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PRIVATE AND PERSONAL WORKSPACE

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PDE MEng 20/21

Final Year Project
10-Page Summary

pde THE GLASGOW SCHOOL of ART University of Glasgow

Project Overview

Problems & Opportunities

Working from Home 2021

It goes without saying that the COVID-19 pandemic has affected the world in a huge variety of ways. The way we have lived in the past year has been drastically different for almost every person. One aspect of life that has perhaps been altered most is work. Almost overnight, people found themselves office-less, forced to adapt their home environments into makeshift places of work. Companies had to make tough decisions that would keep them afloat through this uncharted territory. And of course, sadly, many were left jobless.

The world has given mixed reviews of the current situation, some loving the extra freedom and lack of commute, while others feel caged, cut-off and unhappy with their working environment. Reports of prolonged work days, burnout, post-work stress and the struggle of sharing work space with cohabitants have tainted the appeal of the work-from-home revolution. It has become clear that the situation is not as democratic as you might think. Individuals who have dedicated office rooms in their domestic environment have the privilege of being able leave that space and physically shut the door on their workday. Individuals who must work in their bedrooms, living rooms or kitchens do not have this luxury - which can make it very difficult to disconnect from work when trying to relax.

The Market

The home office furniture market is expected to grow considerably in the coming years. With design studios such as Layer and Vitra jumping at the opportunity to apply their craft to this problem, it is clear that there has never been a better time to rethink and develop products for the work-from-home environment that the future holds.

The Opportunity

At the same time, this unexpected situation has given businesses across the world a chance to conduct a unique experiment, an experiment that's results could potentially change the face of work, and of commercial real estate as we know it. Working from home, when it works, can be great for the environment, a godsend for employees and a gold-mine for businesses. The reduced numbers of commuters cuts down CO_2 emissions and reduces wear on roads and pressure on public transport. Employees can better structure their days without the stressful and time-consuming commute, and enjoy increased personal space and the comfort of their own home. And if enough employees take up the habit of working from home, businesses can reduce the amount of commercial space they rent, slashing overheads.

These positives have become so apparent, that many predict the future of work to be 'hybrid', with more focus on the splitting of time between the office and the home. A survey conducted by the Chartered Institute of Personnel and Development has shown that employers expect that the proportion of employees that regularly work from home in the UK will jump from 18% pre-pandemic, to 37% post-pandemic. Alicia Tung, employment specialist and Chief Operating Officer at Great Place to Work Institute, based in China, expects to see a trend of a 60/40 home-office split in Asia-Pacific becoming commonplace in the coming years.

If everyone is to reap the benefits of this hybrid future, then everyone must be supported in doing so. My project centres around this - the support of those who find and have found working from home difficult in the past year, and improve the experience further for everyone else.

My product aims to help users who are working in communal home areas create an effective, organised, private and personal workspace, that will disappear post-work, helping to re-establish these valuable feelings of psychological detachment, and in doing so minimise post-work stress.

Projected 105% increase in UK regular home-workers

Experts expecting trend of 60/40 office/ home split to appear

55% of Americans want hybrid work model going forward

Everyone should be able to enjoy the benefits of this WFH 'revolution'

The Brief

Design a product to improve the work-from-home experience for people who do not have dedicated office spaces, and therefore work in communal home areas.

Research

Key Insights

Connection with Stakeholders/Experts

Continually throughout the project, potential users, reluctant home-workers and a variety of experts have been kept in close communication. While I made use of extensive desk-research, surveys and forums, **I found person-to-person interaction often reaped the most interesting and insightful points of research.**

It was important when talking to potential users, to cast a wide net in terms of age, occupation and work-from-home situation.

Psychological Detachment

I read a number of research papers that highlighted the importance of psychological detachment from work. A leading cause of burnout and impaired well-being is the onset and poor management of self control demands (SCDs). Working from home generally introduces more SCDs into the psyche as we tend to associate our home with relaxation, and not our occupations. Our offices are primarily set up as places of work, our homes, not so much. Managing SCDs is essential for mental health and well-being in general, and research has shown that those who experience significant psychological detachment from work are better equipped to deal with these stressors.

