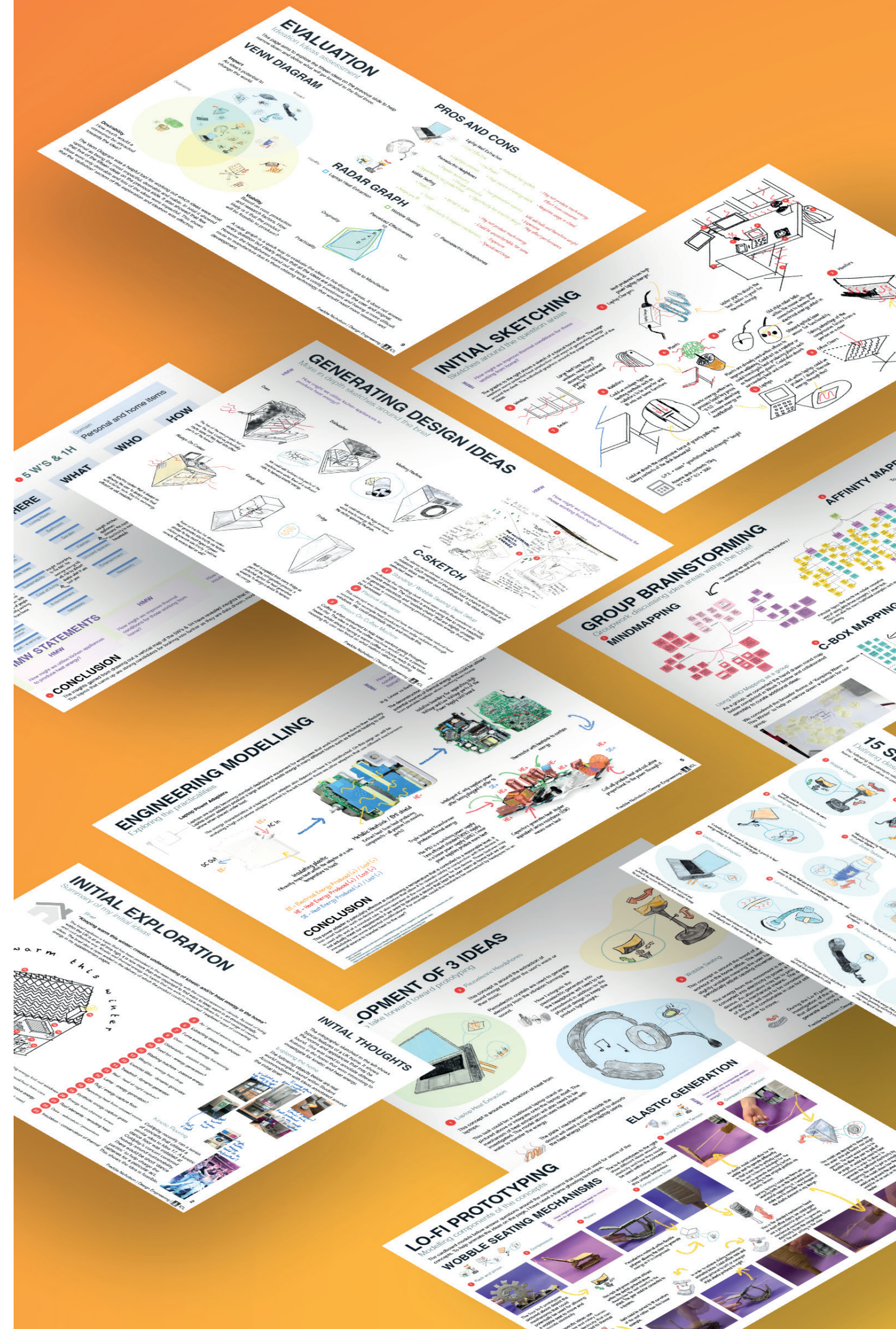


# KEEPING WARM THIS WINTER

Introduction to Design Engineering - Part A





# INITIAL EXPLORATION

Summary of my initial ideas



## Brief

**“Keeping warm this winter: creative understanding of kinetic and/or heat energy in the home”**

The brief explores a topic that has been prevalent in the news recently with the current economic climate. As cost of living within the UK is at an all time high, it is now more than ever important to find ways to keep warm in an environmentally and cost effective way. Kinetic and thermal energy are topics that are wide in scope and allows for a vast range of creative ideas. The brief also is open ended in the delivery of which the product could be provided. I explored ways of converting energy in my supplementary pages.



- 5 Air / ground source heat pumps
- 6 Extracting steam from shower
- 7 Fume extractor energy
- 8 Oven - passive energy harnessing
- 9 Dishwasher - passive energy
- 10 Food bin - energy generation?
- 11 Washing machine - passive energy
- 12 Weights - energy from drop
- 13 Exercise Bike - dynamo generator
- 14 Treadmill - dynamo generator
- 15 Bed - heat at night capture?
- 16 Lamp - energy generation?
- 17 Rug / energy capture floor
- 18 Re-routing heat from unused rooms
- 19 Synthetic energy capture grass
- 20 Energy from chimney fumes
- 21 Roof elements - re-routing heat
- 22 Door - education / prevention
- 23 Insulation - conservation of thermal

## INITIAL THOUGHTS

The info graphic sketched to the left shows typical features of a UK home. It shows the rooms and appliances that may be found. This was used to annotate different features in the home that were interesting to investigate for kinetic and heat energy.

### Exploring the home

The following objects below are real world examples found within Student Accommodation with ideas annotated around the initial brief.



### Kinetic Flooring

Coldplay recently ran a series of concerts that utilised a similar idea to Idea 17. A kinetic dance floor was installed at Coldplay's concert centred heavily around sustainability. There would be short 'dance parties' to help charge the batteries for a particular act. This shows the idea is feasible.



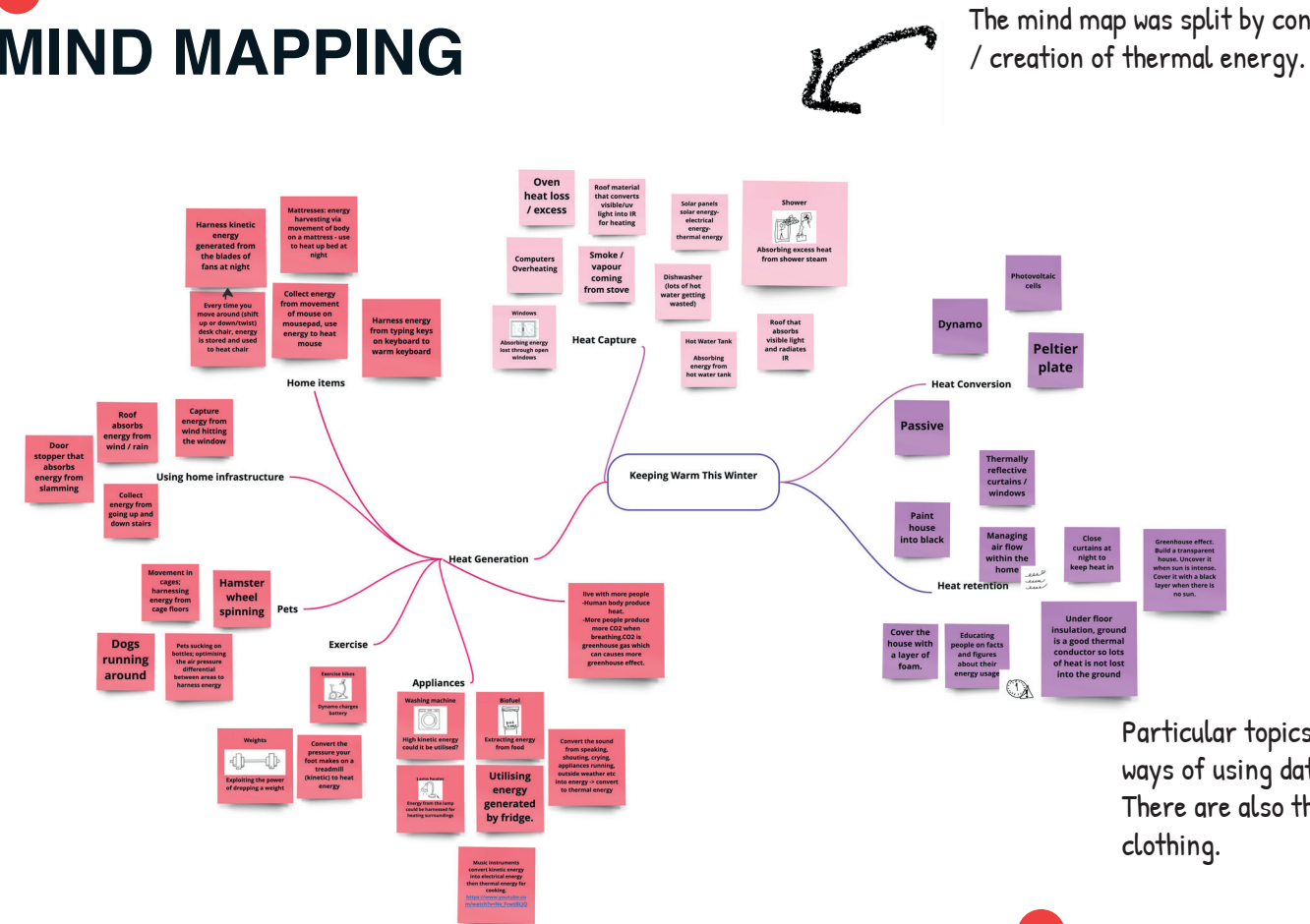
1. <https://energy-floors.com/products/the-dancer/coldplay/>



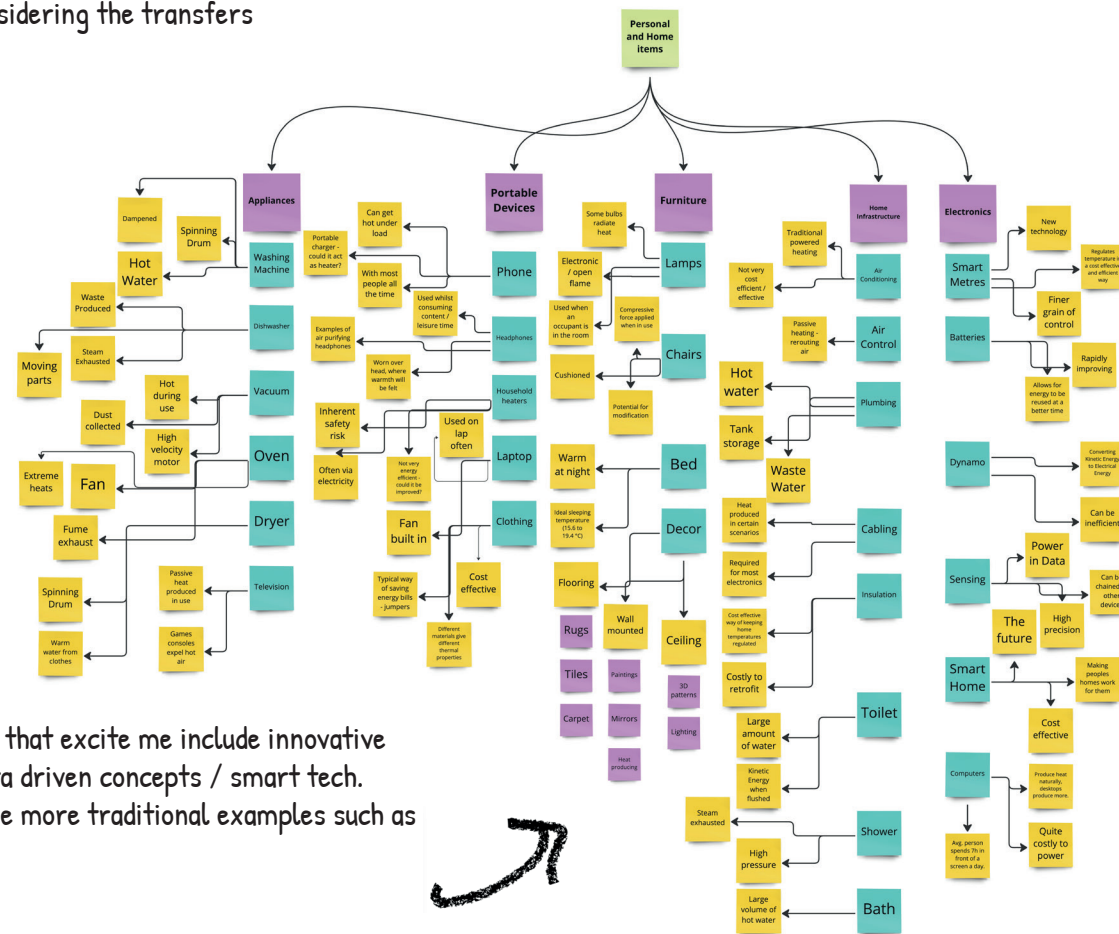
# GROUP BRAINSTORMING

Group work discussing idea areas within the brief

# 1 MIND MAPPING



The mind map was split by considering the transfers / creation of thermal energy.

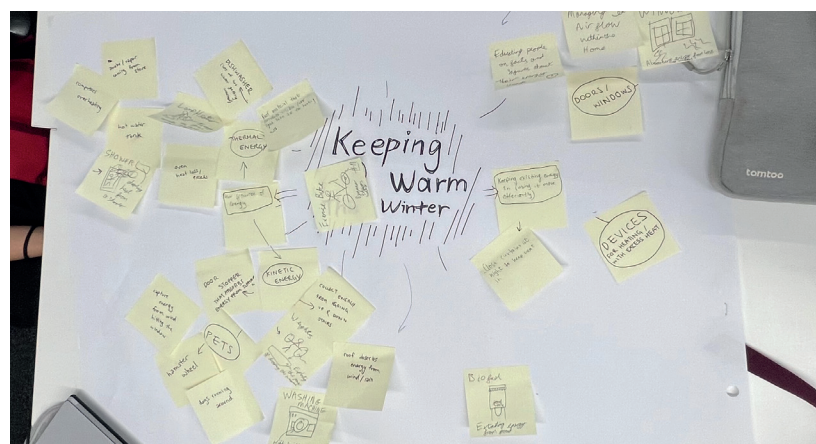


Particular topics that excite me include innovative ways of using data driven concepts / smart tech. There are also the more traditional examples such as clothing.

