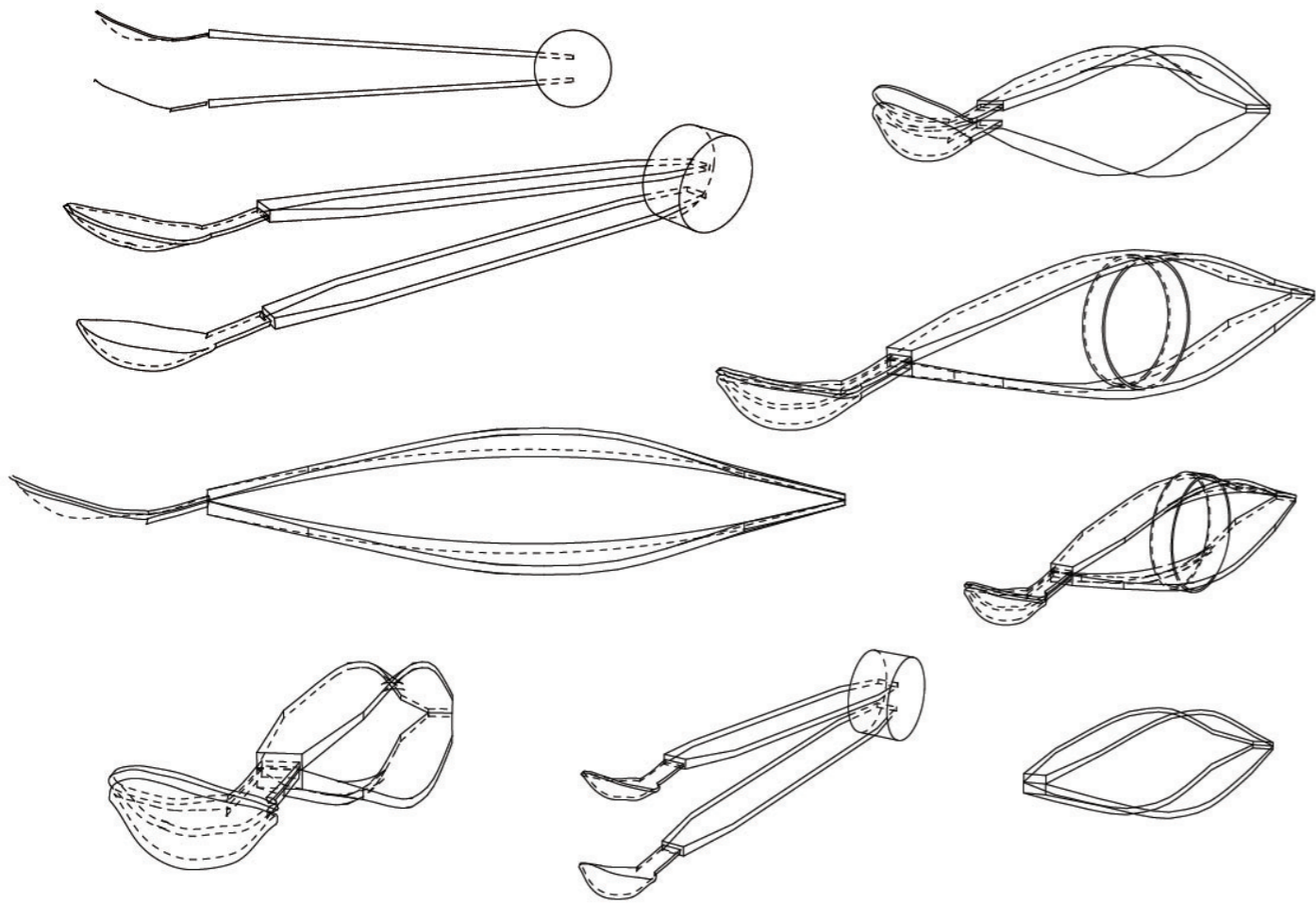
Continuing on with my theme of daily routines and daily struggles, designing a spoon in which the user can make a cup of tea with one hand was the basis for this design, whilst also encouraging certain hand movement at the same time. As the spoon needed to incorporate a therapeutic aspect, I needed the final design to look and seem as engaging to the user as possible to get the user to even handle or buy it in the first place. I wanted the shape to be organic and as symmetrical as possible.