Original Articles

Psychological detachment: A moderator in the relationship of self-control demands and job strain

Wladislaw Rivkin, Stefan Diestel & Klaus-Helmut Schmidt

Pages 376-388 | Received 18 Feb 2013, Accepted 13 May 2014, Published online: 06 Jun 2014

Download citation https://doi.org/10.1080/1359432X.2014.924926 Check for updates

Review Article

Self-Control Demands

From Basic Research to Job-Related Applications

Klaus-Helmut Schmidt and Stefan Diestel

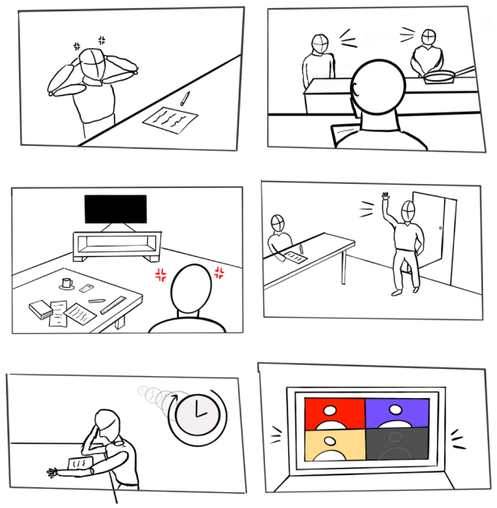
Leibniz Research Centre for Working Environment and Human Factors, Technical University of Dortmund, Germany

“Consequently, detachment implies that short-term mental absence from work (e.g. in leisure time) may have beneficial effects on strain. Similarly, Sonnentag and Bayer (2005) found that employees who experienced higher levels of detachment from work during leisure time reported an increased positive mood and decreased feelings of fatigue at bedtime.”

“Sonnentag and Fritz (2007) argue that during periods of psychological detachment, employees experience a reduction of job demands and a break from work-related stressors. Thereby, detachment facilitates recovery processes, which enhance psychological well-being (Meijman & Mulder, 1998). In contrast, individuals who are unable to detach from work in leisure time return to work in a less recovered state. In such a state, handling stressors becomes even more effortful and thus results in increased strain (Binnewies, Sonnentag, & Mojza, 2009).”

I decided at this point that facilitating/improving psychological detachment from work was going to be the central feature/theme of my product.

Problem Identification



Survey results, interviews and observational analysis helped me identify the **most common and detrimental problems** that the communal-room-working employee experiences on a day-to-day basis. The problems that kept cropping up were as follows:

• Lack of concentration/work-stress • **Distracted by noise and activity in work area** • Physical reminders of work when trying to relax • **Distracted by impromptu conversations with cohabitants** • Static position for long hours • **Inadequate audio quality and lighting when video calling.**

These problems and their consequences were analysed, and potential solutions to them postulated. These solutions, among other things, were captured as the key user requirements, which would go on to drive concept development.

Key User Requirements

- A healthy and effective workspace.
- Psychological detachment from work at the end of the day.
- Separation from the rest of the home/room when working.
- A system that prevents overwork and detriment to the body.
- A compact solution that can be stored easily.
- Improvement to video-conferencing output.

Existing Products

Analysing the strengths, shortcomings and aesthetic qualities of existing products on the market helped to inspire me during the design process. It also ensured that the designed product would bring something new to the table, building on the successes of other products. I was especially inspired by room-manipulating products (see the fold-out wall, bottom right). I wanted to utilise this concept: the changing of the surroundings to help facilitate a sense of detachment. I have always been intrigued by the change in feeling of a room after furniture has been moved to a different configuration.

Concept Ideation

Forming Initial Ideas and Development

2D-Ideation

Hand and tablet sketching was always the first port of call for ideation of initial ideas and feature development. Sketches were often presented to potential users for feedback - which generally helped shape the aesthetics and function of the final product. In preparation for the interim presentation, evaluation of 4 key concepts using the project proposal criteria took place. This led to the **decision to take forward the temporary workstation/ study booth idea**. As well as being the concept that ranked the highest in the evaluation, it was also the "gut-feeling' concept that i was most interested in pursuing.

Key Progress by Interim

At the interim presentation I presented a rudimentary CAD model that highlighted the main features of the workspace and showed it in context.

