

A level Coursework portfolio



Identifying and outlying possibilities for design

Client/End user



Wendy my grandmother, lives in a lovely village called she is 81 years old and her hobbies are charity work as well as gardening and cooking. She is especially fond of her plants and loves to sit out in the sun in summer. She is energetic and chatty however as she has aged she has found her usual daily tasks a challenge. She is currently retired and so has lots of free time. Wendy is very aware on the topic of climate change and so she likes to buy environmentally friendly products as well as she likes to recycle where she can.

Design context

Needs of the elderly

Information gathering

As part of gathering my primary information I did the following. Firstly I spoke to my client asking them general questions such as there hobbies and what they do on a day to day basis etc. After this I asked them some more questions related to identifying a product. As a result of this Q+A I found that Wendy has arthritis in both of her hands which as a result she says she finds it hard to grab onto items such as pens. Another thing my Q+A resulted in was that I found out she finds it hard to bend down to move things and when she does bend down she says it makes her exhausted very quickly. She says she finds daily tasks have become very tiring and that a solution too some of these problems would be very helpful. Many people her age struggle with the same sort of issues and so when designing I must be inclusive of these people. Ways in which I could archive this could be through adjustability for people and ergonomic design.

On top of this I emailed a few retirement homes and websites (listed below) asking for information to do with everyday tasks the elderly struggle with. One replied sending me some links to some useful websites that explains the struggles for elderly people. I found out from the websites listed below that many elderly people have back problems from lifting heavy objects as well as many have problems with their hands which restrict them from doing everyday tasks. On top of this I spoke to my rugby physio about why and how arthritis occurs to try and understand more in order to help aid my design to people who struggle. That said the main focus is to be inclusive for all ages and abilities.

Maria Pickard <maria.pickard@ageuk.org.uk>

to me

Hi

Thank you for your email which my colleague has forwarded onto me. I hope your project is going well. Falls can be a large problem for older adults and can lead to poor mobility from injury and loss of confidence.

You will find some useful information on falling and mobility on the age UK national website- www.ageuk.org.uk

will also find useful information on aids and adaptations on Nottingham Rehab Supplies. This is the leading place for aids in the UK- www.nrshealthcare.co.uk.

I wish you the best of luck in your project. If you would like any further information please don't hesitate to contact me.

Kind regards

From:

Sent: 22 January 2018 10:54

To:

Subject: Elderly and Design

Email List and email sent

Dear Sir/Madam

I wonder if you can help me? I am currently starting a major DT A level project. I am a pupil at school and I am looking at problems that the elderly have with mobility (such as walking or bending down to pick something up) I was wondering if you could inform me with any scenarios where the elderly struggle with mobility or point me to any useful websites. This information would be greatly appreciated and I hope to help solve these problems as my A level Coursework. I plan on creating a solution to these problems. Any help or advice would be very helpful.

Kind regards



Find your local Age UK | Contact

Buy products

nation and advice

that growing older doesn't come with a manual. That's why we provide free information and help you on topics as diverse as claiming benefits to care homes.

n areas of help



Friends of the Elderly

calculator

Find out exactly what you are owed - quickly and easily - with our benefits calculator.

How to find help at home

How to go about finding the help you need at home, from light housework to personal care.

Help with dementia

From help with understanding the condition, tips on living well and advice on caring, we have the lot.



Giving older people the opportunity to live fulfilled lives through providing an exceptional level of care

Friends of the Elderly care homes

We are dedicated to providing individual care with dignity that meets your needs. We employ an informal, relaxed approach to ensure that we maintain our home from home feel, but we always deliver our care with absolute professionalism. Our homes provide residential, dementia, nursing and respite care.

I also went in to care home opposite my house to ask some questions to the elderly and the general response was that gripping items was difficult as well as mobility and moving around had become generally difficult. I then spoke to Mike who is one of the workers there and he said that the elderly struggle with mobility as well as they often drop things.

User needs



The first user need for my client would be a device that could easily transfer firewood from my Wendy's garage to her log basket next to her fireplace. This is a short walk from the garage to the upstairs living room. At the moment, she takes a lot of time to move a sufficient number of logs and she says it causes her back and hand pain, not only this she says she often ends up with splinters in her hand which are painful. A device that could move this load easily would be very appropriate as it would speed up the moving process as well as it would reduce pain and effort from the task. The product must be able to travel over the gravel path and rough terrain as well as easily go up vertical inclines and steps. The product would also have to reduce the chance of getting splinters from the logs. The best way to do this would be to avoid contact with the logs as much as possible. Whilst my client hasn't said how many logs she wants carrying, she said it should carry more than her previous solution. This way the number of journeys she makes should be reduced.

The second user need is kitchen related. Wendy says she struggles to pick up heavy items such as drinks cartons. She also struggles too grip onto kitchen utensils as well as she struggles to open jars and tins. This is due to her arthritis which has worsened with age. At the moment, she has to struggle to do these activities and she often leaves jam jars open so that she doesn't have to open the jars which results in the food going off. A device that makes these jobs easier would be very useful for Wendy. To reduce the weight the product would most likely

need to pivot on something to produce a moment or possibly use more of the body such as wrists and arms to increase strength. The device would also need to be inclusive for people who struggle with arthritis and other conditions. This is especially important as 350 million people have arthritis worldwide. Ways in which this could be achieved would be to identify the anthropometrics needs for these people as well as ergonomic design catered and inclusive for people with arthritis.