I chose to have a selection of 2 spoons, one hand crafted from Wood and another digital produced using Rhino3D and a 3D printer, as the idea came together I decided it was important to have a nice contrast between the two materials and processes. I wrote my dissertation on the story of cutlery design, within the text I included a chapter on new materials being used within the field. 3D printers and are becoming more and more popular annually, and with a selection of the materials being bio-degradable, I believe it is much better design solution to average, disposable plastic cutlery, even though maybe a little more expensive.

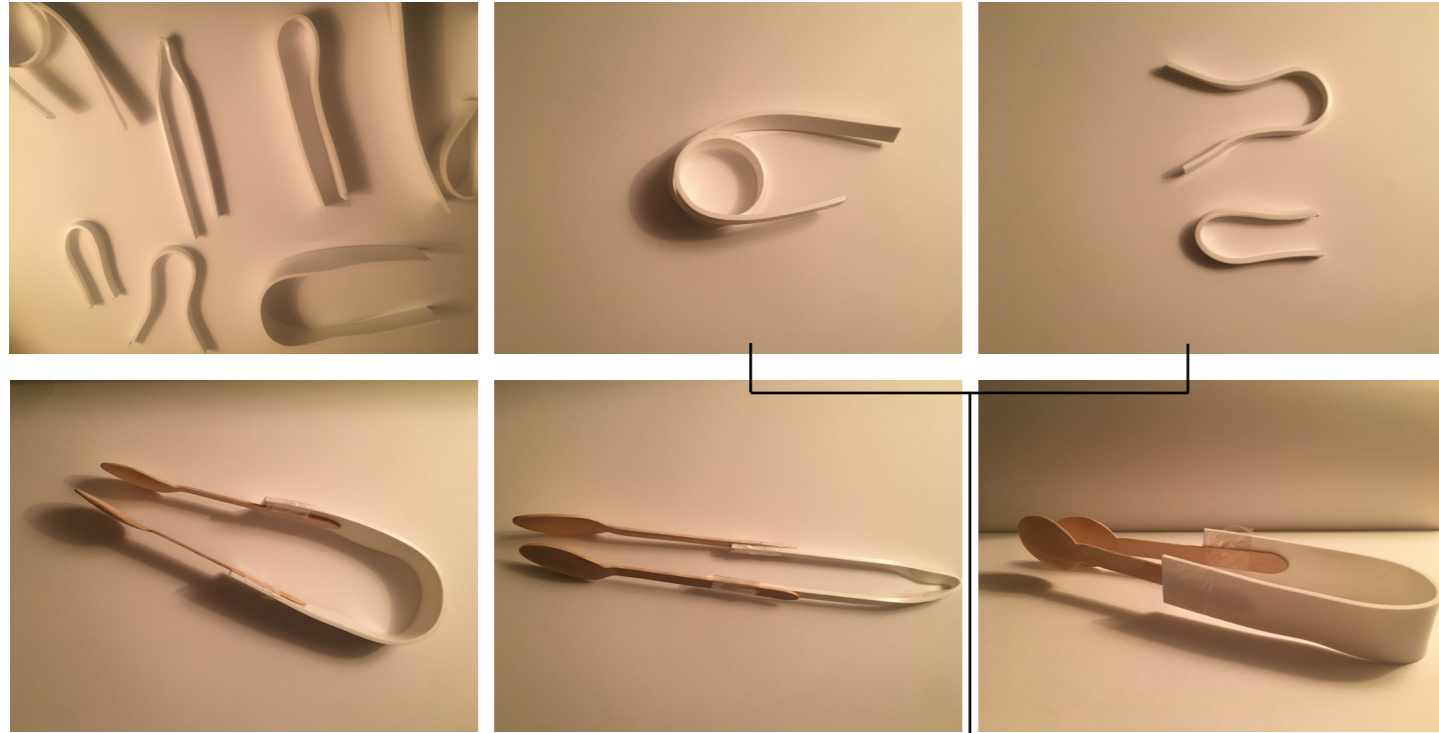
Where the wooden spoon would increase the emotional attachment the user has with the object, whilst also being more exclusive and expensive than the other spoon process would, I believe it is important to have a mixture of both, the digitally, 3d printed spoon made from standard PETG material, will therefore be cheaper and also appeal to a larger amount of people having trouble with Arthritis. If I was to take this object further after University, being able to hand craft spoons and also being able to mass produce the model should allow me to cater for everyone. Whilst also pushing the use of 3D printing further too.