I also presented the early user testing I had conducted: the production of a simple cork board **"visual separation booth"**. This was tested on two individuals, to measure the effect of privacy and visual separation in communal work spaces on focus and productivity. While simple, this task was a pivotal point in the project as the feedback in both cases was far more positive than I (and I believe, the users) had anticipated. **Both users reported that the feeling of a personal space, separated from the rest of the room had a positive effect on their productivity and general feeling towards work.**

Users were encouraged to place only essential tools inside the booth when working (i.e. mobile phone, water bottle etc. kept outside, only for use when required). This was also reported on as being beneficial, **minimising distractions and time spent procrastinating**. Difficulties with the prototype and opportunities for improvement were also noted, allowing me to improve the design based on user insight, rather than intuition.

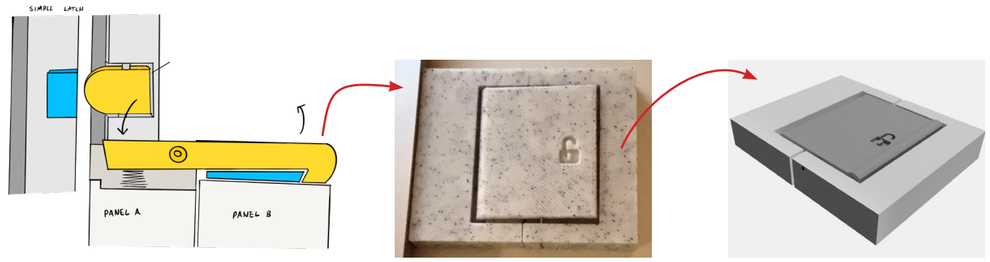
Interim Concept

1:1 Scale Testing of 'Visual Separation Booth'

Development Process

From ideas to refined features

Generally, the development of every feature would begin as a brainstorming page of 2D ideation. 2D ideas would be evaluated and the chosen design would be taken into CAD for preliminary modelling, or physically prototyped. Evaluation of preliminary designs by myself or test users would then produce a set of refinements to complete in CAD (or to make to Arduino code in the case of the electronics). I found it beneficial to deploy and stick to a rigid development process like this - to ensure that flaws or problems were caught and fixed.



For example: Development of locking mechanism - ideation, prototyping, evaluation, refinement

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PRIVATE AND PERSONAL WORKSPACE

Alkov is a temporary workspace designed for those who are working from home without access to dedicated office spaces. During office hours it provides the user with a private and personal place to work, partially separated from the rest of the communal area they are working in. At the end of the day, the product and work tools are packed away and wall-mounted, becoming a pin board and acoustic panel for the home. This helps to facilitate a level of psychological detachment between user's work life and home life. A number of features have been developed in the product to aid the work-from-home experience in a variety of ways:

Privacy

When the workstation is set up a **wide angle of visual privacy is achieved**. User prototype testing returned the insight that users valued the visual barrier, not just for privacy, but also for the minimisation of distractions.

The product's height was made high enough to ensure even taller individuals would enjoy the reduction in visual distraction from their surroundings.

Health

The integrated light bar not only illuminates the workspace, but includes **break timer functionality**, alerting the user when it's time for them to take a break from their static position. This notification takes the form of a pleasing but clearly visible light animation.

The structured breaking practice has been developed to fight the onset of musculoskeletal issues due to sedentary behaviour, minimise eye strain and aid productivity.

Organisation

The booth walls are inlayed on both sides with **recycled polyester felt panelling**, which users can pin paper work materials onto using flat-headed push pins. These can be left up when the booth is folded down - ready for the next day. The left panel features a removable whiteboard, helping users direct their workflow.

The **pegboard panel** allows the user to curate their own storage setup via modular attachments, holding essential tools to hand.

Video-conference

The RPET felt panelling has excellent **sound absorbing qualities**. This means that reverberation in the user's voice picked up by their laptop microphone when video-conferencing is significantly reduced - which **improves voice clarity** and can potentially improve attention span of listeners.

The booth light bar can be adjusted in both brightness and temperature, to ensure that the user's face is well-lit with a natural-looking hue.

Detachment

The set-up and tear-down procedures of the product act as a **physical stimulus for the start and end of the work day**, hopefully helping to walk the user in and out of their working mindsets. This works in a similar way to the currently-popular fake commute or the ancient art of the morning ritual.