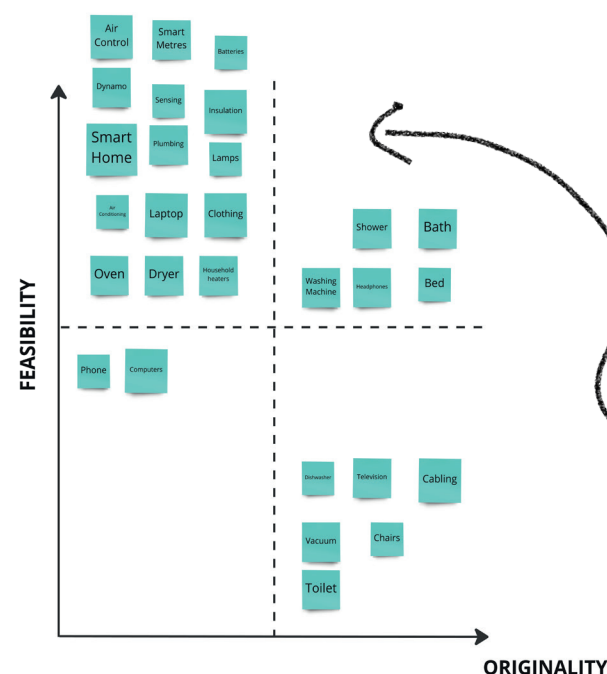
## Using MIRO Mapping as a group

As a group, we converted the hand drawn mind map below completed in Week 2 below and collaborated remotely to curate additional ideas.

We considered the broader theme of ‘Keeping Warm This Winter’ to help us narrow down a domain for our group.



### 3 C-BOX MAPPING



The C-Box mapping exercise was particularly effective as it highlighted quickly which areas were most interesting to investigate for my project.

Some ideas did not seem feasible / interesting such as mobile phone heating

Ideas in the top left (breakthrough ideas that can be implemented) are what this project should target.

A lot of my most original ideas involve using data in creative ways. For example air control that adjusts based on how many occupants are in a room and reroutes heat from empty spaces to make the occupants feel warmer. There are also traditional areas to explore such as clothing and their materials / design.

## 2 AFFINITY MAPPING

To discover further detail around different individual ideas around our chosen domain 'Personal and Home items' the mind map to the left explores the different categories mentioned below.

From this extra creative work, the affinity mapping was able to go into finer detail than our group work to gain more inspiration around potential ideas.

It also highlighted the broad context area that the domain covered and what was more likely to be used in the real world.

Group Selected Domain

## Personal and home items

This could include appliances, portable devices, furniture, home infrastructure (boilers, insulation, etc...), electronic equipment and much more.



# INITIAL ANALYSIS

Asking narrower questions about the design brief

## 1 5 W'S & 1H

Domain

Personal and home items

### WHEN

Exercise / workout time

Cooking in the kitchen with appliances / utensils

Time to relax / remaining stationary

Work from home

Good / poor weather

Night - low energy consumption

Peak - evenings

Insight: According to a ONS survey, there was a rise in 12% from 30% to 42% of people mostly working from home

### WHY

Seasonal Changes

Differing energy requirements

Remote roles

Sustainability

Cost of living

Entertainment

Necessity

Insight: According to the BBC the average energy bill will rise by almost double what it was last year.

### WHERE

Living Room

Bathroom

Garden

Kitchen

Unused spaces

Insight: Kitchen appliances consume the most electricity in most households

### WHAT

Producer

Generator

Natural Solutions

Appliances

Clothing

Electrical

Passive Heating

Steam

Water

Insight: Passive heating once installed has one of the lowest maintenance costs compared to alternative methods.

### WHO

Families

People with disabilities

Children

Elderly

Visitors

Toddlers

Teenagers

Insight: The elderly are most vulnerable to heat related health concerns (either too hot or too cold) such as hypothermia.

### HOW

Heat Capture

Heat Conversion

Heat Generation

Heat Retention

## 2 HMW STATEMENTS

### HMW

How might we utilise kitchen appliances to produce heat energy?

### HMW

How might we improve thermal conditions for those working from home?

### HMW

How might we utilise heat capture and insulation (passive) within the home?

### HMW

How might we reduce economic costs of traditional heating methods?

## 3 CONCLUSION

The insights gained from drawing out a vertical map of the 5W's & 1H have revealed insights that framed my How Might We questions. The topics that came up are strong candidates for looking into further as they are data driven, modern and actively being researched.



# ENGINEERING MODELLING

Exploring the practicalities

MMH

How might we improve thermal conditions for those working from home?

## Laptop Power Adapters

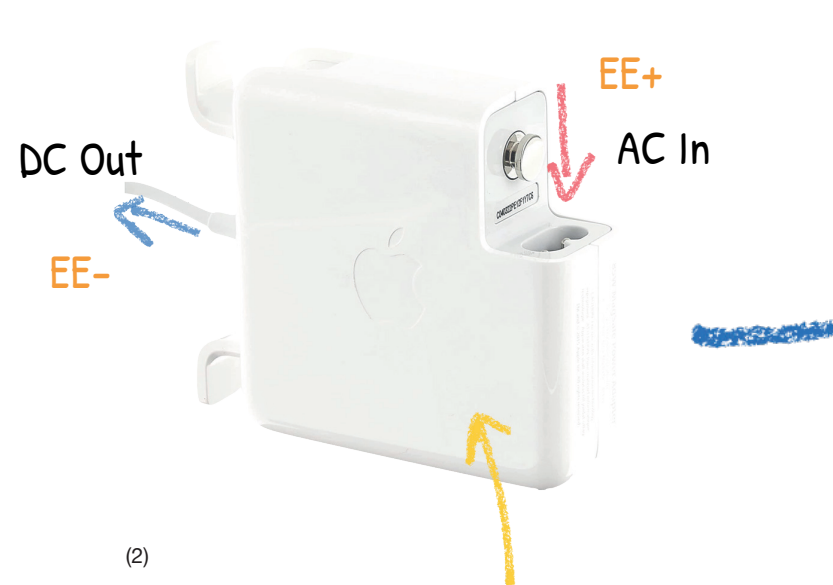


Laptops are quickly becoming standard deployment equipment for employees that work from home due to their flexibility. Laptop power adapters produce a large amount of waste energy in many different forms such as thermal heating to coil whine when placed under load.

The energy characteristics of a laptop power adapter also depend on how it is constructed. On this page we will be analysing a high end power adapter pictured to the left however there are other adapters that use different mechanisms

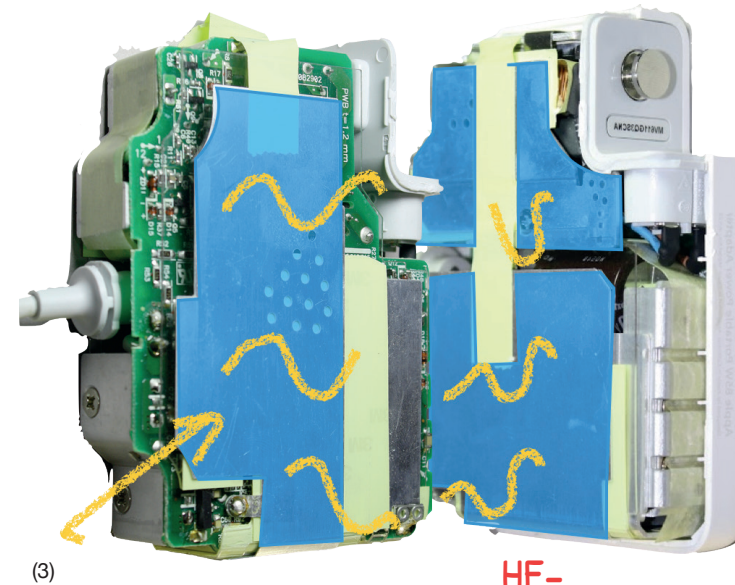
(e.g. Linear vs. Switching described below).

The deconstruction of an adapter will allow us to uncover potential sources of thermal energy that could be utilised from portable laptops when working from home.



Insulating plastic

Efficiently traps heat within the adapter at a safe temperature to touch

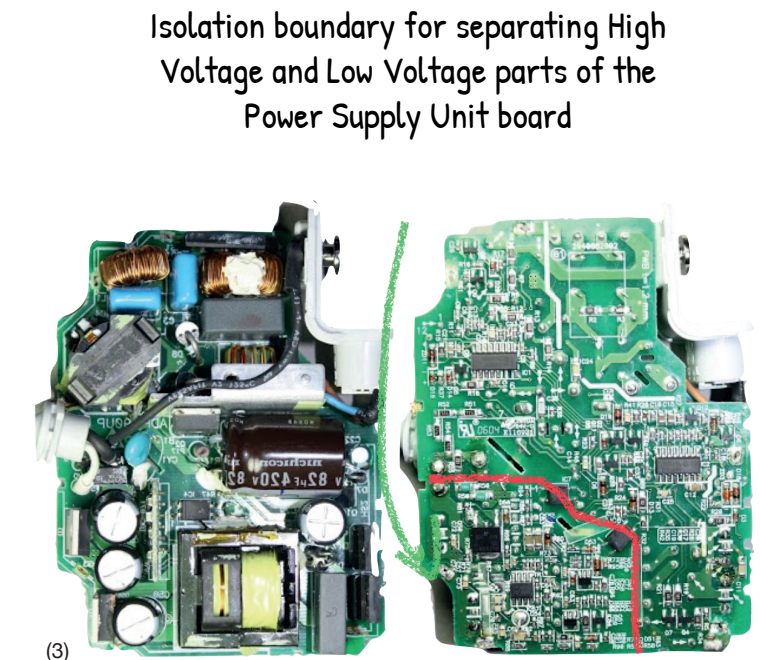


Metallic Heatsink / EMI shield

Extract heat from heat producing components - all passive (no moving parts)

Triple Insulated Transformer produces thermal energy

Mac PSU is a switching power supply. Less efficient standard (85%) supply is a linear power supply (60%). Linear power supplies produce more heat.



Isolation boundary for separating High Voltage and Low Voltage parts of the Power Supply Unit board

EE - Electrical Energy Produced (+) / Lost (-)

HE - Heat Energy Produced (+) / Lost (-)

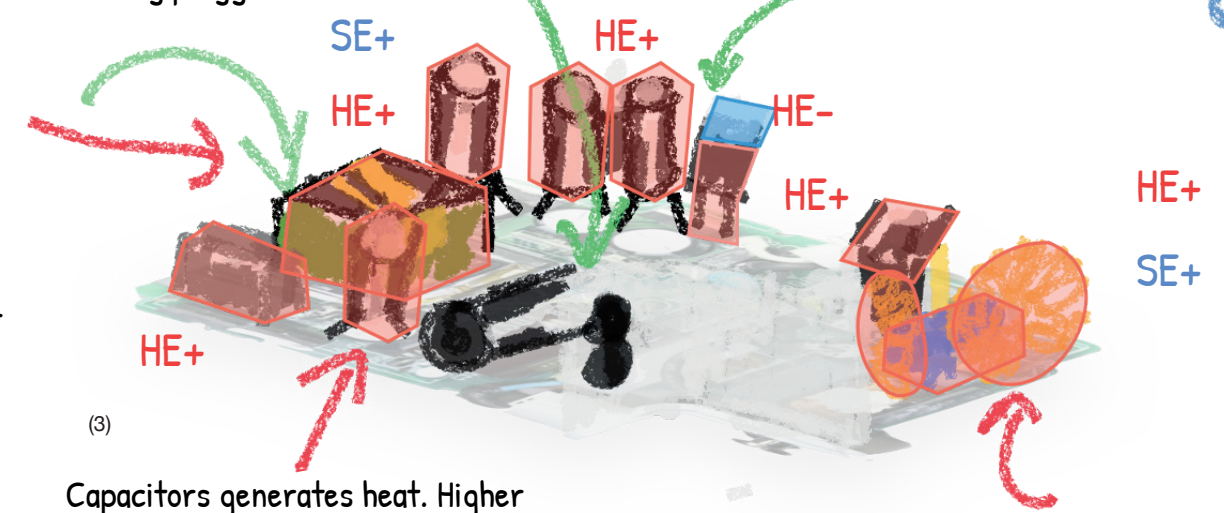
SE - Heat Energy Produced (+) / Lost (-)

## CONCLUSION

This power adapter is particularly effective at maintaining a temperature that is controlled to a reasonable level. It has smart features such as device communication that allow it to operate safely in conjunction with the device it is used with and at a constant rate. It also operates at the most optimal power for the device. These features may not actually meet our requirements if we were to develop a device that kept the user warm at home but we can immediately see some potential modifications. For example, could the heatsinks be connected by heat pipes to an external source to transfer heat to the user?

Intelligent IC only supplies power after being plugged in after 1s

Thermistor with heatsink to contain energy



Capacitors generates heat. Higher equivalent series resistance (ESR) means more heat.

Coil will produce heat and coil whine proportional to the power through it.