Tea Spoon

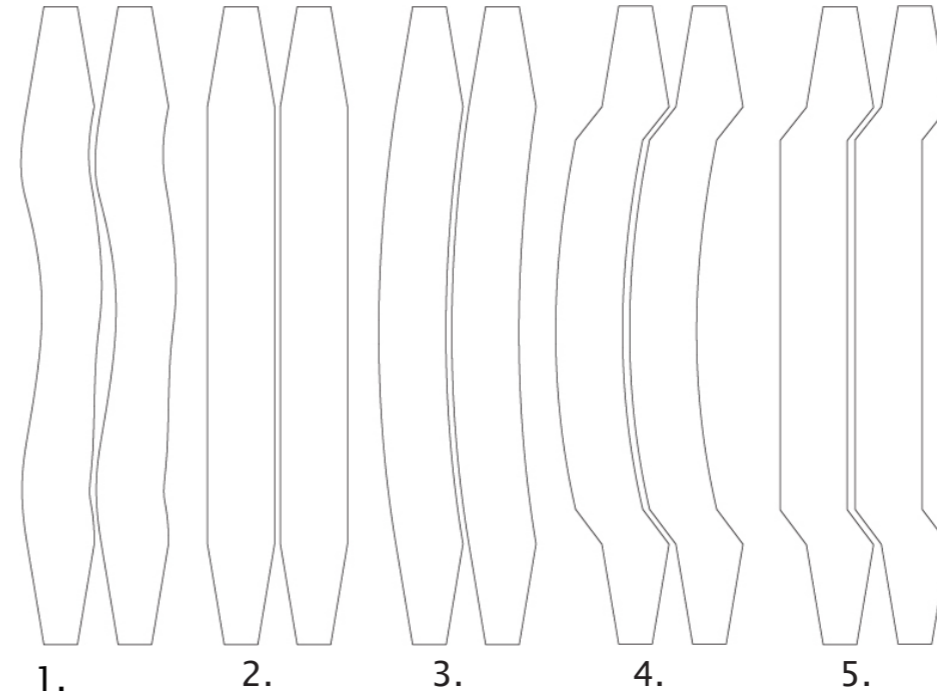


### Initial Acrylic handle mock ups and size tests -



Both of these tests felt very comfortable within the hand, also adding a form of resistance.