Configuring the pegboard storage system is a simple and creative task to **help build momentum in the morning.**

User Journey

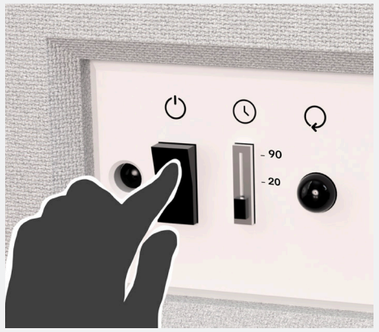
Set-up/Use/Pack-up

At the start of the day, work tools and modular attachments are removed from the storage compartment.

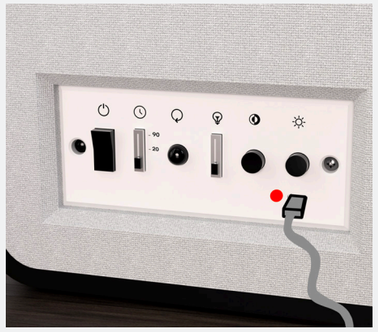
The user removes the product from the wall and places it on their work surface.

The user unfolds the panels, creating the workspace area.

The modular storage attachments are set-up in the user's chosen configuration, and the workspace is populated with work tools. The space is now ready for work.



The electronic system is turned on via the power switch (electronics user cycle on following page).



If the battery needs charged, the user simply connects their laptop to the booth via USB-C cable.

The whiteboard panel is connected to the main frame via magnets. The user can remove it to write on it, helping to direct their workflow.

At the end of the day, the modular attachments are detached from the pegboard panel. They fit together neatly to save space.

Work tools are removed from the workspace footprint, with smaller items (i.e. stationary, headphones and modular attachments) stowed in the basket.

The user folds-up the panels, giving physical stimulus to the psychological end of the work day. Pinned materials can remain up when the product is closed.

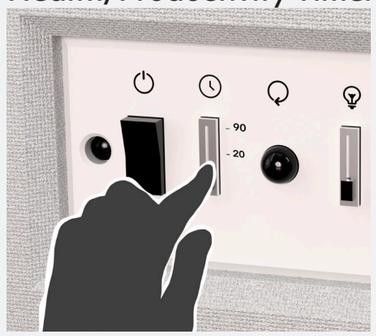
The product is then returned to wall, its central panel to act as a communal pin board, or stowed away out of sight. The work day has come to a close, and so has the workspace.

relax

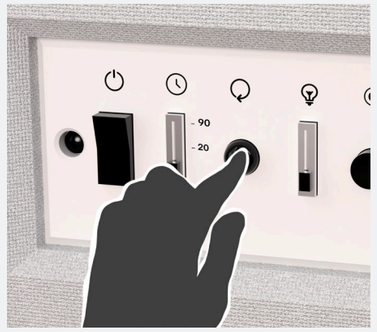
rest and recuperate from the day
recover from self control demands
disconnect fully from work if possible

User Journey

Health/Productivity Timer

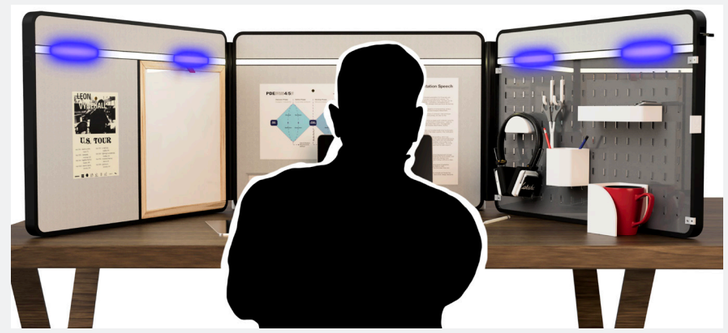


The timer function is turned on and set to either 20 minutes (normal) or 90 minutes (for a ‘deep work’ period).



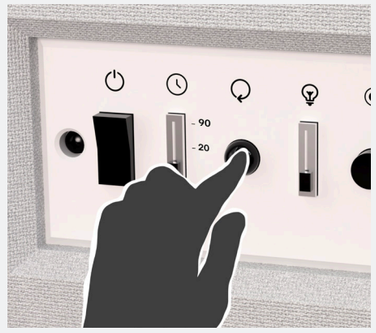
Turning on the timer function causes the notification to appear. The reset button is pressed to clear the notification and begin the timer.