The third user need is to do with gardening. My gran is an avid gardener and she loves to look after her large garden. This includes looking after flowers, weeding, digging and planting new seeds. However, as she has aged she said she finds it difficult now to use all her tools required for these tasks. For example she says she doesn't has the strength to dig plant holes and she says she finds it hard to hold tools such as a trowel. Her tools often get mixed up and lost. A device that could make these tasks easier would make these tasks more enjoyable. As well as this the device must be able to store the tools. Again, a design that would be inclusive of people with arthritis would be needed here. A lot of ergonomic thought would also need to go into a product to help her to try and make the gardening as enjoyable as possible for the user. The user would also need a way of storing all the tools in one place. Approaching a design like this would require a lot of thought but mainly planning. The tools would need to be organised and easily accessible for my client as well as they would need to be easy to transport around the garden. This would likely result in a product with wheels similar to a trolley.

The fourth user need is that often Wendy struggles to lift her shopping bags from her car to her house. She says she has to take multiple trips to collect all her shopping and that it is also very hard work. She says she often needs the help of other people to either do the task for her or help her complete it. A device that could make it a lot easier to lower/carry the load of the shopping would be needed. Allowing to complete this task alone would make her life a lot easier. This would reduce the strain on Wendy and make the task a lot easier. The device would have to somehow lower the weight needing to be carried whilst maintaining the quantity of shopping that can be carried. I would also have to make the bags easier to grip/carry due to her arthritis if that approach was to be chosen. The user would also need a way to easily unload the shopping and easily put the food away. A design to solve this problem would have to prioritise function over form to solve this problem as well as it would require a lot of thought into how to solve the problem.



Quantifiable/factual research

- 10 million people have arthritis in the UK
- 350 million have arthritis worldwide
- Arthritis can affect people as young as 30
- 11% of the population in the UK have lower back pain
- A million older people in England struggling with everyday tasks, such as washing and dressing, are being left to fend for themselves according to Age UK
- One third of elderly people say they struggle with a task they once found easy according to Age UK
- Over 2 million in the UK have sight problems

As we can see there are a few problems that affect people as they grow older. Throughout the design of the problem I choose to address I must consider these points throughout in order to be inclusive for the elderly.

Initial Client Interview

Q: As of now what are your hobbies and past times?

A: At the moment, I would say I am heavily into gardening as it is very rewarding to me. Due to me now being retired I have a lot of spare time to do what I want and this is mainly gardening when the weather is nice. I also like to cook from time to time as I like to eat a lot of cake!

Q: Usually, what does your day consist of?

A: As I am retired now I have a lot of free time. What I do with this free time changes quite a lot, I like to play cards and watch films but on other days I will cook and go out to the garden centre to shop for some new plants.

Q: Currently do you suffer from any medical problems?

A: Well apart from my poor eyesight the only medical problem I have is that I have arthritis in both of my hands, it makes it very hard to hold items such as pens and so it can be a struggle sometimes.

Q: Apart from this do you find any other tasks difficult?

A: Yes, most certainly, I struggle to bend down and pick up anything as it hurts my back, as well as these heavy objects are hard to pick up and sometimes my hands lose grip and I drop the item on the floor. Carrying too much weight on my wrist and back has led being in more pain when doing the things, I love.

Q: Could you give some examples of these problems?

A: Yes of course, I struggle to carry logs from my garage to my living room where the fireplace is, it is quite a long distance and it usually takes a long time as well as it is very tiring. The weight of the logs usually becomes too much and I need regular breaks. Furthermore, another example would be that when I have breakfast in the morning I often struggle to pick up the drinks cartons as they are so heavy. Just a couple of days ago I dropped a carton and it spilt everywhere.

Sources-

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

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

<http://www.fote.org.uk>

<https://www.thesilverline.org.uk/what-we-do/>

Design Brief

Problem

My client, Wendy, has problems moving logs from her garage to her fireplace due to them being too heavy and her having arthritis in both her hands. She says she can't move enough logs currently and she says she is often in back pain as a result of moving logs.

Brief

Design and make a product that reduces the load on Wendy when carrying logs and making easier for the logs to be picked up without putting anymore strain on my client. The product should allow multiple logs to be moved safely and easily as well as some consideration must be taken into how the logs are loaded and unloaded into the product. My client would like the product to be as eco-friendly as possible.

Situation



Task analysis and things I need to research

Ergonomics/Functions-

- Stable so that logs don't fall over/product tips over
- Function over form
- How the logs will be loaded/unloaded
- Easy to grab handles/pulleys
- Adjustable features to reduce strain/problems
- Centres of gravity
- How to travel across uneven surfaces/up stairs

Aesthetics/Form-

- Following a theme/design era
- Fit the surroundings/ not an eye sore
- Creative design
- Uniform shape

Anthropometrics-

- Average hand size for 65-100
- Average height for 65-100
- Average arm length 65-100

Dimensions-

- Spaces to fit in (e.g. doors)
- Volume of logs carried
- Overall size

Safety-

- BSI/CE
- What machine/workshop standards to follow
- Sharp edges/correctly made
- Toxic/harmful materials/finishes

Process, mechanism, techniques

- Design to be mass produced, batch produced, one off?
- Use of mechanism to gain mechanical advantage
- Time efficient
- Correct joining technique's regarding product
- What degree of accuracy I should use
- What mechanisms reduce force/effort of lifting/unloading etc
- Strongest/best materials to use regarding product
- How labour intensive will it/should it be

Sustainability-

- Long life cycle
- Recycle/recycled materials
- FSC/Eco-friendly resourcing
- Using materials efficiently/what materials
- Limit machine use to save power/energy efficient

In depth interview

Question: Whilst transporting your logs from the garage what do you find most difficult doing?