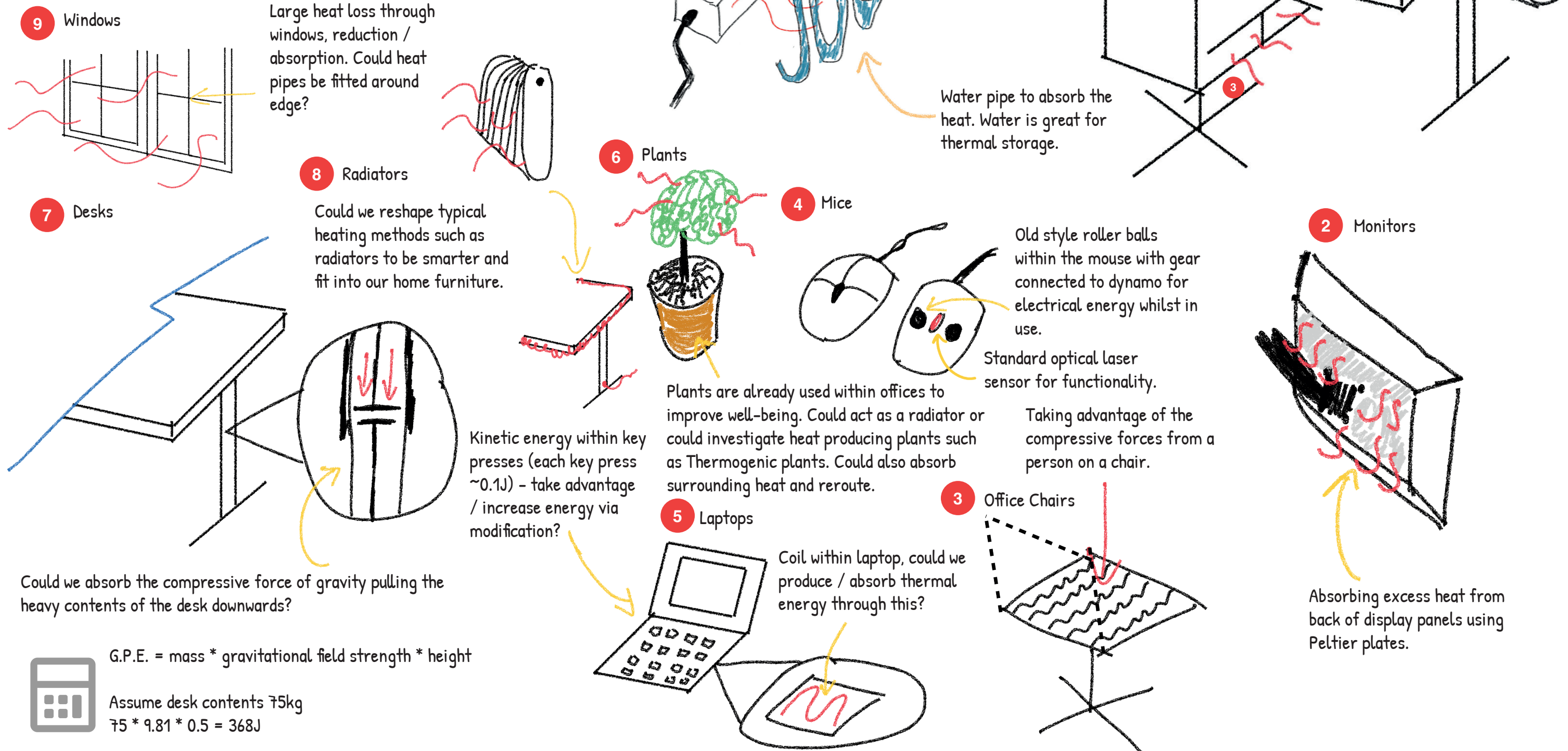
# INITIAL SKETCHING

Sketches around the question areas

HMW

How might we improve thermal conditions for those working from home?

The graphic to the right shows a sketch of a typical home office. The page explores some potential heat production and ways of generating energy around the desk. The individual graphics around the page show some of the ideas.





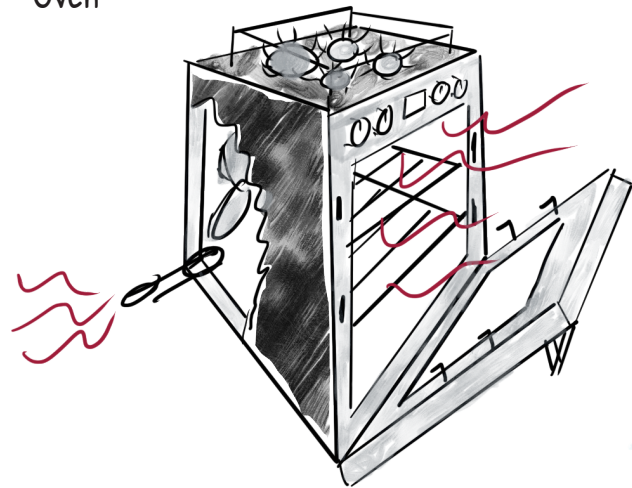
# GENERATING DESIGN IDEAS

More in depth sketches around the brief

HMW

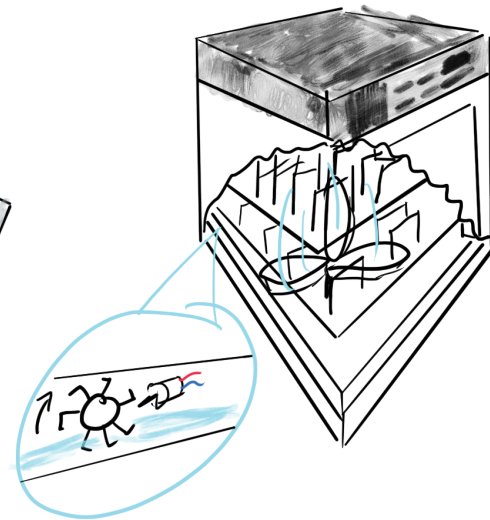
How might we utilise kitchen appliances to produce heat energy?

Oven



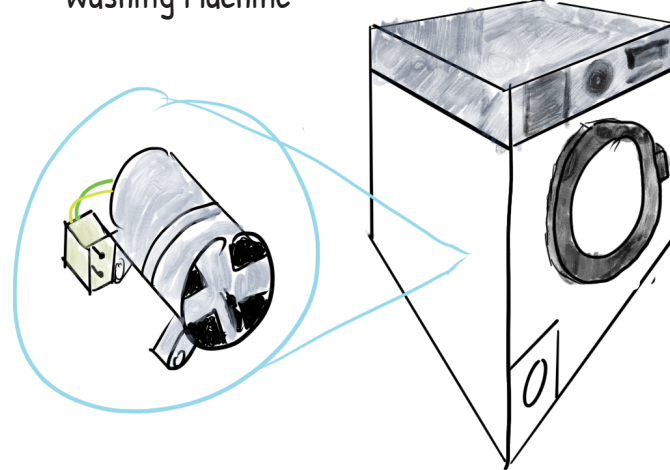
The fan of the oven propels hot air over the food. Could we potentially route some of this heat into other parts of the home?

Dishwasher



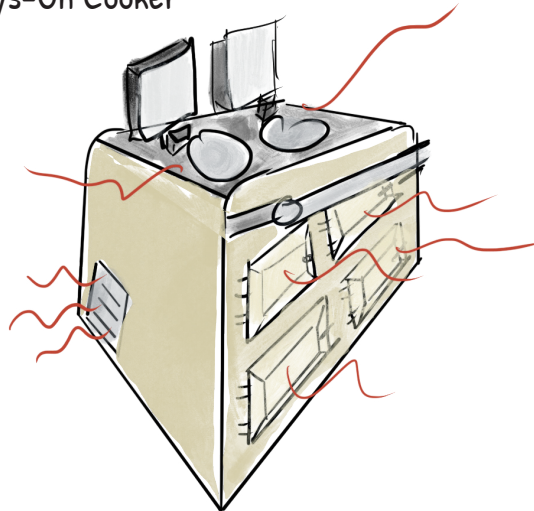
We could add turbines into parts of the machine where water flows at a sufficient rate to harness kinetic energy.

Washing Machine



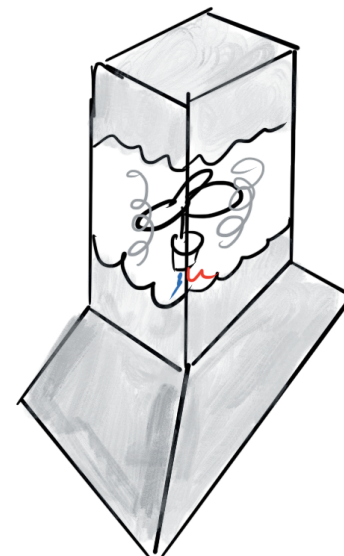
We could absorb the huge amounts of waste kinetic energy that come from the motor spinning the drum.

Always-On Cooker



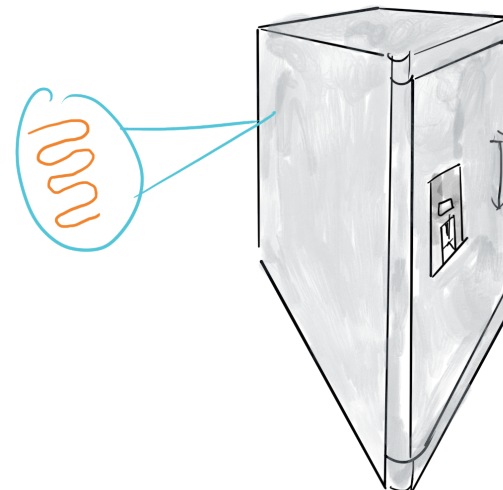
An electric cooker that is always on allowing the user to always cook food with a better taste. Electric and energy efficient as well insulated.

Range Hood



Fume extraction for above cooker that generates electricity via turbine similar to how most types of power station generate electricity. Could we reroute the excess heat as well?

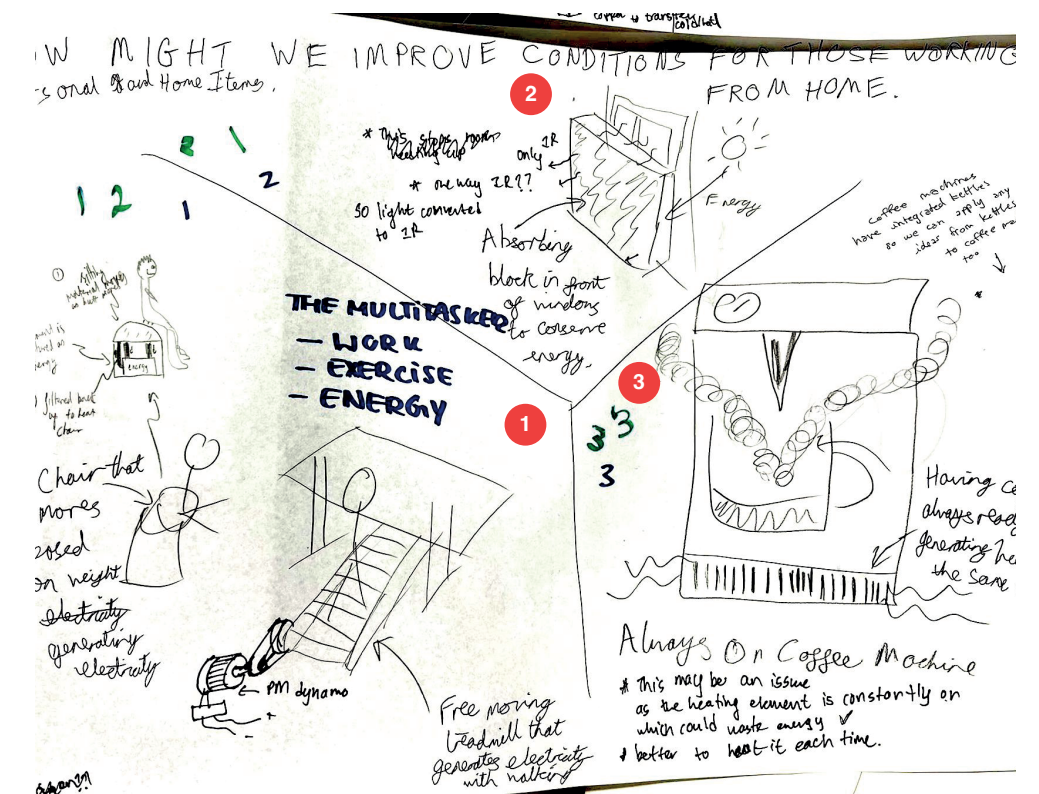
Fridge



Heat is expelled from every fridge as part of the refrigeration process. A potential option for heat generation would be to design a device to harness this energy.

HMW

How might we improve thermal conditions for those working from home?



## C-SKETCH

The above scan shows a completed C-Sketch activity through four rotations. Each member of the group had a chance to critique and improve ideas with their own contributions. The ideas that I initially selected were:

### 1 Standing / Wobble Seating Desk Setup

Following the standing desk trend seen within the pandemic to help people exercise. The concept is around using free to move treadmills to generate electricity and 'wobble chairs' that are slightly unstable so the user is constantly moving producing kinetic energy that can be harnessed.

### 2 Passive Elements

This concept was broadly around how we could utilise natural heat sources. For example heat produced from solar radiation through windows. We could potentially store and reroute this.

### 3 Always-On Coffee Machine

Coffee is often consumed to help keep workers going throughout the day. The idea is that the coffee machine would act as a passive heater whilst always having a warm coffee of choice ready to be taken meaning the user can focus on what matters rather than waiting.



# 15 SELECTED CONCEPTS

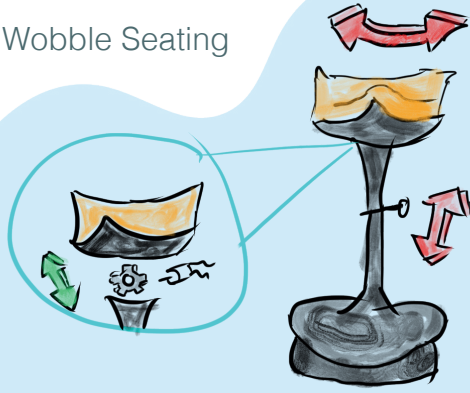
## Defining design ideas

The following are concepts related to the brief 'How might we improve thermal conditions for those working from home'. Most of them draw on previous pages. I also considered the different mechanisms they might use.

MMH

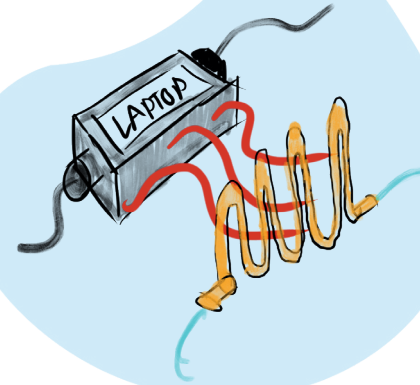
How might we improve thermal conditions for those working from home?