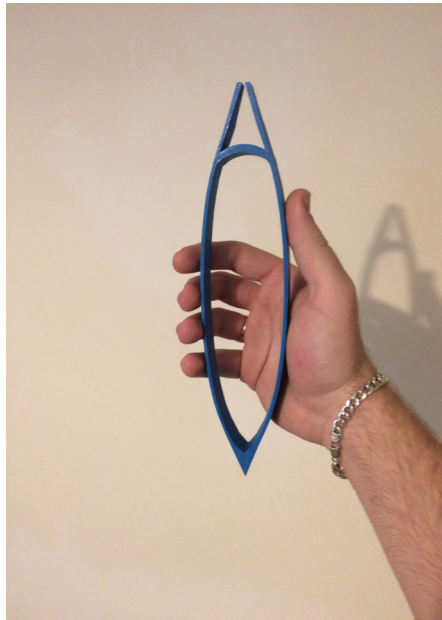
### Handle designs -



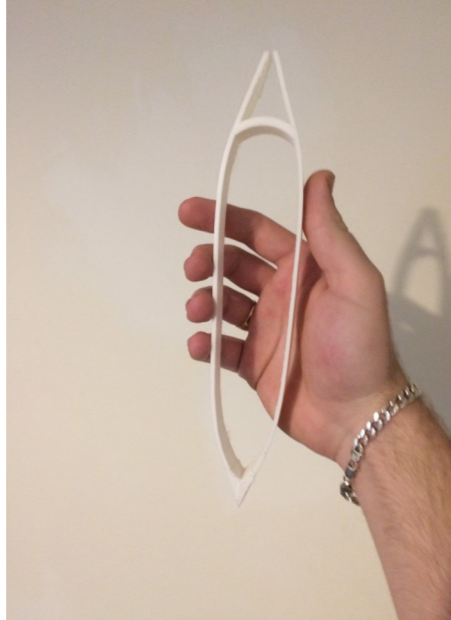
I got all 5 of these designs laser-cut in 5mm white acrylic, to test which were most comfortable in the right and left hand, number 2 is what i chose to develop further.

## Material and resistance testing –

I testing my original design using PETG 3D filament, TPU filament and Yew wood.



PETG was firm and flexible, this is the material I will print the final design with.



Standard TPU was too flexible, nowhere near enough resistance or flexibility, the spoon top wouldn't be string enough to pick up the tea bag.



After initial tests with ash and Yew, I decided to go with Yew. Naturally a flexible wood, it worked perfectly.