Answer: The main problem with moving the logs is that they are very heavy which means I can only carry a few logs. This requires me to make multiple journeys which is very time consuming. I also find reaching the logs on the floor causes me back pain and occasionally I get splinters.

Question: In terms of comfort/ergonomics where would you say your current method of moving logs (basket) could be improved?

Answer: The handles could definitely be improved. They are difficult to grip I think the handles are not wide enough which makes it even harder to hold the basket. Another thing I find uncomfortable is unloading the logs. Emptying the basket creates an awkward angle which hurts my wrists.

Question: Your current solution to this problem is quite small, would you like my solution to be a similar size?

Answer: I think to create a good solution the product will need to be able to carry a few more logs. As long as the product can fit through my doorway I have no real opinions on the size of the product.

Question: You said you found picking the logs up hard, how do you think this could be improved?

Answer: At the moment picking up the logs strains my back, I would like to see my new product use a method that doesn't require me to bend over when I pick up the logs. Whether this is done with a sort of log grabber or another method I do not mind.

Question: What would your price range be for a product like this?

Answer: I think it depends on the solution that you create. I think a product that is robust and meets the problem could be worth around £50-£100.

Question: Are you willing to have your solution contain mechanisms that could create mechanical advantage or better comfort?

Answer: As long as the mechanisms are useful as well as they are easy to operate for someone like me I think mechanism could be great and hopefully they will make the solution more inclusive.

Question: How do you think the product should look and fit into its environment?

Answer: I think that the solution should have a modern look that is preferably a metal and not a wood construction. I plan on storing the solution in the garage next to my husband's work bench and therefore a "machinery" look would be good.

Question: What is your stance/opinion on this solution in regard to the environment?

Answer: Truthfully this product will resort in a carbon footprint. However, I think steps at each stage of production must be taken to reduce this carbon footprint. If there are steps in the production solution where you have the chance to be more environmentally friendly I would like you to take them.

Question: Any final comments on the problem?

Answer: Yes, I would like the solution to use wheels if possible. I think this would make the solution a lot more effective and then also I can use the solution for other uses.





Existing Solutions

Aerocart Firewood Carrier

300 x 400 x 500mm



After watching a video review of this product I felt like I understood the product and its function. The Aerocart can hold up to 80kg of logs which is plenty more than my gran will be able to lift. It is well made ergonomically as it has rubber grips for handles as well as it is stable. It's designed so that it adjusts the loads to the centre of gravity for a balanced and easy-to-manage load.

It has two rubber wheels which mean the logs don't have to be directly lift which reduces the load on the user. These rubber wheels also mean the Aerocart can handle different terrains which is good as my gran must cross a gravel path whilst transporting her logs. They don't need to be inflated and so this increases the lifespan of the product. The log cover/bag is held in by a spring latch mechanism on either side which I will discuss on my mechanism page.

The wheelbarrow itself is made from steel mainly which is highly durable. This will stop dents from the logs which will again increase the lifespan of the product. Not only this we can see that it may be used for more than carrying just logs and so this could solve multiple problems for Wendy potentially. This product has been made in batch production from welding and therefore prices will be lower.

In terms of sustainability this product is very average. The wheels are made from rubber which can be easily recycled. The fabric bag I would assume is recyclable as almost all fabrics are. The wheel arches are made from PVC which can also be recycled. The steel can also be recycled. The only problem with recycling all this is that the product must be disassembled which can be a long and complicated process, more than likely it will end up in a rubbish dump.

https://www.youtube.com/watch?v=NenQoBZq_E

Log grabber

650mm long



I have chosen this product as I think it might be a useful device for the picking up and placing the logs without having to bend over which will help make the task of picking up logs easier. It does this using a claw and a scissor lift mechanism which I will talk about on my next page. I think this device would possibly be an attachment to a product as it would not be good for transporting multiple devices.

The product itself is made from steel and has a clean powder coat protecting it. As a result it is very durable and has a long lifespan. In terms of function I think it has been poorly designed for my client. The handle looks small and uncomfortable as well as it looks like it has no grip and so my client with arthritis would struggle to use this product.

I think this product would be very easy to mass produce and so I think if I was to recreate something similar to this making it on a mass production level would be easy and so this would drive the price of the product down.

In terms of sustainability I think personally this product is hard to judge. It is made out of steel which can be recycled however it has a finish on it which might make it hard to recycle. However it has a long life span so it means its average CO₂ output over time will be low.

<https://www.amazon.com/Grabber-Carriers-Holders-Fireplace-Tweezers/dp/B01NBSXPKH>

Worx Firewood Transporter

600 x 800 x 700 mm



As we can see from the product the Worx Firewood transporter appears to be very simple yet effective. It has a large plastic tub which is capable of tilting on hinges to unload the logs which I will talk about later. It can hold up to 500kg of firewood in the steel coated tub. It has 4 all-terrain rubber wheels with the back two being adjustable through the handle and an axle system which I will again mention on my mechanisms page. These wheels mean it has no problem travelling over gravel which my client Wendy has to transport the logs over.

The handle has an ergonomic rubber grip to help the user as well as the handle can also be attached to the back of a lawnmower etc. The tub can also be used to carry other items such as tools and plants. By doing these things the designer is trying to make an inclusive product. Function is priority for the product. The axels and tub are made through welding and heating the metal to shape it.

I think the main flaw in this design would be lifting the tub up whilst full of logs or loading the logs into the tub. The effort needed to do these tasks would more than likely be too great for my client and so I would possibly need an attachment of sorts to load the logs into the tub easily and without having to bend down.

The materials rubber and steel are mainly used in this product, both are recyclable and so this product is eco-friendly. The life cycle of this product is very long as the product is very durable.