1 Wobble Seating



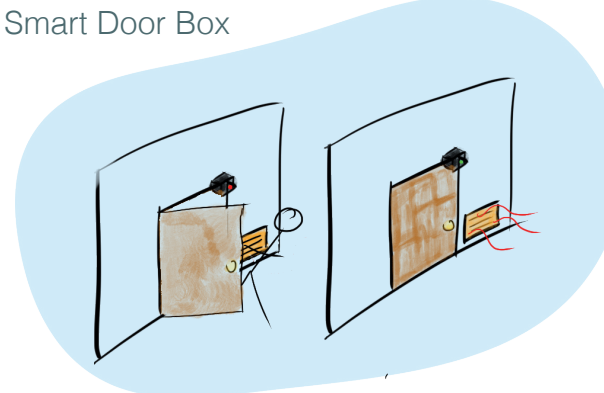
Energy would be absorbed from the users kinetic movement.

2 Laptop Charger



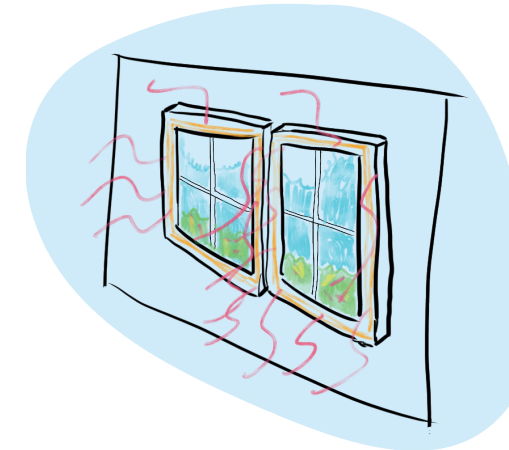
Following engineering modelling, extracting heat from power adapters.

3 Smart Door Box



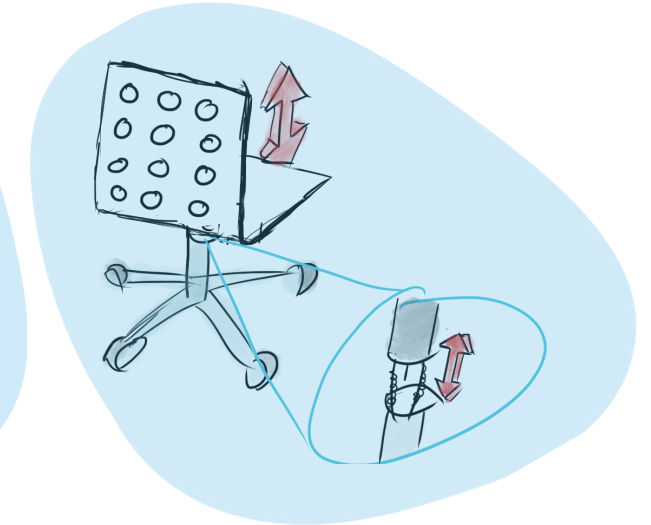
A smart sensor that adjusts your heating system to direct heat towards rooms with inhabitants.

4 Heat Pipe Windows



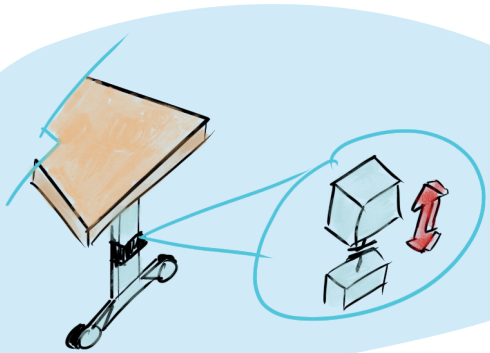
Heat pipes on the sides of windows to absorb solar radiation and convert into heat, could also act as more efficient radiator.

5 Compressive Force Generator Chair



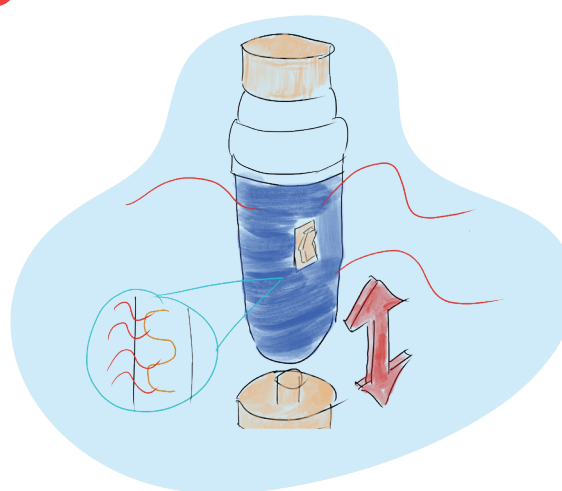
A chair that absorbs the compressive kinetic energy from a user sitting and converts to heat.

6 Standing Weight Generation Desk



A standing desk that converts the load due to gravity to heat energy similar to the concept of GravityLight.

7 Water Bottle Radiator



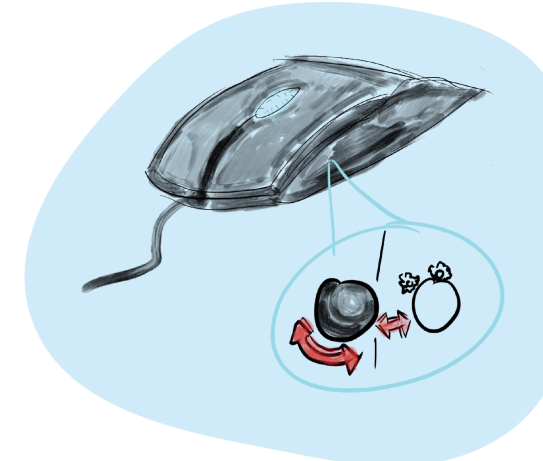
A water bottle that also acts as a radiator and keeps water cool, similar to the mechanism in a household fridge.

8 Radiator Plant



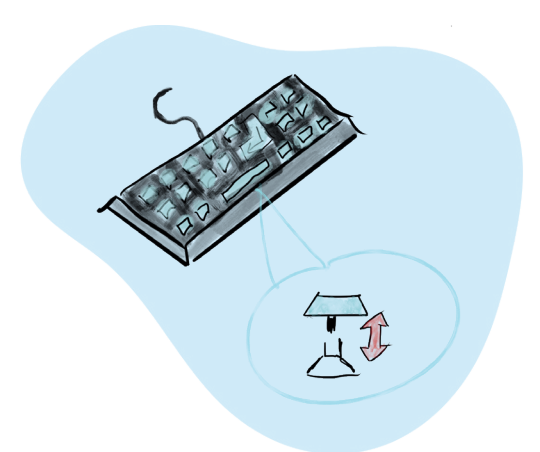
A plant pot / fake foliage that acts as a radiator. Could also be Thermogenic.

9 Roller Ball Generator Mouse



Mice used to rely on 'roller ball' instead of optical lasers. Could a hybrid model be made that converts the balls kinetic energy?

10 Key Press Generator



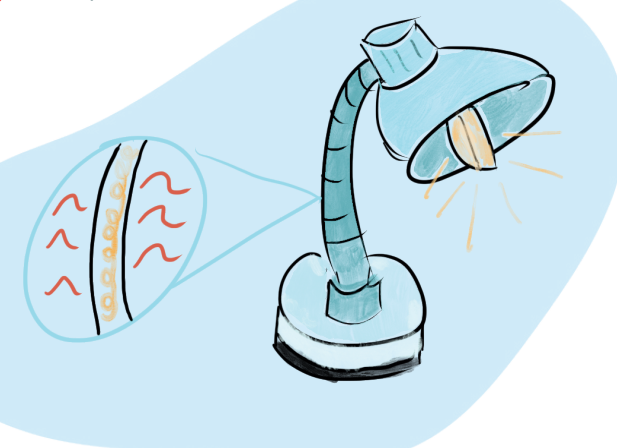
Converting key presses in a busy home office to energy to keep the user warm.

11 Laptop Heat Extraction



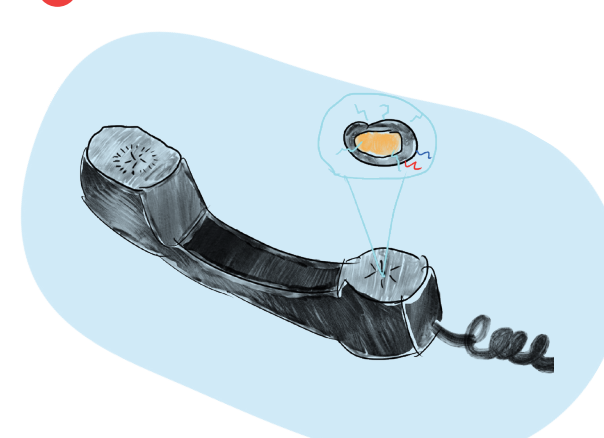
A laptop stand that runs cold water via a coil and extracts the excess heat energy to a radiator to keep the user warm.

12 Lamp Radiator



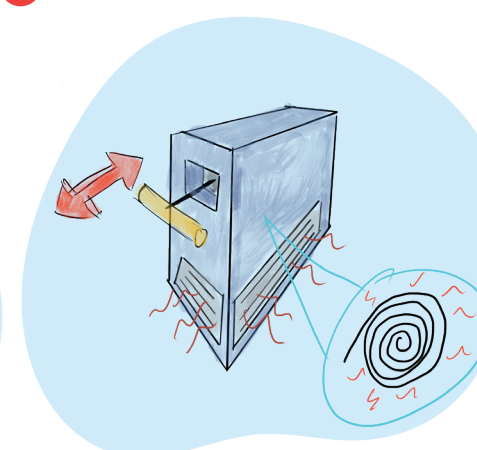
A lamp with coiled elements attached to the bulb power source allowing user to keep warm during the day.

13 Piezoelectric Phone Generator



Converting sound energy from a desk phone to electrical using a piezoelectric plate.

14 Under Desk Pull Heater



Converting kinetic energy from pulling the handle with resistance generating electricity either due to dynamo or other mechanical means.

15 Piezoelectric Headphones



Piezoelectric generation in either speaker cup or microphone to generate heat on the headband.

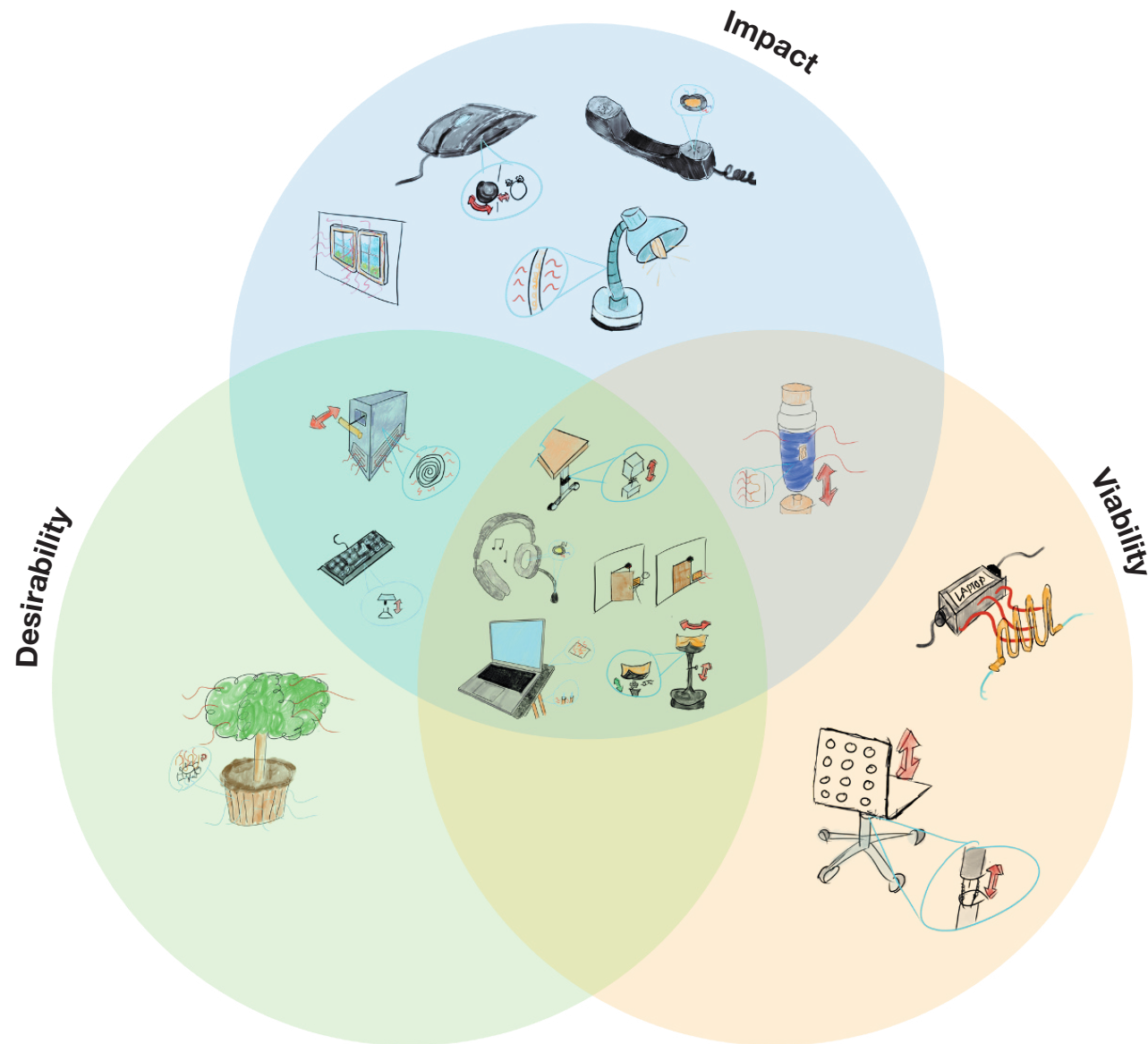


# EVALUATION

## Ideation Ideas assessment

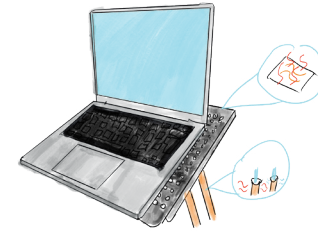
This page aims to explore the fifteen ideas on the previous slide to help narrow down and define what will go forward to the final three.