## Making the spoon in wood – Summary of how the spoon was hand crafted.



1. Former measured and band sawed



2. Spoon design marked up and cut using Yew.



3. Spoons were hand carved and sanded.



4. Sanded until they both fit together.



5. Each piece steamed for 15 minutes and bend for 4 days in former.

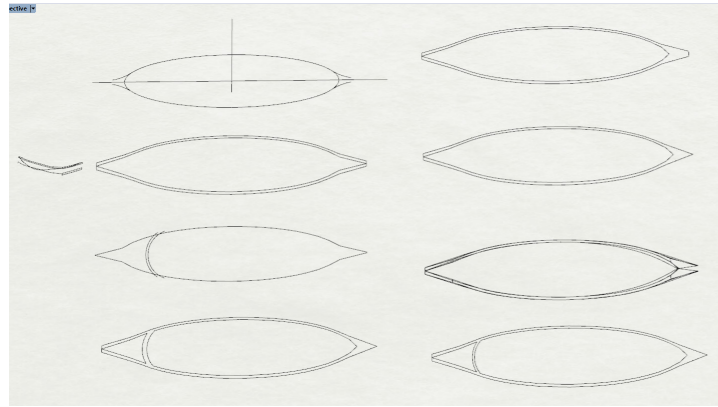


6. Additional parts cut and ready to glue.

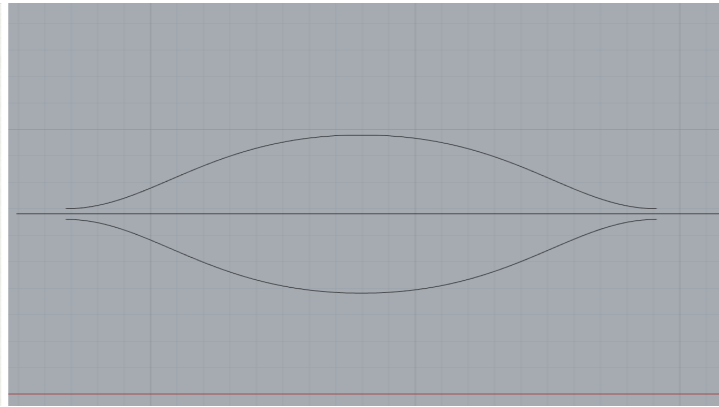


## Modelling the spoon in Rhino –

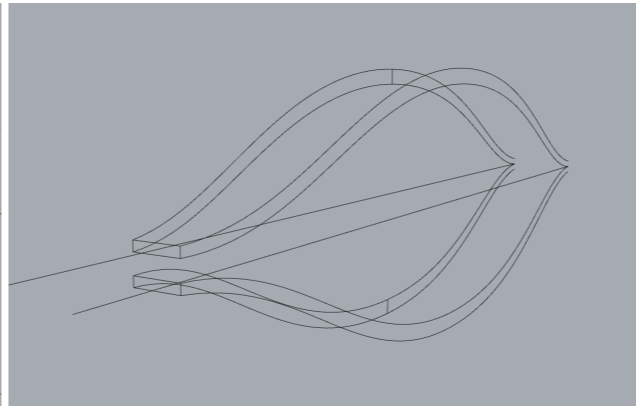
Summary of the spoon was designed and made using Rhino3D software.



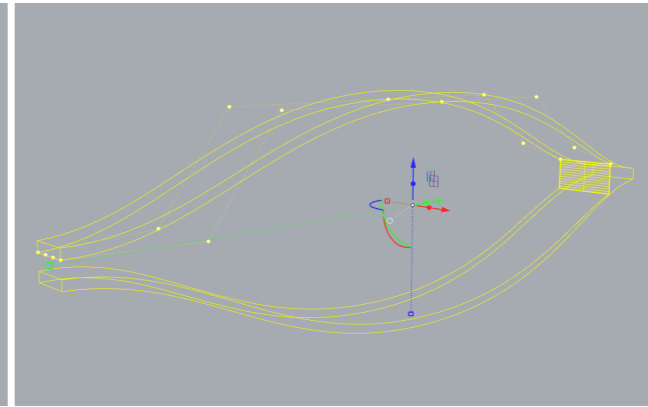
1. This original shape, using line and curve tools.



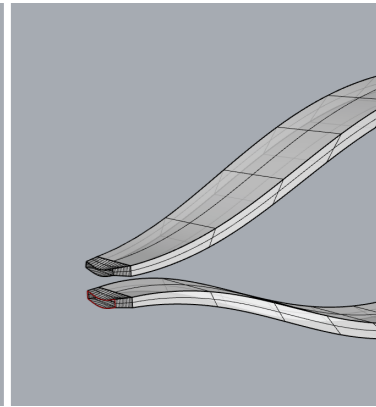
2. The final form I decided on and started to develop, best matching the wooden spoon.