The user plans what work they will do in the 20/90 min period and gets to work, concentrating on the task in hand.



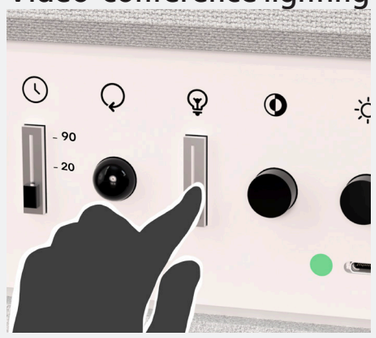
After the timer is up, a light animation plays across the bar, drawing the users attention and notifying them of the end of the work period. This rests on the ‘waiting’ animation - featuring blue beams bouncing back and forth across the bar.

The user stands up and takes a break from their static position, screen and work. This is a good time to stretch, refill water bottles or catch-up briefly with cohabitants. A 20 minute period should be followed with a 2-3 minute break; a 90 minute period should be followed with a 15 minute break.



The user returns to their desk, and presses the reset button to start the timer again.

Video-conference lighting



The video-conferencing/workspace lighting can be switched on using the lighting slide switch.

The light bar turns on, illuminating the workspace and the user’s face.

The user views their own image on the conferencing software and adjusts hue (warm/cool) and brightness until the a natural-looking, effective picture is achieved.

Hot desking

There is also an opportunity for Alkov in the burgeoning culture of hot desking. As the work from home revolution continues, it is likely we will see hot desking becoming more and more popular as businesses cut down on commercial property. Alkov could be stored at work in a locker, and then set up at the user’s hot desk for the day.

This could bring an element of personalisation to an otherwise impersonal desk space.

Prototyping & User Testing

Key Prototypes Timeline

Visual Separation Booth

In order to test two of the theories underpinning the concept - that increased privacy would aid focus, and that a temporary workspace would aid psychological detachment - a basic “visual separation booth” was constructed using cork boards and 3D-printed snap-fit feet. Two individuals were tested for two days, a day with a prescribed, U-shaped layout, and one with a layout of their choice.

Key findings (User testing):
Positive reinforcement of concept; dimensions should be scaled up for more comfort/privacy; footprint should be adaptable; a lighting circuit to illuminate work area would be of benefit.

Rapid Cardboard Prototypes

Rapid prototypes to test new dimensions in terms of study space provided and privacy/minimisation of visual distractions.

Key findings (Self testing):
Confirmation of approximate panel dimensions; test and subsequent dismissal of roof panel concept; manoeuvrability of planned dimensions verified.

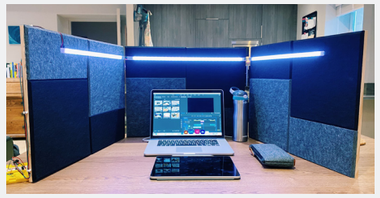
Study Booth Physical/Electronic Prototype

A functional prototype featuring the developed double-close hinge design - with hinges sourced from a local hardware shop. The refined electronics were integrated into the product in order to explore wiring design that would still allow hinge closure. The production of this prototype meant that after the lighting user experience was developed, code iterations could be deployed quickly and easily, allowing for rapid testing and evaluation. Interior of the prototype was clad with acoustic panelling, enabling me to conduct practical acoustic testing.

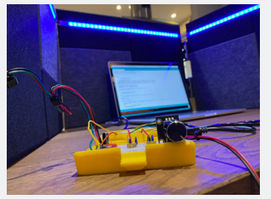
Key findings (Self Testing):
Identified the need for refinement of the electronic user cycle; verification of the need for a wall-hanging or other storage solution.