## VENN DIAGRAM



The Venn Diagram was a helpful tool for working out which ideas were most optimal as being the most impactful, desirable and viable. In total it showed that five of the fifteen ideas on the previous slide. It also showed that few ideas were only desirable and lots of the ideas were impactful. This shows that the 'definition' section of the exploration and ideation was effective.

## PROS AND CONS



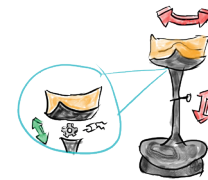
### Laptop Heat Extraction

- + Cost Effective
- + Potential for system
- May not produce much energy
- + Low Power
- Effort from consumer
- + Laptops common
- + Huge source of energy waste
- Requires usage in stand



### Piezoelectric Headphones

- + Popular accessory
- + Two generation sources
- Will add bulk and therefore weight
- + Unique generator
- Expensive
- + Opportunity for product line
- + Opportunity for acoustic design
- May affect performance



### Wobble Seating

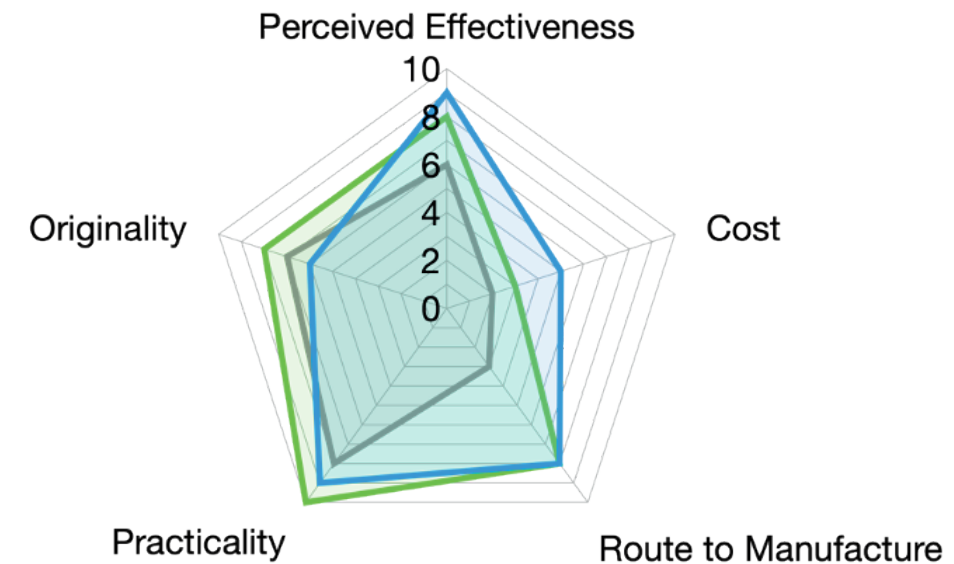
- + Modern
- + Broad in scope
- May not produce much energy
- + Trend
- Could be uncomfortable for some
- + Keeps you fit
- + Opportunity to explore mechanisms
- Expensive
- Specialised Usage

## RADAR GRAPH

■ Laptop Heat Extraction

■ Wobble Seating

■ Piezoelectric Headphones



A radar graph is a quick way to evaluate the ideas in five discrete areas. It does not answer every question but clearly shows that all the ideas are practical for the user and original. However the headphones stand out as being a costly investment and having a more difficult route to manufacture due to them utilising technology that would need more research and development.



# DEVELOPMENT OF 3 IDEAS

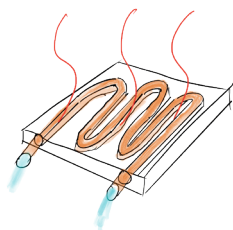
Three ideas to take forward toward prototyping



## 1 Laptop Heat Extraction

This concept is around the extraction of heat from laptops.

This task could be a traditional laptop stand as pictured above or integrate onto the laptop itself. The mechanism of heat extraction will also need to be investigated. The model above uses heat pipes with water to transfer the energy.

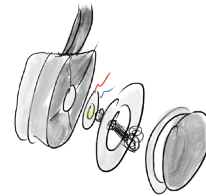


The plate / mechanism that holds the device will need a coil designed to absorb the heat energy from the laptop using water. An alternative may be direct Peltier plates that come into direct contact with the laptop.

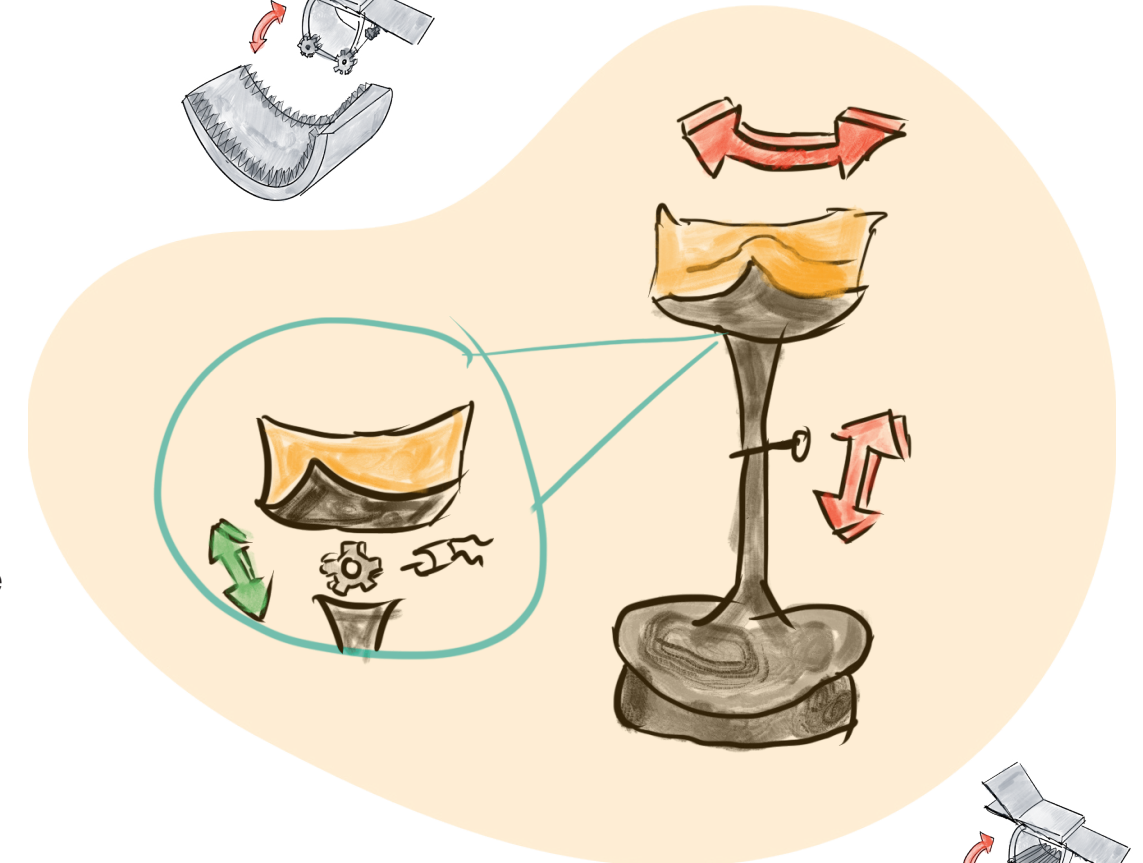
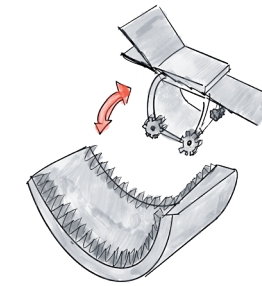
## 2 Piezoelectric Headphones

This concept is around the extraction of sound energy from either the user's voice or their music.

Piezoelectric crystals are used to generate electricity from the vibration forming the sound.



How I integrate the piezoelectric generator into the headphone will need to be considered in addition to the physical design to keep the product lightweight.



## 3 Wobble Seating Modelled in prototyping

This concept is around the trend of active workout in the home office. The seat is slightly unstable meaning the user has to periodically adjust causing movement.

The energy from this movement is then converted into electricity to power a heating device. An alternative may be to produce energy via mechanical means. The design of the seat will need to be considered so the product is comfortable in use but still causes the user to move..



During the Lo-Fi prototyping, investigation of the mechanism that allows the seat to move and generate electricity will be required. 10

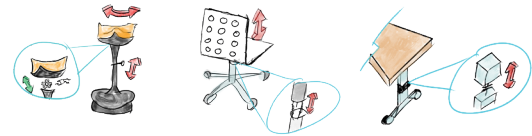


# LO-FI PROTOTYPING

## Modelling components of the concepts

The cardboard models below answer questions around the mechanisms that could be used for some of the concepts. To help animate the ideas on the page, I have used a frame ghosting technique.

## WOBBLE SEATING MECHANISMS



HMW

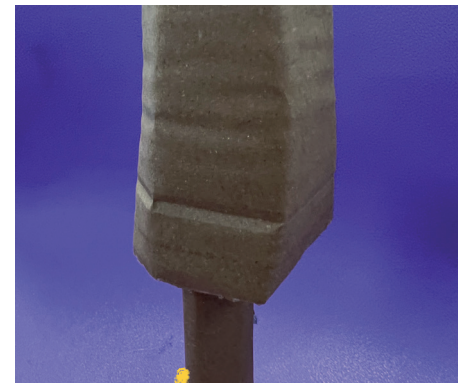
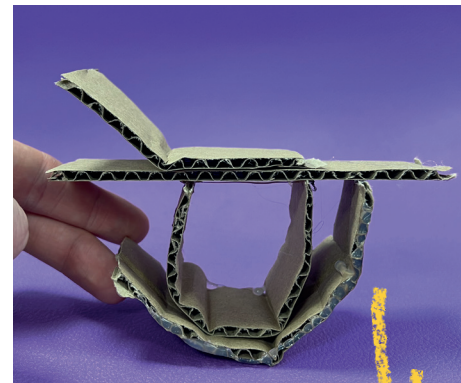
How might we allow the seat to move in use to generate electricity?

1 Rack and pinion

2 Compressive

3 Rotary

4 Compressive Slide



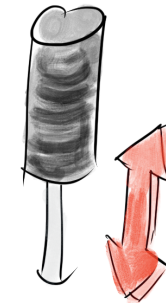
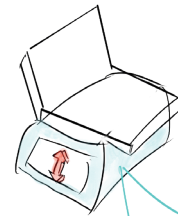
The four lo-fi prototypes pictured above depict the mechanisms that could potentially be used for allowing a wobble seat to move and generate electricity.

These specific ideas use compressive and rotary forces to generate electricity that can then be converted to thermal energy.



This rack and pinion could be utilised within the sketch pictured above showing how the seat mounts to the stand. The gear could be connected to a dynamo.

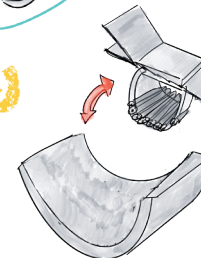
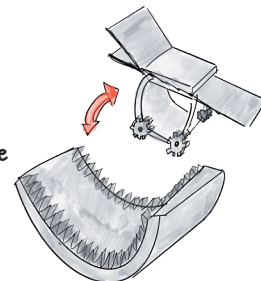
Piezoelectric material within flexible polymer allowing the chair to generate energy as it is compressed.



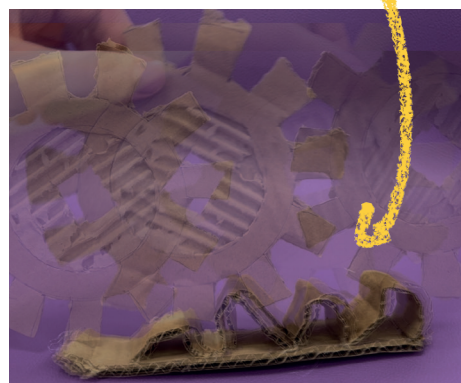
Rack could be curved to fit curvature of the seat rather than this linear example.



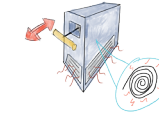
In order to achieve sliding mechanism animated below. Could utilise rack and pinion pictured to left or conveyor style wheels pictured to right.



This is the standard mechanism found on most office chairs. We could again use a piezoelectric plate or another mechanical mechanism to generate electricity from the compressive force of the user sitting in the chair.



# ELASTIC GENERATION

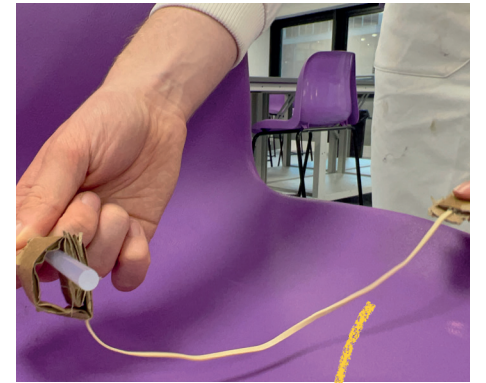
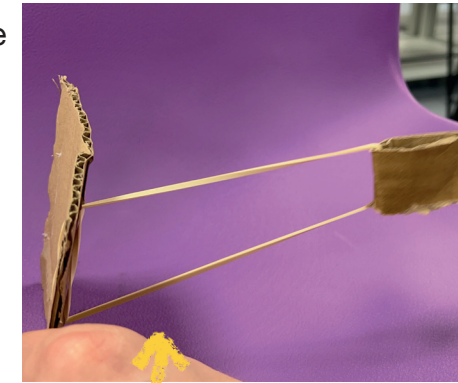


HMW

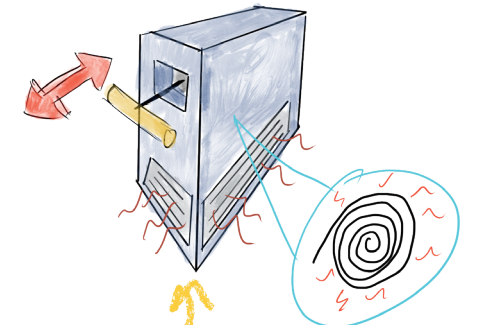
How might we incorporate elastic elements into our design to capture energy?