Upon looking for real solutions in various places I found the following product. After using the product for a while I felt I fully understood how it worked.

In turns of function the product was mediocre. It had two ergonomic handles to help for grip which was good as well as it had a foot bar to help lift the weight of the logs when moving. However I found that the smaller logs had a tendency to fall off which was bad. However the weight of the logs had been taken into account and I found that the centre of gravity when the logs were loaded was perfect which made the logs easy to manoeuvre as well as it made the transporting part stable and safe. As for form the product is designed purely for function and so the product wasn't particularly aesthetically pleasing.

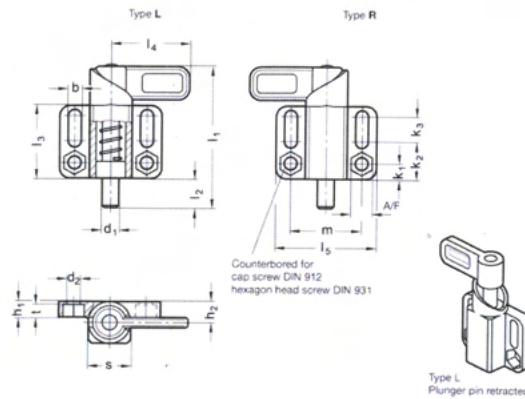
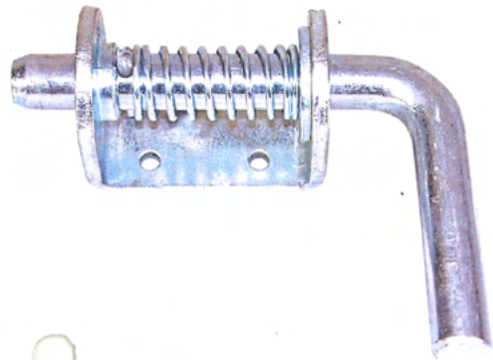
I would assume that this product is mass produced as it is quite a simple design to produce using jigs/templates. The materials used in this are mainly steel and rubber for the wheels and handles. The product is then finished in a layer of green paint with the metal being welded together. As a result I would imagine that the product is very strong/durable and therefore it will have a long lifespan. The cost of the product was fairly good at £29.99.

In terms of sustainability I would assume this product if basic. Steel can be recycled as well as rubber can also however dissembling this product may be complicated and so possibly not all parts of the product will be recycled. In terms of life cycle the main body of the product will last a very long time however the inflatable wheels could become damaged and so a replacement could be needed at some



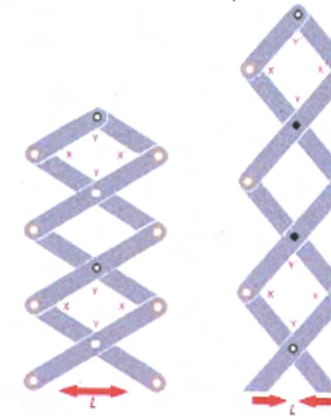
Mechanisms from Existing Solutions

Spring latch system



The spring latch system works by having a spring-loaded bolt that is angled off at the top edge. It works by the user applying a force to "unload" the bolt and when this is released the spring uses the built up mechanical energy to return to its original position and effectively lock back in place. It will not become unlocked unless a user physically unlocks the spring latch.

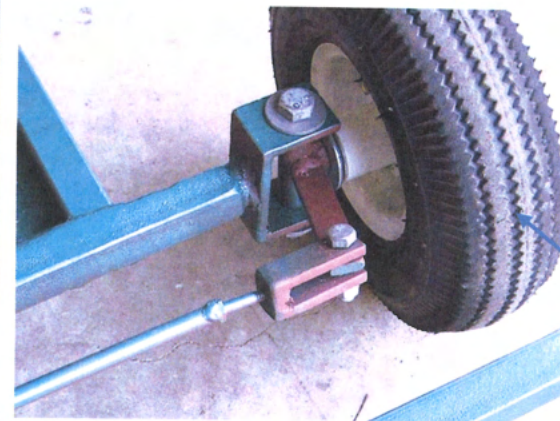
Scissor lift system



This mechanism uses a criss-cross pattern also known as a pantograph. Dues to this criss-cross pattern it gives the user more mechanical efficiency as well as it reduces link inertia. This mechanism could become very useful in my product as it could be used to extend town and pick up logs without my client having to bend down to pick the logs up herself.

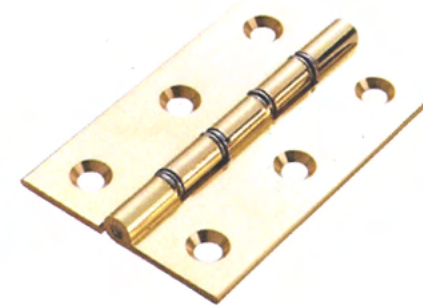
Axle system

The axle system used in the Worx firewood carrier could potentially be very useful for my product. The system works by a main handle/rod being pulled in the direction of travel, this then causes the track rod to change the angle of the wheels on the king pin. The wheels turn and so the cart travels in the direction on the pulling force. This could be useful for a product of mine as it would give easy steering of the logs when needed.



The average wheelbarrow wheel size is 400 x 100mm

Hinges and tub



As well as the axel system the Worx firewood transporter also uses some sort of hinge system, although this may appear very basic hinges have lots of advantages. The first being that the hinge will dissipate any pressure as well as hinge will give the user mechanical advantage. As well as this it makes the product easier to place back in its original position without being exposed to damage as well as wear and tear. The hinges also give the product an extended life span which is good regarding the environment.