User Testing

Self Testing

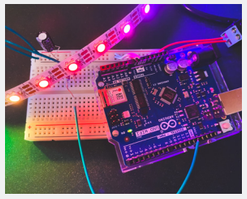


Self Testing



User Testing

on to iterative CAD refinement



User Testing

User Testing

Electronic Timer Prototype

A simple LED strip timer prototype, controlled by an Arduino Uno. The strip was mounted behind a desk, emitting a mood-light-like glow. This gave me the opportunity to familiarise myself with the programming and control of LED strips. The user would press a button to start the timer, the lights would fade and stay off for 20 minutes, at which point a calming and pleasant light animation would occur, alerting the user that it was time to stand up, move around and take a short break from their screen, static position and work.

Key findings (User testing):
Gained familiarity with basic programming for LED strips; learned that the calm notification was not abrupt enough to properly notify the user; users felt the benefit of using the timer and enjoyed the novelty; users reported that the splitting up of the day into 20 minute segments did indeed aid productivity and diminish procrastination.

Refined Electronic Timer Prototype

A refined version of the 1st iteration. I 3D-printed a hard case for the Arduino to aid portability and versatility when delivering to test users. I also purchased and cut to size an LED strip diffuser in order to create a “light bar” to soften the light and minimise any potential thermal issues that may occur with long white-light use. This was far more effective at notifying users than the soft glow of the previous prototype.

Key findings (User Testing):
Received similar positive response to the 1st iteration prototype; identified the desire to be able to change the brightness; a power-on light animation should be developed to provide a pleasant user experience.

Refined Physical/Electronic Prototype

Changes were made to the electronic hardware and software, in order to deploy the developed user experience into the prototype. Fully-functioning code was written (including the timer and lighting features) and a variety of switches and an encoder were added to test full functionality of the product at 1:1. The notification was also changed so that it did not rest on a solid colour but continued animating until the user reset it or switched it off - ensuring notifications were not missed.

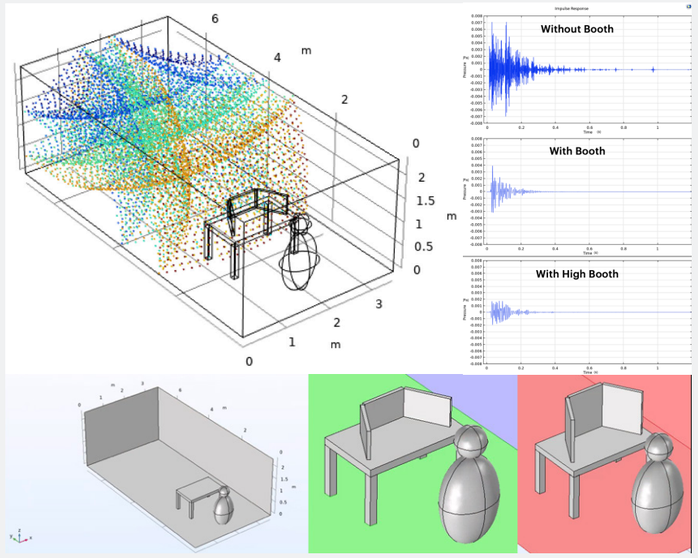
Key findings:
Users found that illuminating their faces while video-calling was effective, and were pleasantly surprised by the magnitude of the acoustic benefit; identified the need for cable-holes on both sides of the product; users also were excited by the prospect of modular storage solutions being added to one of the panels, and confirmed that this would be a helpful addition.

Technical Focus

In-Depth Acoustic Analysis

Acoustic Impulse Response Simulation

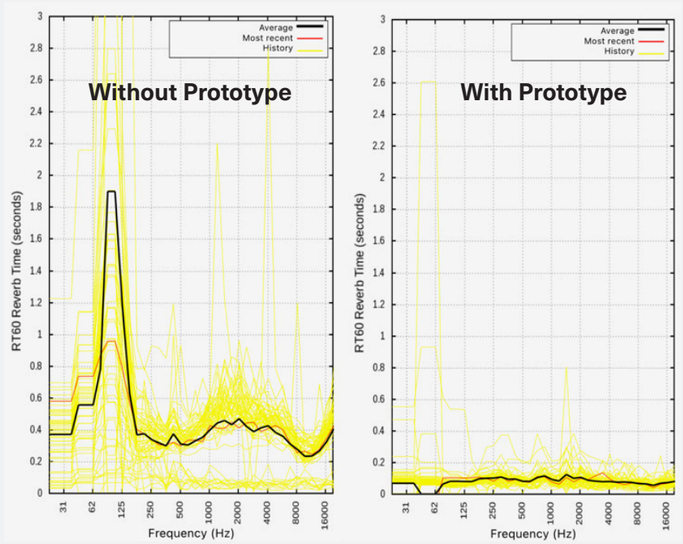
To investigate the potential acoustic benefits of the proposed concept, I explored the use of computational acoustic simulation. COMSOL Multiphysics was used to simulate a standard method of room acoustic testing: reverberation time measurement via impulse response. The methodology for this practice is laid out in **BS EN ISO 3382-2:2008.** This was done by simulating a typical 'living room', with a wooden desk and a representation of a person, set up with appropriate acoustic absorption coefficients. A simulated microphone was placed inside the workspace, near where the user's laptop microphone would sit in real life. Tests were completed with external and 'vocal' noise sources, and with two versions of product geometry.