1 Straight Elastic Tension

2 Compact Coiled Tension

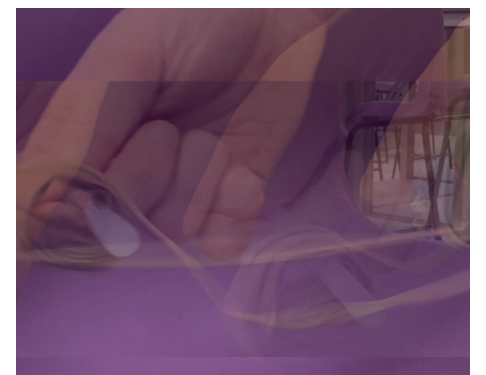
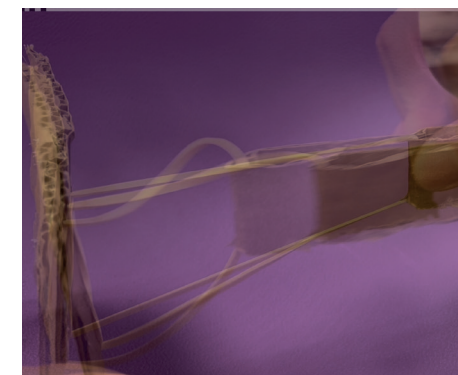


An elastic model could allow for the wobble seat to operate differently in that a user has to actively cause the seat to become dislodged for the seat to generate electricity before returning to the original position via elastic tension.



During testing I could see there was wearing both on the band and on the material supporting it. I would need to make sure to consider the lifespan of the elastic element in my design.

This model was designed to show how the under desk pull heater reel might operate. The band would need to be flexible to allow the user to pull at an angle. It would also need to have resistance in order to allow it to generate the sufficient electricity by requiring the user to put in enough force. The model shows how the band would wrap around the wheel which would be on an axle on the inside of the heater.





# SUPPLEMENTARY PAGES

Introduction to Design Engineering - Part A





# INDESIGN DEVELOPMENT

Learning journey creating a project page design

## TYPE

### Helvetica Neue

is the font used within my portfolio. I have used Helvetica Neue in many projects both web based and print beforehand and always felt it has conveyed information in a clear and simplistic manner fit for any print medium.

Below you can find the different text styles used within the document.

## TOP HEADER

Tag line

## Impactful

## SUBTITLE LG

Annotation

Body

Subtitle 1 (any colour)

Subtitle 2 (any colour)

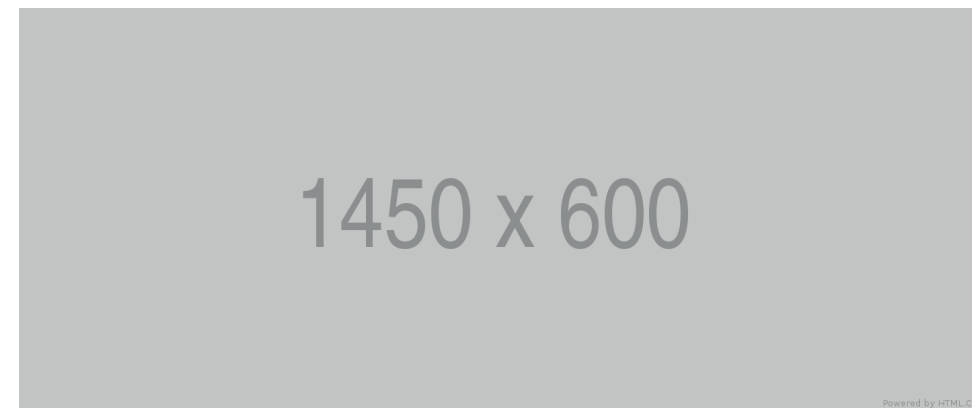
Less  
is  
more.

After watching the example marked coursework project, I realised how important it is to convey information in a concise manner.

For the project the copy I write should try to cover the points required in as concise and effective way as possible.

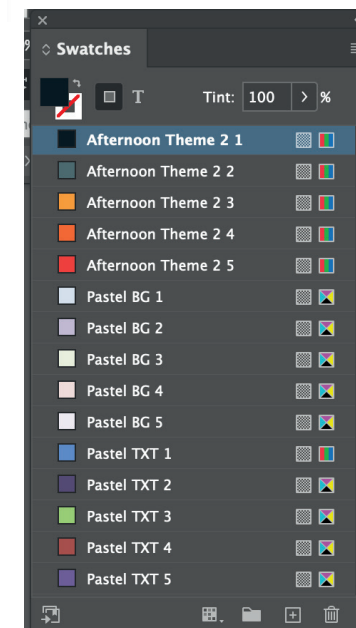
## IDEAS

Contrasting duo tone titles with an upper-case main headline title drawing reader attention inspired by my personal portfolio site.



Images should span column(s) width where possible.

Colour swatches imported with naming scheme making it flexible to switch later on.



Rule of thirds column structure, with crossover for larger content.

Named footer with automatic page number on each page with Imperial vector Gray scale logo made in Illustrator.

## SUPPLEMENTARY COLOURS

For the colour palette the project will use 'Afternoon Theme 2' from Adobe's Colour 2021 colour library.

Adobe Colour 2021

Afternoon Theme 2



Freddie Nicholson

Pastel



## STRUCTURE

Example Information Box

These boxes are for main content when it does not seem appropriate to write directly onto the document.

An example would be an important note about how a design might work.

Generic box for multimedia content

This box is for any kind of content such as images, annotations for diagrams, important notes etc.

Generic box for multimedia content

Flat edge boxes are used instead of a rounded design for page elements to create a crisp look and feel for my project.



# ADDITIONAL EXPLORATION

Looking further into the brief

## PASSIVE HEATING

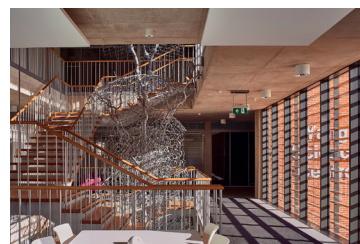
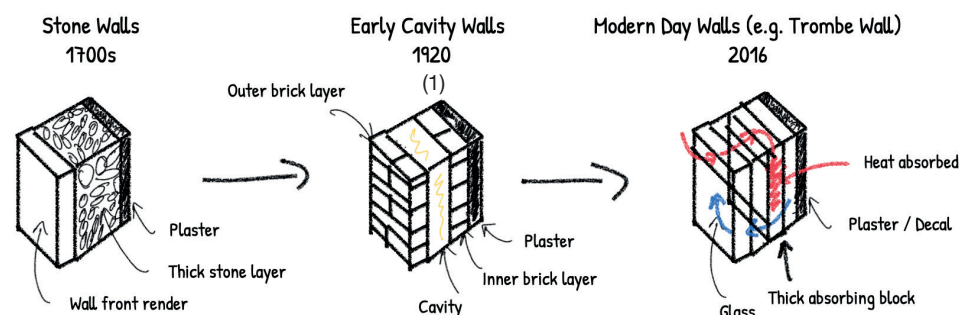
The idea behind passive heating is the use of natural elements (the sun) to help maintain a living temperature within a building.

They are being used in modern day architecture as they do not require substantial kinetic or electrical energy making them more sustainable than alternative active heating solutions such as radiators, heaters and air conditioning.

Light is transferred once it hits the

building in the form of solar radiation. The system consists of the element shown in the picture above. From the aperture (large glass panel) through the absorber that is often dark to absorb the sun's energy to the thermal mass below that retains this heat through distribution that could take many different forms. There is also a control that could consist of simply a slanted roof as shown above or more complex electrical systems that help regulate the temperature to room temperature.

## BRITISH HOMES



1. <https://sustainability.williams.edu/green-building-basics/passive-solar-design/>  
2. <https://www.abingdon.org.uk/academic/subjects/>

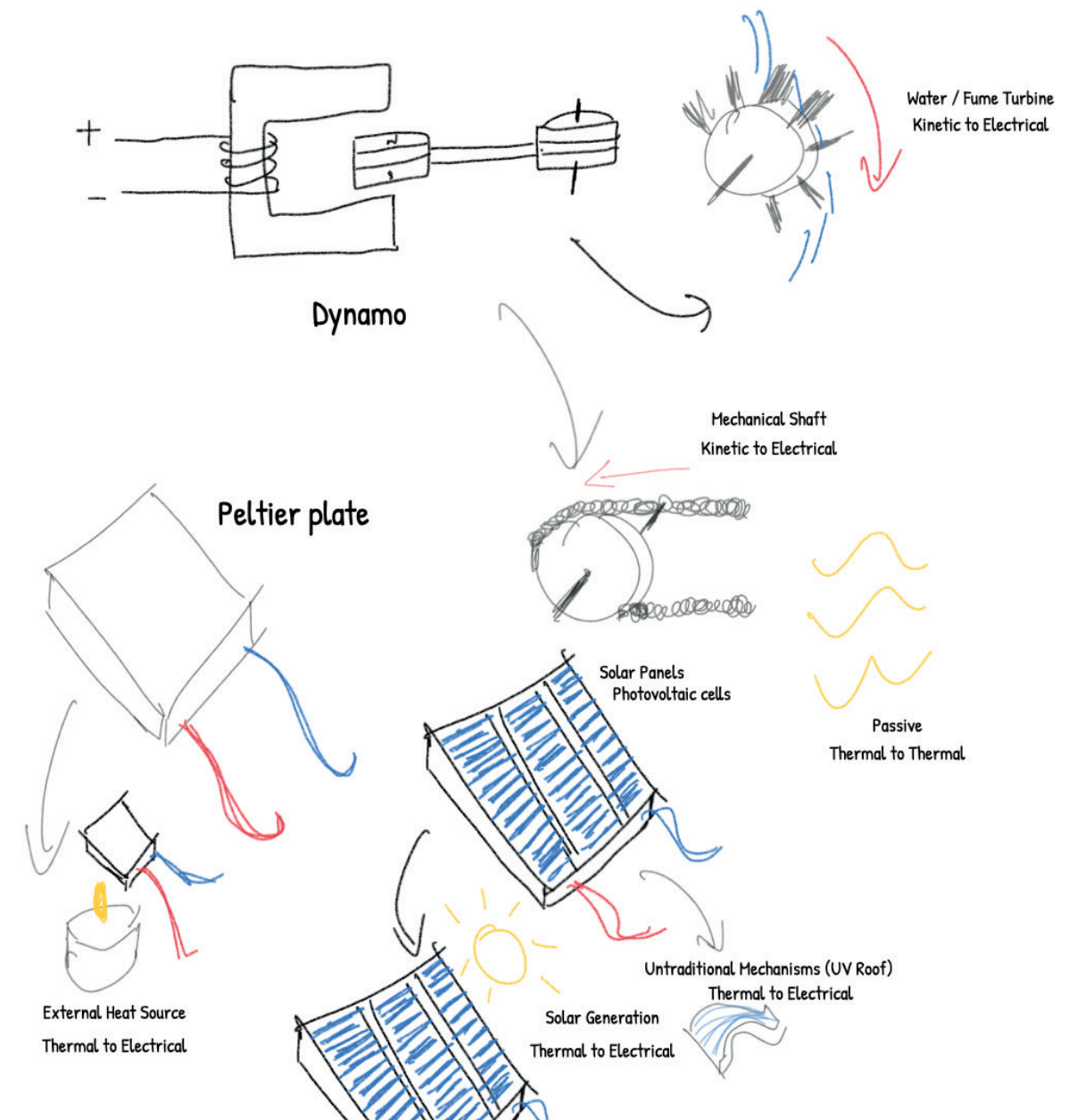
(2)

The info graphic to the left shows different types of walls over the years that may be seen within British Homes.

Earlier walls were much simpler than they were today due to lack of machinery that is now available.

Most homes in England now have a cavity to help thermal insulation. There are also even more advanced "Trombe" walls that follow similar ideology to passive solar design shown above.

## CONVERTING ENERGY



Some examples of generators are shown above. Dynamo generators are the immediate type of conversion that came to mind when I considered the brief. They are a simple yet flexible solution to converting energy with several uses in modern day power generation from nuclear to water powered dams.

I also considered more novel approaches such as Peltier plates. However I am initially concerned about the practicality of using them in terms of efficiency. Another example is photovoltaic cells and using them in non traditional ways such as UV Roofs.