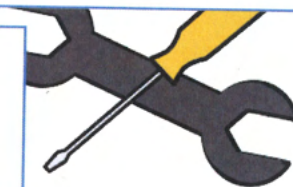
Gyro ball



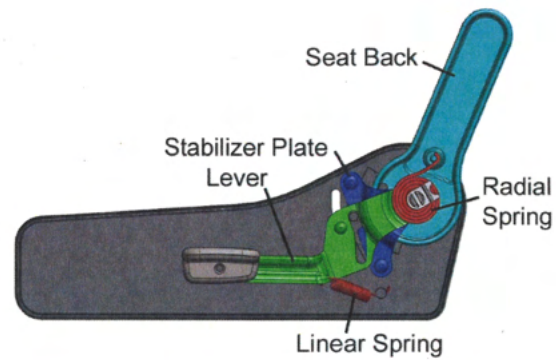
Whilst looking for real life solutions I can across a wheelbarrow with this gyro ball, although this isn't directly used to transport firewood I thought it could become useful potentially for my end design. It works by having an axel running through the middle of the ball which allows it to rotate. This in turn then lets turning become easier as well as smoother. The only downside is that it could potentially lead to the product becoming unstable.

The wheel and axle consists of a wheel attached to a smaller axle so that these two parts rotate together in which a force is transferred from one to the other. A hinge or bearing supports the axle, allowing rotation. It can amplify force; a small force applied to the periphery of the large wheel can move a larger load attached to the axle.

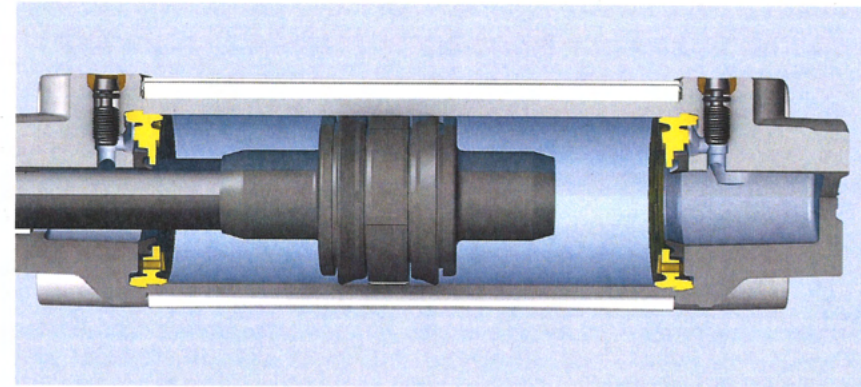
For wheels that are attached individually under shopping carts for example the wheels use a lazy Susan to rotate/turn and the individual wheels are attached by the axle system just on a smaller scale.



Adjustability and inclusivity



This adjustable mechanism is from a car seat however it could be possible applied to my design. It uses a variety of springs which lock in place to hold the seat in place. It helps give a range of angles for the user. I think I could use this mechanism to change the angles of my product to provide more comfort and suit the user better.

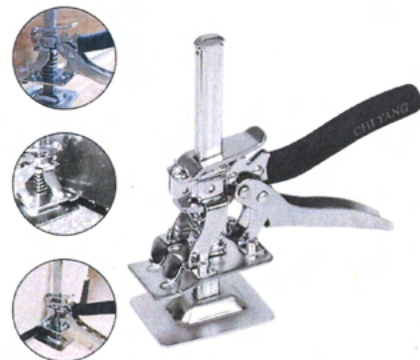


This is the internals of a hydraulic piston. Hydraulic pistons have many applications and so it could be applied to my product. Pistons respond to changes in weight (i.e. logs) and so I could apply this when there are different masses of logs being carried. Lightweight could mean the piston is less activated and so the logs would remain at a higher position making them easier to unload. That way you could control the access to the logs through the weight of the logs being carried. That way a user who struggles to unload the logs could only carry a little amount to making unloading easier.

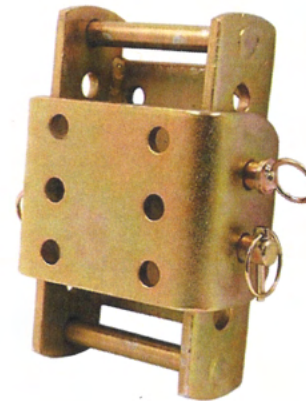
This is an example of inclusive design. This is actually a pen holder for someone who has suffered from a stroke. The designer has designed the handles to make it easy to grip. The pen itself doesn't even need to be held by the user. This would be a good idea to implement for my handles and mechanism. Making them easier to hold without struggle will make the product easier to use for the user. Using mechanism that don't have to be directly interfered with instead with larger parts of the design will make it more inclusive for people who struggle.



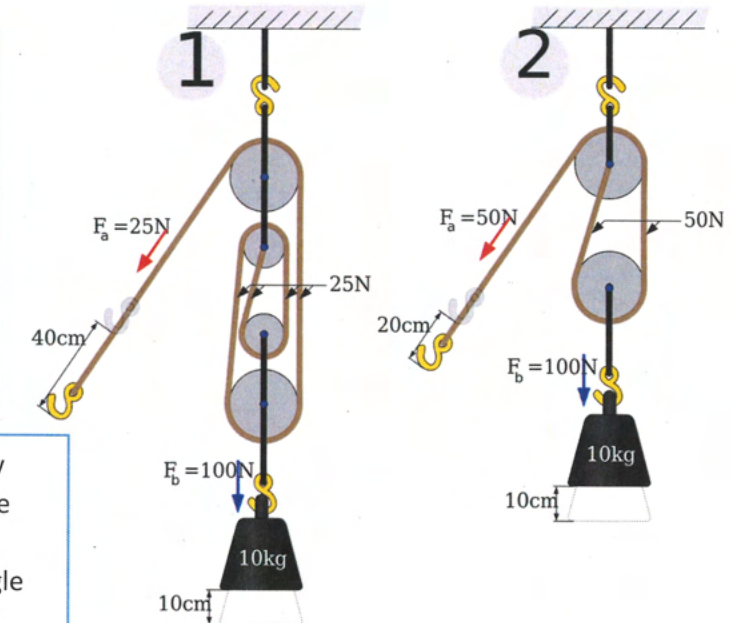
Sometimes a design prioritises function over form. This keyboard is a prime example of this. Although this keyboard may look 'wacky' it has been designed for maximum comfort. The design itself helps reduce carpal tunnel syndrome. Sometimes it is more important to prioritise ease of use for a product. For my design, I must consider doing this to maximise comfort for the people who struggle such as my client.