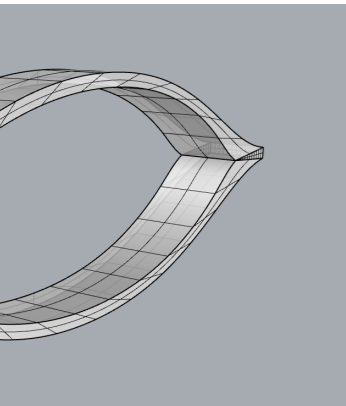


3. Lining it all up using copy and mirror tools.

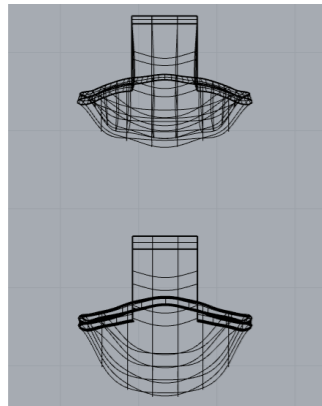


4. Adding back support and also joining the frame together.

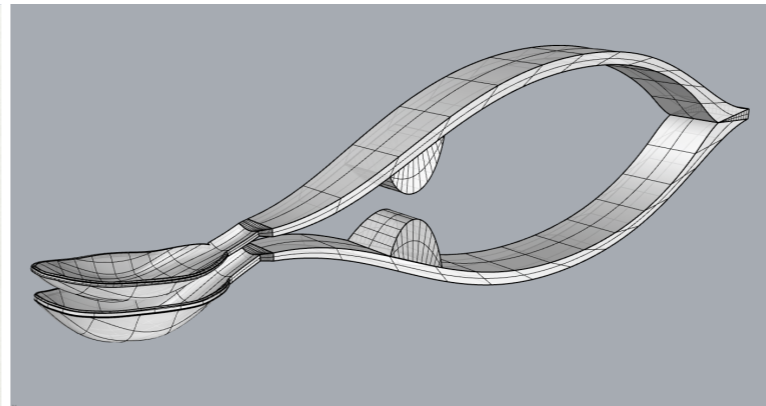
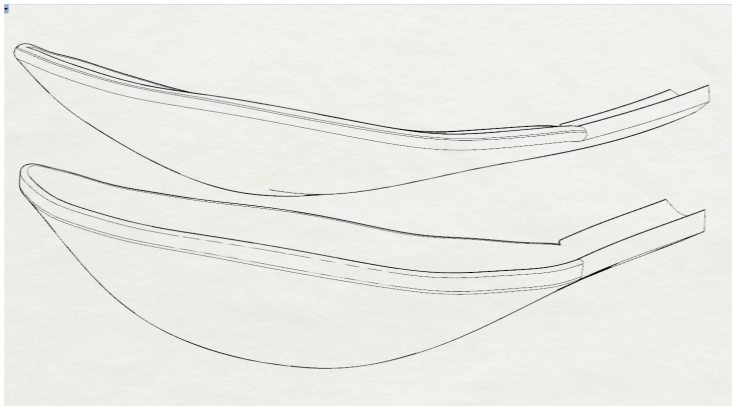




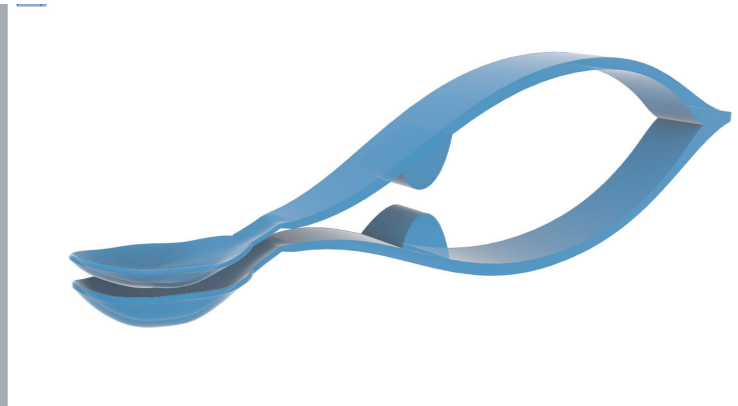
5. Lofting each curve.



5. I used the spoon head from my market project and manipulated it to fit my design, I made the bottom larger than the top also staying within my original design.