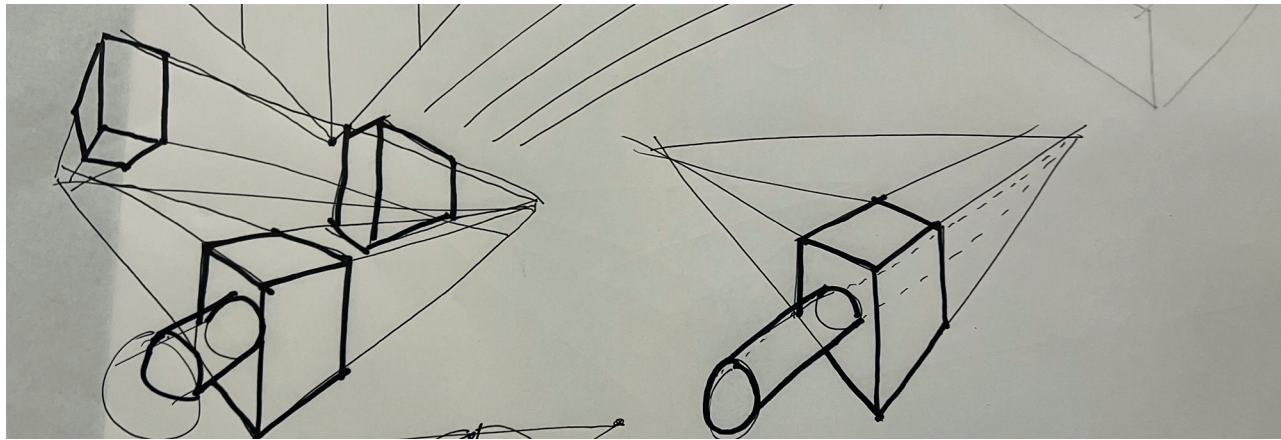


# DRAWING PRACTICE

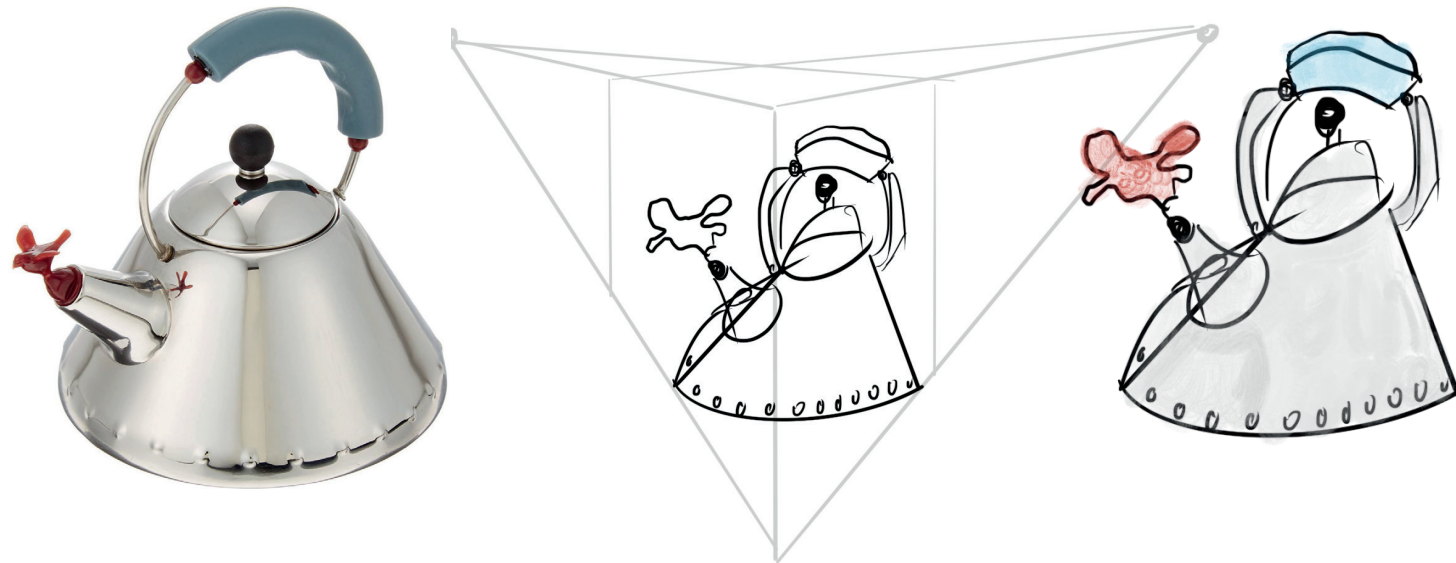
Using resources provided to practice sketching

## 2-POINT PERSPECTIVE

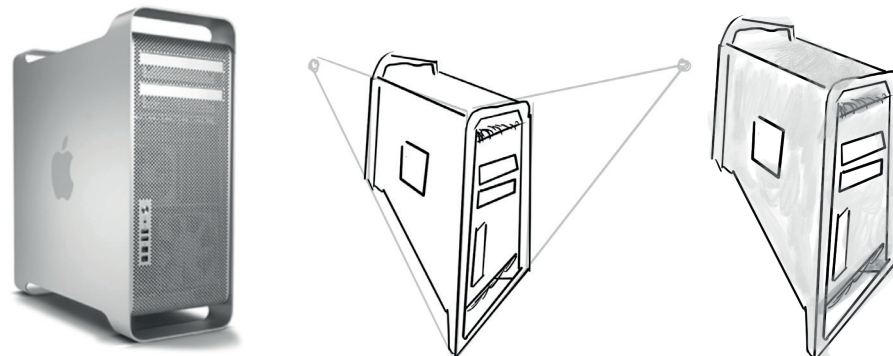
This page goes over the Week 3 tutorial work covering sketching techniques such as 2-Point perspective. Pictured below is the initial technique template for 2-Point perspective drawn by hand in the tutorial. This was then used throughout the project to produce sketches as a low opacity layer in Procreate.



1 Kettle



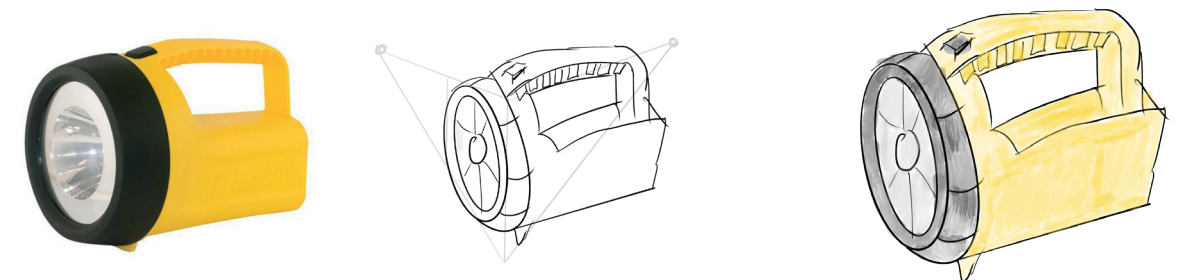
2 Desktop Computer



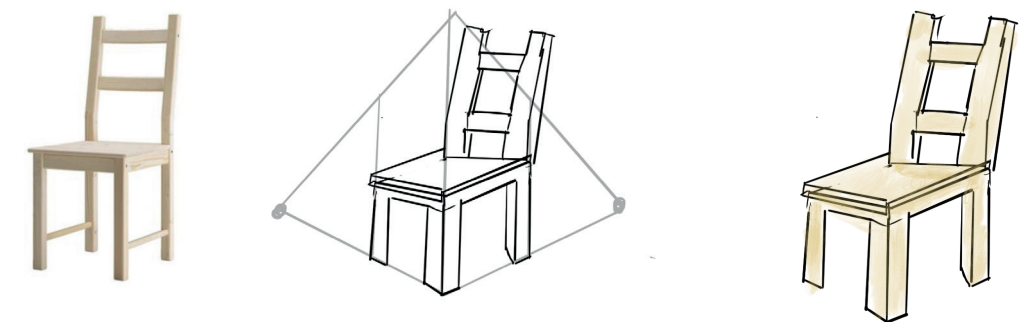
3 Hair Dryer



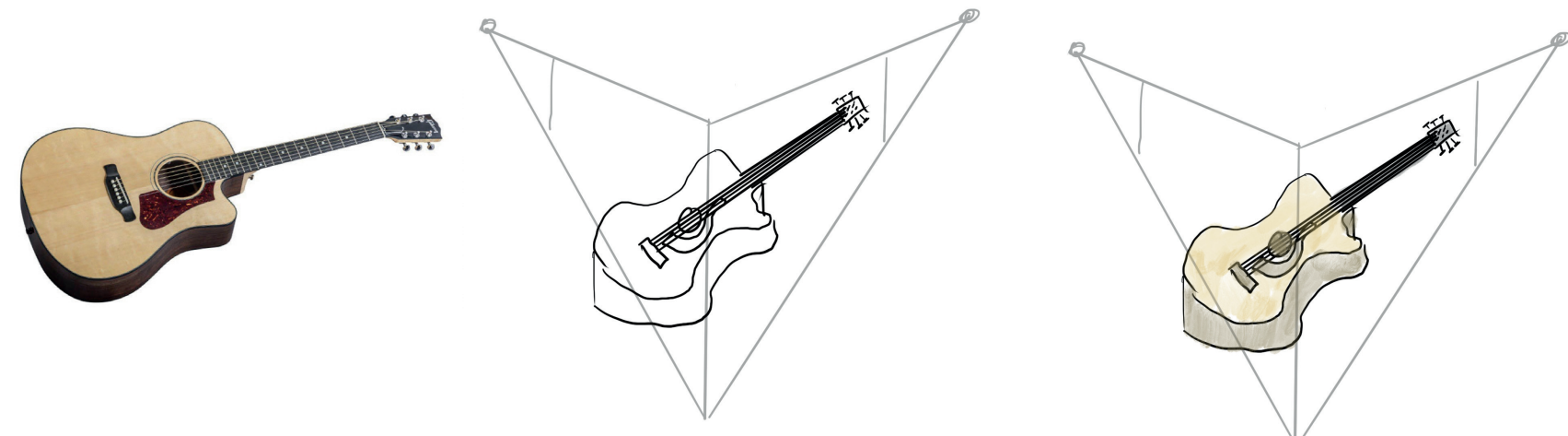
4 Flashlight



5 Chair



6 Guitar



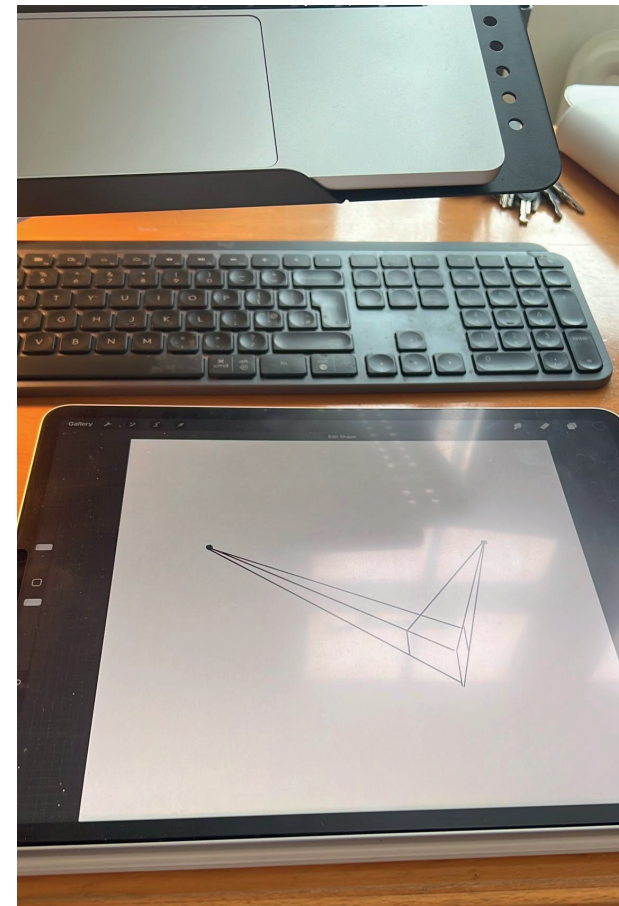


# DRAWING EXPERIMENTATION

Taking my drawings further

## PROCREATE

Procreate is an application for iOS allowing you to have incredibly powerful digital art tools on a standard iPad with Apple Pencil. It comes with a wide range of brushes, features and a wide colour palette.



### Brushes

The Inking Technical Pen was used for outlines within these slides.

#### Technical Pen



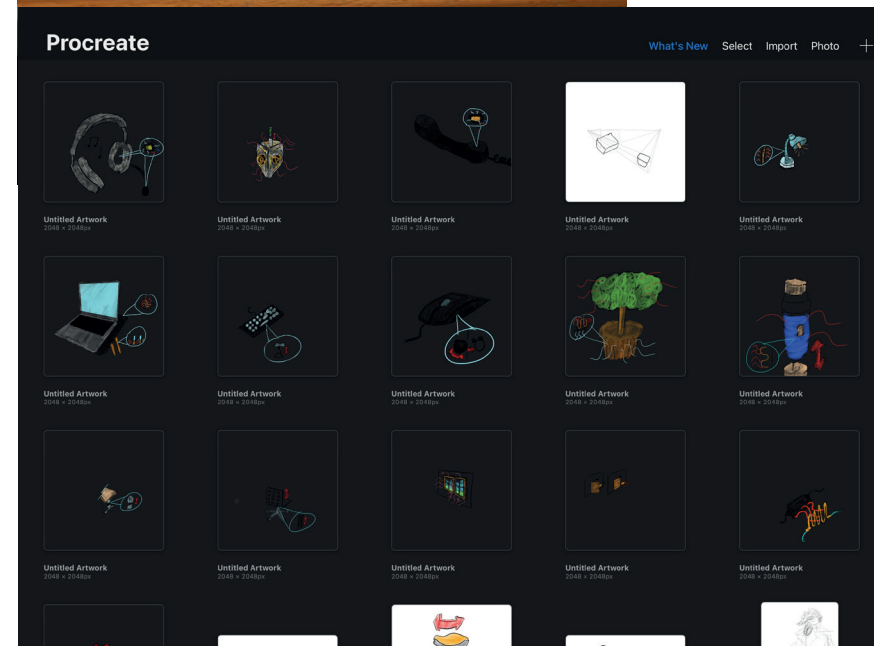
Wet Acrylic was the preferred fill brush, often used in combination with Procreate's automatic selection tool to ensure the fill did not overlap with the outline.

#### Wet Acrylic



### 2-Point Perspective

A template was used similar to what appears on the left. These were based on what was taught in the tutorial session. I turned down the opacity and had it as a background layer that I could toggle on and off giving me much more power than if I was to sketch by hand. If a mistake was made, you simply tap two fingers to undo. You can create a perfectly straight line very easily with smart shapes.



### In Practice

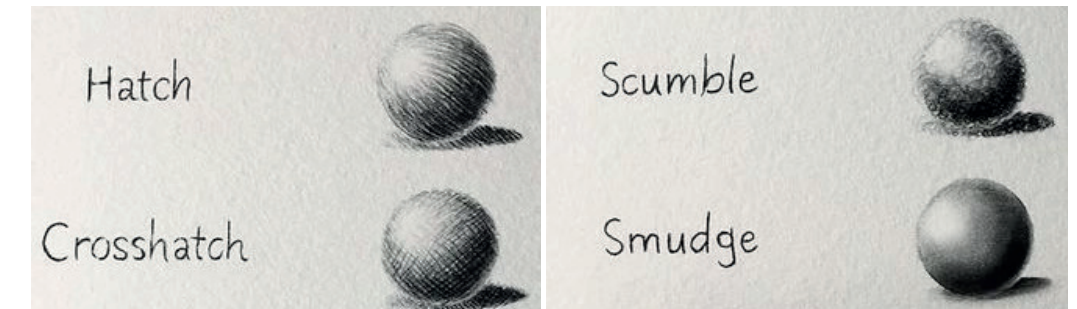
This was my first time using Procreate for a project. It proved very useful with features such as quick and easy exporting to transparent PNGs that could be placed directly in InDesign.