This is another example of an adjustable mechanism. It is a crank system that when the handle is squeezed the height of the base changes. This concept could also be integrated with an ergonomic handle to maximise its comfort and effectiveness. Changing the heights of the logs on a platform could be done by squeezing two of these ergonomic handles together.



This is another example of an adjustable mechanism. It is called a drop plate. It runs on a sort of rail track system and use two pins to change the height. Not only could this system be changed manually, I think it would be possible to attach a pulley system so the component of the weight could be reduced by using multiple pulleys. This would make carry 10kg of logs only 2.5kg if four pulleys were used.

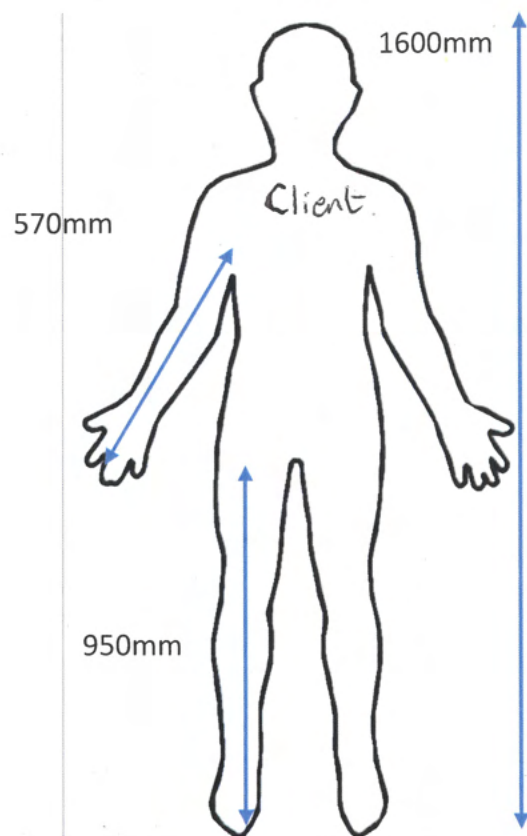
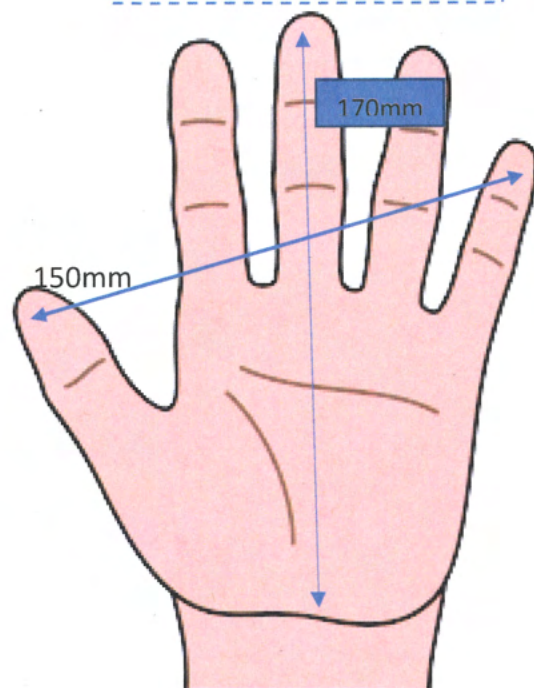


From the prism, we can see a range of handle angles are available. Sometimes users find using products in different ways to others more comfortable. This way it is important to include all aspects of how a product could be used such as the angles of the handles. That way the product will be suited comfortably to a wider range of users without an impact to how the product itself works.



Sometimes a product needs to be completely reinvented to suit people who struggle. These scissors are a prime example. They have a complete new look to suit people who struggle to grip (arthritis). Whilst designing items that may be hard to hold I need to look at the bigger picture and remember to include people who struggle with tasks that might not be immediately obvious.

My client's measurements



Arthritis, Anthropometric data and Product Standards

Anthropometrics

Anthropometric data can vary a lot depending on many factors. These include the target audience; young children will be smaller than fully grown adults for example.

The product I will produce will be made for my client but I must also take into account that she may be smaller/taller than the average person and so I must take into account anthropometric data for all the measurements I use. My product will be used by adults in an estimated age range from anything from 19 years old to 65+ years old.