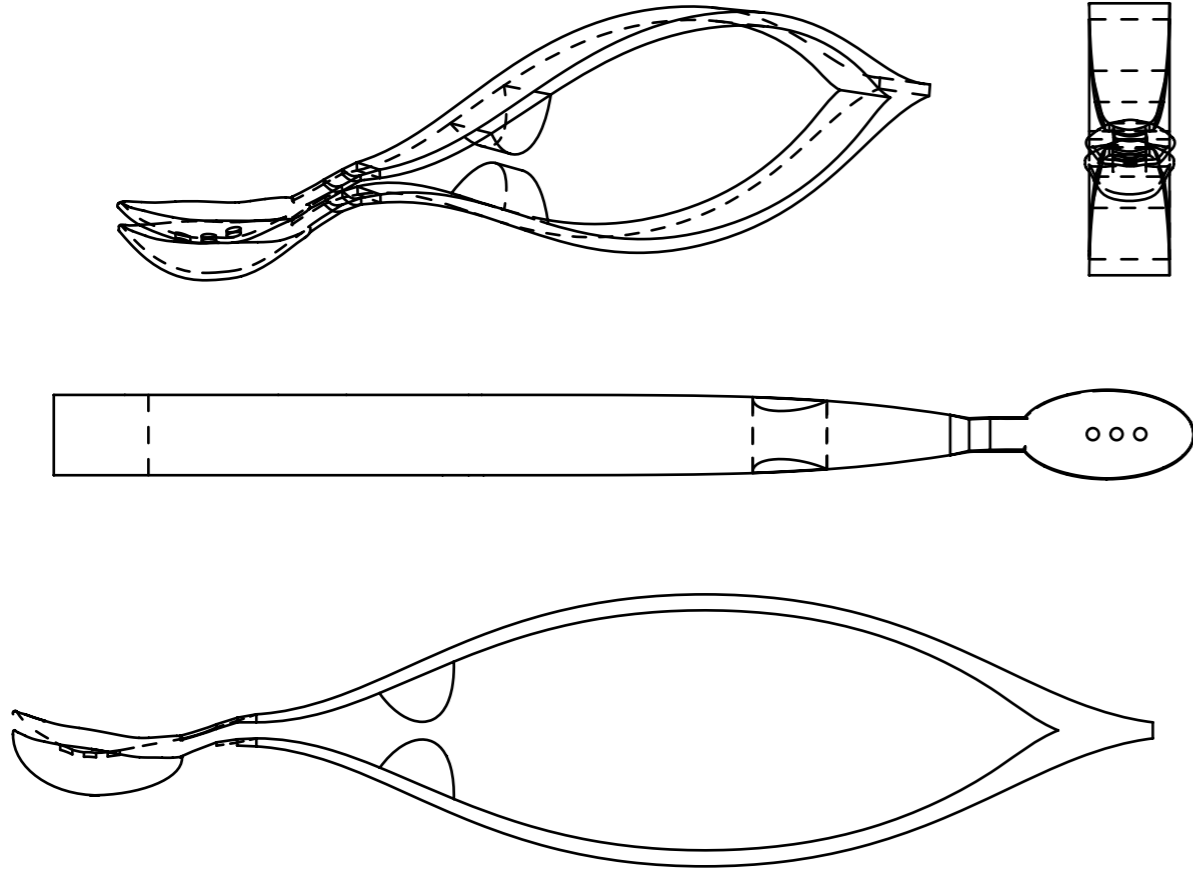


6. Joining all parts together and adding middle supports.



7. I made sure the joined parts were a closed polysurface, ready to send to get printed using PETG.

Technical Drawings of the finished design -



## Summary -

By using the Tea Spoon as a starting point, it has enabled me to design something which fits into the criteria i set myself at the start of the project, throughout my questionnaire and the feedback. It can be used within an average person's daily routine, whilst also fitting into a dialy task which normally happens to be during the more painful points of the day which were identified as being in the morning and afternoon.

It is really important to me to get across the contrast between the two materials and processes used. Both are completely different and both hold a very different meaning to the user, however at the same time both having the same therapeutic quality. Within my last trip to Reigate, I asked a number of the group members whether it meant more to them to have a hand crafted, expensive object over something mass produced and alot cheaper. Many said they would take the cheaper version, with some coming back saying hand crafted & wood. This show s that I would need to target a slightly different audience, maybe in a different place for this to be as commercially successful as the printed spoons.

I am very happy with how the spoons has developed, flexibility within the wood Yew, adds a great resistance to the hand whilst also appearing very engaging to the user. As soon as the 3D printed spoon arrives and the show is over, I am very keen to take both back to the group in Reigate and beyond to get a better opinion on which material and process people with Arthritis would prefer.

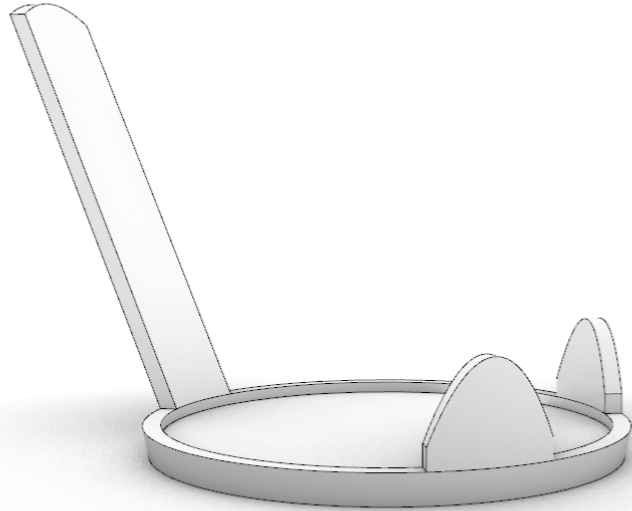


## Hot drink Fidget -

Here are two concepts in which i'd like to develop further after University. The first is the Hot drink fidget.