It also allows you to add much more colour detail than if you were to draw by hand. There are also features that just aren't possible on paper such as copy and paste and selection boxes.

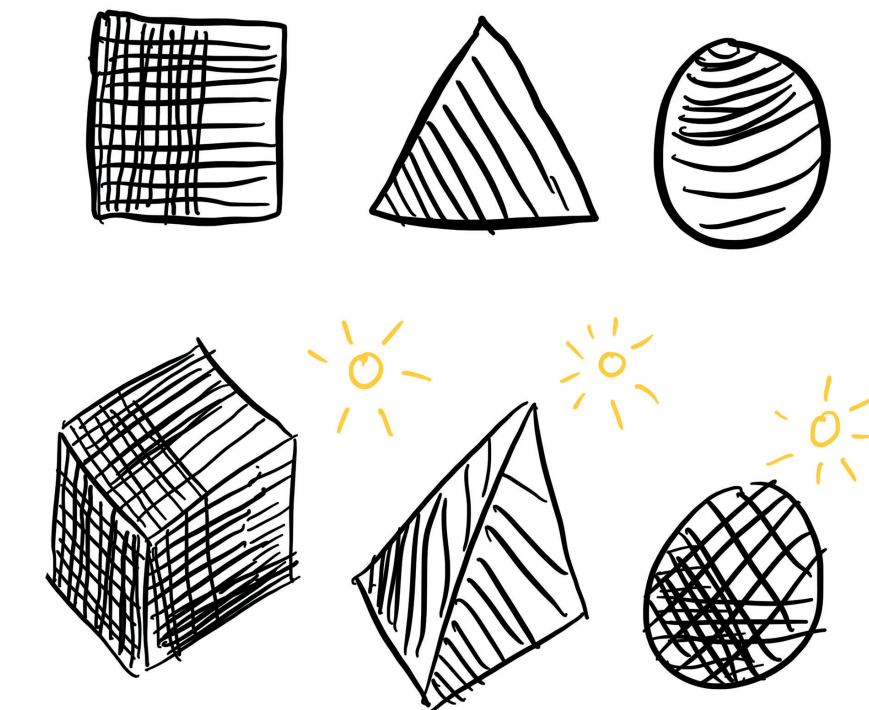
I will definitely be using Procreate in my next project for sketching as it is a definite improvement in efficiency for producing design drawings.

1. <https://mymodernmet.com/taji-joseph-drawing-tutorials/>

## TECHNIQUES



Above are some professional pencil sketching techniques used by artists. The appearance of denser lines creates a darker pattern indicating a shadow from the light source.



Feathering and cross hatching can be used to give a 3D appearance. Above are some 2D and 3D examples with the 3D examples having the point of light marked.



The Smudge tool in Procreate can be used to help create a softer gradient. This is useful for shading and making darker spots / shading subtle without needing to change brush.



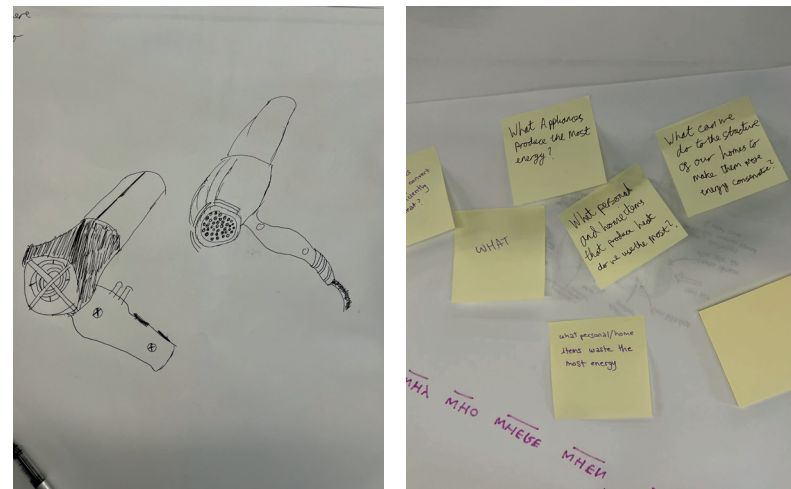
# IDEATION SKETCHES

## Iterative Design Methods

This page shows some of the different sketching ideation methods used as a group within the tutorial sessions to generate some of the ideas shown within the project.

The sketches shown within this page are brainstorming 'conversation' sketches which were then refined using Procreate, InDesign and Keynote.

## GROUP TEAR DOWN



Our group took apart an appliance of our choosing. As our domain was 'Home and Personal Items' we felt a hair dryer suited this description well.

We first started sketching the object to practice the skills we had learnt with 2 point perspective and some group members also drew annotations around a torn apart model to help us gain insights with our engineering modelling.

We found the hair dryer had a high power coil at its centre which then had air propelled from the back breathing plate producing hot air to dry the hair.

We also considered the How Might We questions related to our domain based on this and what could be potential options.

## GROUP C-SKETCHING

The group also completed the C-Sketching and each member contributed to each others ideas. Another group then reviewed our ideas. The 4 top ideas were:

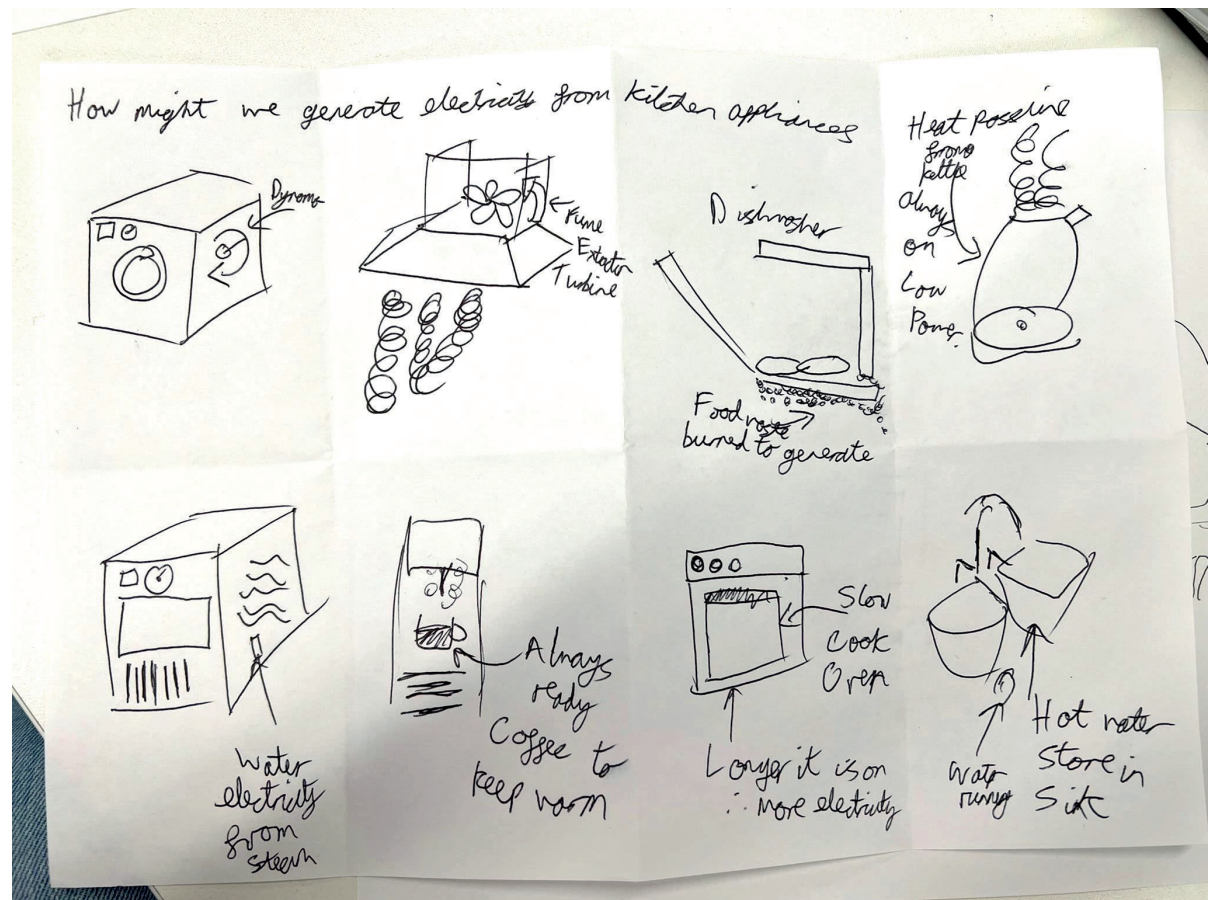
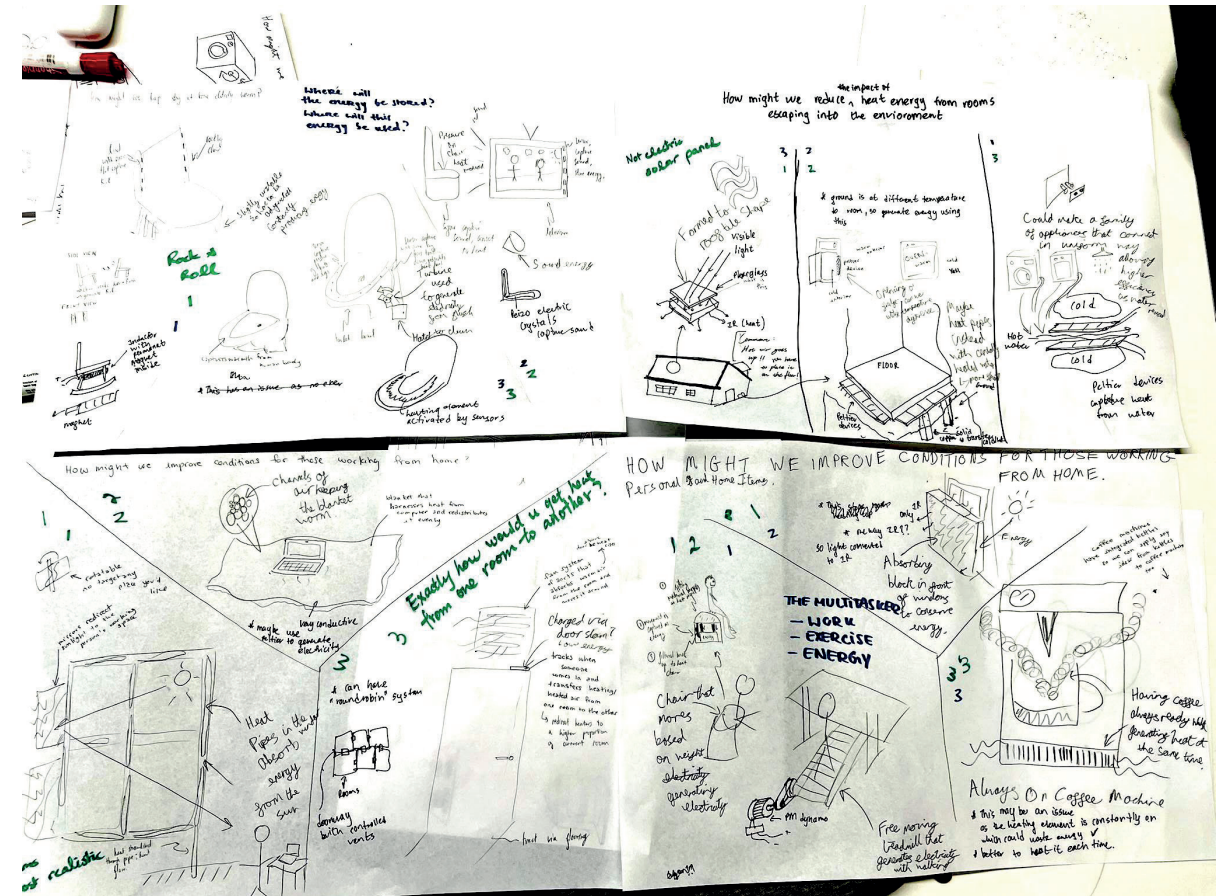
- 1 Standing / Wobble Seating Desk Setup
- 2 Heat Pipe Windows
- 3 Rocking Chair Generator
- 4 UV Roof Panel Generators

The unpopular ideas were always on coffee machine (too much energy), smart heating control, energy generating toilet and connected kitchen appliances.

## GROUP CRAZY-8'S

We completed a Crazy-8 Activity where we completed a new idea every minute based around the brief 'How might we generate electricity from kitchen appliances?'

- 1 Dynamo Washing Machine
- 2 Turbine Fume Extractor
- 3 Dishwasher Kinetic Generator
- 4 Always-On Kettle
- 5 Microwave Steam Extraction
- 6 Always-On Coffee Machine
- 7 Slow Cook Oven
- 8 Constant Run Kitchen Sink



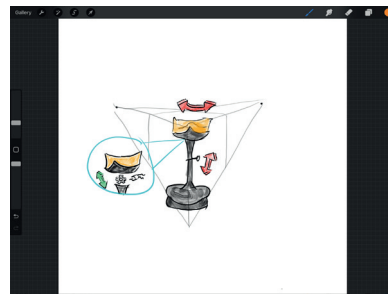


# IDEATION SKETCHES

## Conversation to Presentation

Before compiling the 15 selected concepts page in InDesign, a page of 15 'conversation' sketches was made to clarify the ideas in my head before drawing them in more detail.

Procreate was used with a 2 point perspective template that was another layer with low opacity.



Keynote was used extensively behind the scenes of these slides to create illustrations and graphics. For example, the bubbles around the sketches were made using the pen tool with smooth points.