Dimension	Gender	5th percentile (mm)	50th percentile (mm)	95th percentile (mm)
Hand length	Male	173-175	178-189	205-209
	Female	159-160	167-174	189-191
Palm length	Male	98	107	116
	Female	89	97	105
Thumb length	Male	44	51	58
	Female	40	47	53
Thumb breadth	Male	11-12	23	26-27
	Female	10-14	20-21	24
Index finger length	Male	64	72	79
	Female	60	67	74
Hand breadth	Male	78	87	95
	Female	69	76	83-85

Dimensions	Man (Percentiles)			Women (Percentiles)		
	5%	50%	95%	5%	50%	95%
Height	1630	1745	1860	1510	1620	1730
Leg Length	850	935	1020	750	820	890
Arm Length	730	790	850	650	715	780

Anthropometric data of British individuals aged 19-65 years old

Product Standards

Every product today has to meet lots of standards and requirements. In Britain there are two main standards that my product should meet these being British Standards Institute (BSI) and European Conformity (CE). These two organizations one for Britain and one for Europe set out safety standards and requirements that each product has to meet so that it can be sold on the market.

Some examples of these requirements are as followed:

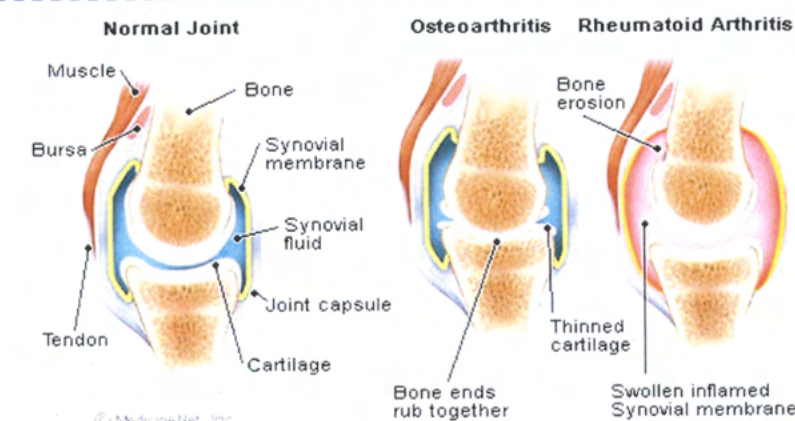
- Quality management (BS EN ISO 9000 series)
- Requirements for electrical components (BS EN 50088)
- Environmental management
- Safety of machines/mechanisms (BS EN 418, BS 8800)
- Design of products- accessibility (BS 888)
- Symbols and terms (BS 5378-2)
- Information and communication technology management (BS EN 61082)



Arthritis

Arthritis is a common condition that causes pain and inflammation in a joint. In the UK, around 10 million people have arthritis. It affects people of all ages, including children. Due to my client having arthritis as well as possible many others using this product could have arthritis I thought I should research into what it is and how I need to adapt my product to help make the task at hand easier for my client and possible future users.

In general arthritis targets four key areas these being the hands, spine, knee and hips. Arthritis can cause movement to be more difficult than usual, leading to pain and stiffness. This can lead to gripping items or bending over to pick up logs for example difficult and painful and so when designing I must take into account these problems so that my design is inclusive for all people including my client.

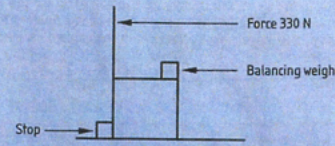


Normal and Arthritic Joints

British Standards

My product will need to meet BSI standards if it is to be sold in the UK. Here are the main standards I must meet with my product:

BS 4875-1 and BS EN 1728 apply to my design. Test 1 for this standard is the static load test on a scale from 1-5 based on the performance of the product. My product will need a performance rating of 4 to make it have the longest realistic lifespan possible.



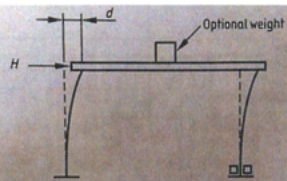
Test no.	Title	Description	Test level (see Table 2)				
1	Seat static load test	Test force (in N)	1	2	3	4	5
			-	1 100	1 300	1 600	2 000

The second test my product will have to pass is the back-static load test. This test looks at the stability of products with forces applied. My product will need to be stable to meet this standard. This standard is especially important as the product will have to remain very stable whilst going over rough terrain and up vertical inclines (stairs).

Test 3 for this standard also looks at the stability of product, but up inclines, again this is very important for my product as it will have to travel up inclines. My product will need to be inclined at 10 degrees when it's been manufactured and still be stable. I will apply a varying amount of force to see which level 1-5 it meets. I will aim to meet level 3 or higher for my product.

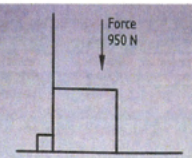
Another BSI standard it must meet is BS EN 1730. Again, the forces to be applied depend on the test level.

Test 1 is the vertical static load test. This test applies a vertical load in the centre of the product to see how much it bows under the force. Level 5 for this test uses two forces 560mm apart. For this test, I am aiming to meet the test level 3 requirement to ensure that my product does not bow under the maximum load of the logs which I have stated to be 50kg.

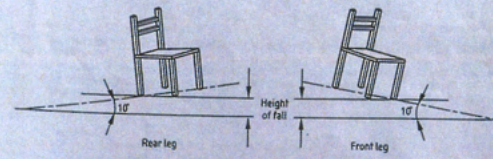


Test no.	Title	Description	Test level (see Table 2)				
2	Horizontal static load test	Test force (in N)	1	2	3	4	5
			175	300	450	600	900

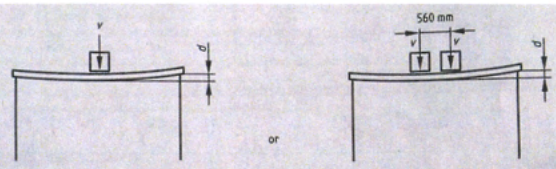
The final BSI standard I want to focus on is BS 3963-6. This is the impact test. In the test, the resistance to mechanical damage is tested using a steel ball dropped from a height of two metres. For my product to achieve test level 5 the ball must not crack the product when the ball is dropped on it.