Designed to go with the Tea Spoon, the fidget would act like a holder for a mug full of coffee or tea for example. As the Mug sits into the holder, the side piece is designed to hang off slightly. Therefore encouraging the user to move their fingers to play around with it, whether that be tapping it or holding it in place. The extra amount of stretching could do someone with Rheumatoid arthritis well.

To take it further and with more time, I believe I can come up with a mug or tableware set which includes the feature. Exploring with different sizes to fit different fingers.

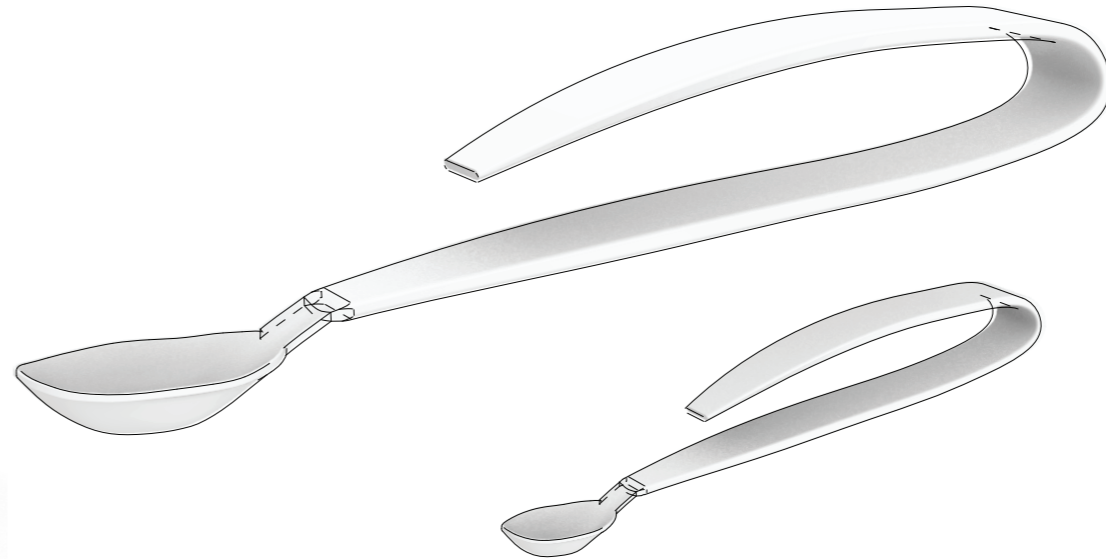


## Flexi-exercise Spoon -

This concept is to do with flexible cutlery, similar to the spoon I design except without one of the spoon heads, if it was made using TPU for example, the top would be flexible enough to add resistance to the hand whilst using it.

Different sizes could be developed, also with different cutlery such as forks and knives.

I believe this could also hold relevance to young children suffering with arthritis, since this subject area is a lot more delicate, it would need a lot more time and research to become successful.



A huge thankyou to Geoff Hinckley and all the members of the reigate group, Fred Malliardet and Tom Ainsworth for all the help with my research for this project.



Daily routines and exercise are two of the main themes running throughout my project, Design Against Arthritis. Whilst trying to factor both of these into my designs, I have used research and feedback to help identify specific areas within the average person with arthritis's daily routine. Through different research and processes, I have been able to design and develop the Life Stick and the Tea Spoon.

Both designed for different body parts and different users, the Life Stick was a concept for people with any type of Arthritis, who may seek an emotional connection to an object aswell as help with mobility. Where as the Tea Spoon, is designed for someone with Rheumatoid Arthritis, being a therapeutic device that helps the user make a cup of tea with one hand whilst encouraging exercise, during the morning and/or the evening.



**Design  
Against  
Arthritis**