Test no.	Title	Description	Test level (see Table 2)				
1	Seat static load test	Test force (in N)	1	2	3	4	5
			-	1 100	1 300	1 600	2 000



Test no.	Title	Description	Test level (see Table 2)				
3	Drop test	Drop height (in mm)	1	2	3	4	5
		Non-stacking chairs with legs longer than 200 mm	150	200	300	450	
		Chairs and stools with legs shorter than 200 mm	75	100	150	250	
		Stacking chairs and stools with legs longer than 200 mm	150	300	450	600	900



Test no.	Title	Description	Test level (see Table 2)				
1	Vertical static load test	Test force (in N)	1	2	3	4	5
			500	750	1 000	1 250	2 900

Test 2 is the horizontal static load test. The test applies a horizontal force to the edge of the table top to check the amount of lateral movement. The base of the product should be held in place whilst the top has a force applied to it. I am again looking to achieve test level 3 for my product. Therefore, the horizontal load it can carry will be equivalent to 45kg.

Appearance of test area	Rating
No surface cracking	5
Slight cracking, e.g. one or two circular cracks	4
Moderate or severe cracking confined to the area of indentation	3
Cracking extended outside the area of the indentation and/or slight flaking of the finish	2
More than 25 % of the finish removed from the edge of indentation	1

Ergonomics

Lifting heavy items is one of the leading causes of injury in the workplace. In 2001, the Bureau of Labor Statistics reported that over 36 percent of injuries involving missed workdays were the result of shoulder and back injuries. Overexertion and cumulative trauma were the biggest factors in these injuries. Bending, followed by twisting and turning, were the more commonly cited movements that caused back injuries.

When designing my product, I must look at the ergonomics and principles of my design problem and how I can look to address the following:

- Use mechanical means (e.g. hand trucks, pushcarts, etc.) when possible for heavier or awkward loads
- It is easier and safer to push than to pull
- Keep loads as close to the body as possible and do not twist while lifting, carrying, or setting down a load.
- Minimize reaching
- As a general rule, bend at the knees, not the hips.
- Get help when needed. Do not lift or carry things you don't feel comfortable with, no matter how light the load
- Plan ahead for all parts of the lift: lifting, carrying, and setting down
- Try to utilize proper handholds while lifting
- Use personal protective equipment where needed, such as gloves with good grip
- Implement rest breaks
- Place items to be lifted within the "power zone". The power zone is close to the body, between the mid-thigh and mid-chest of the person doing the lifting. This is the area where the arms and back can lift the most with the least amount of effort.

Addressing these points through design will lead to a final product that is easier to use and is at less risk of injuring the user. Some points will be easy to address like providing appropriate handles to the product. However, some points require a more complex solution such as using mechanisms to the advantage of the user.

Resources: <https://ehs.unc.edu/workplace-safety/ergonomics/lifting/>

Levels of production, form, function, sustainability and life cycle regarding existing solutions

Levels of production

After researching and looking at existing solutions I came to the conclusion that a product similar to mine will use batch production. This will be the best method of production as it will be cost effective for the scale of my product. Using batch production has three main stages the first being the set-up such as creating jigs to help improve speed/accuracy of the product. The second is cutting the components out and acquiring the needed components that can't be made in the workshop. The last stage is the time taken to make the product.

As I am working in a fairly basic workshop I will buy in the parts such as wheels that can't be made to help produce a better solution. I will employ the use of jigs where I see fit to help produce a better and more accurate design.

Sustainability

Looking at these products I think the sustainability is of a good standard. With many of the designs materials are used sparingly. Although it is hard to tell I would imagine the product are made using only one or two different metals or other materials. This makes recycling easier at the end of the products life. Continuing on from this looking at these products many of them are finished in paints which provide little damage to the environment. The only place sustainability would be an issue would be being parts have been welded together as this uses lots of energy.



Life cycle

Looking at the life cycle of similar products I came to the conclusion that this sort of product starts with a relatively high carbon footprint but due to the product lasting a long time it is split over many years.

The key points I took from my research was that the raw materials needed for the product often required lots of energy to extract, an example being bauxite ore which is used to make aluminium. It has to be extracted from the environment which uses energy.

In terms of manufacture the way this product is made varies the carbon footprint immensely. Product that were welded together had a much higher carbon footprint than products that had been joined using temporary joins such as nuts and bolts or rivets.

Distribution remained mainly the same throughout the products as they all were transported from their factories.

The way the product is used generally results in no carbon footprint. The only exception to this was when an existing solution used an aid such as an electric motor or petrol engine to help with movement.

Finally, with the end of life with these products it varies greatly depending on the product. Some products can be easily dismantled which makes them easy to recycle however others are a lot harder to recycle as they use a mix of materials and welds.



Function

The function of these products is very basic and it is hard to create a product that doesn't function for this brief. That being said I don't think any of these products are particularly well suited to someone who is elderly. Many of the products don't use mechanical advantages to their benefit and I can imagine lots of these products struggle to appeal to people who struggle in life. Another flaw that I spotted was with many of the designs I could imagine the logs falling out easily. That being said I would say 95% of the products I looked at well-made and functional.

Form

Regarding the form of this sort of product they are all very similar. I found many products were made from metal and had a sort of minimalistic look. The products were often painted a bright colour to give the product a less dull look to the eye. A problem with this is that with the logs I can imagine would leave scratches on the product which could ruin the aesthetics. As a result of this I think that dip coating would be a more scratch resistant and corrosion resistant finish. I would say though with a product like this the function is more important than the form.