It was found that the proposed concept **did have a beneficial acoustic effect on both external and internal sounds**. Reverberation time in the room was significantly reduced due to the absorption of sound reflections. This is the desired result as the sound pressure level from noise sources, the intelligibility of speech, and the perception of privacy in a room are strongly dependent on reverberation time. The reduction in sound pressure level from external sources would present as a reduction in background noise picked up by the user's laptop microphone.

Practical Prototype Testing

In order to verify the accuracy of the COMSOL simulation and further investigate acoustics, I wanted to conduct a rudimentary version of the standardised impulse response measurement. I came across an interesting paper: **'The Hand Clap as an Impulse Source for Measuring Room Acoustics'**, which proposes and verifies the suitability of using a simple system comprising only of a smartphone, to allow amateur acousticians and musicians to quickly and easily measure room acoustics. They developed a signal processing chain that could be implemented into a smartphone app, greatly increasing the accessibility of impulse response measurement to the general public. It was found through their verification that their methodology and implementation produced accurate results.



I made contact with one of the authors of the paper, Stephen P. Tarzia, for further guidance on using their methodology. I used their application to take impulse response measurements of my living room (a relatively reverberant space), with and without my refined physical prototype set up around the microphone. The experiment was repeated 50 times in each case to ensure accuracy. **The results corroborated with those of the simulation, showing a marked reduction in reverberation time across the frequency spectrum.** Especially interesting was the removal of a reverberation time relative maxima at around 125 Hz. This was a very positive finding as 125 Hz is the approximate fundamental frequency of the adult male voice.

Subjective Audio Testing

To ensure that these numerical results translated into noticeable benefit to the user, a qualitative test was set up. Interviewees were video-called and read an excerpt from the Great Gatsby by F. Scott Fitzgerald twice, once with and once without the use of the prototype. The interviewees were not told which reading was done with the prototype. Interviewees then completed a short survey about their perception of audio quality and speech intelligibility in each case. **All interviewees reported greater speech intelligibility and quality <u>with</u> the use of the prototype.** When asked which version of audio they would rather listen to for an extended period of time (i.e. in a long meeting at work), all interviewees responded they would rather listen to the audio recorded from the prototype workspace.

The in-depth acoustic analysis of preliminary designs helped me validate my hypothesis regarding the improvement of acoustics for video-conferencing. It also showed me the correlation between surface area of absorbing material and reverberation time, which helped to inform the final dimensions of my design. Qualitative testing with potential end users ensured that the numerical findings translated into a recognisable and positive difference in heard audio quality. These were valuable insights that helped me move forward with my project.

Parts and Assembly

ABS Frame

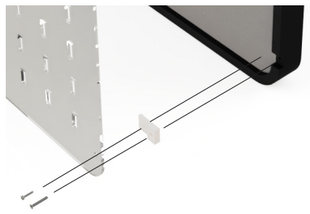
The mechanical basing of the product is an injection-moulded ABS frame. This has been designed so that one mould (with changeable inserts) can be utilised for all three panels. Injection-moulded continuous plastic hinges are ultrasonically-welded to each frame, and secured in place by an aluminium pin. Locator holes for the magnetic discs and a channel for the light bar and wiring are moulded as part of the panel. I found a manufacturer that would produce the tooling and a run of components for a more-than-agreeable price.

ABS frame and hinge

Pegboard Panel & Storage Basket

The pegboard panel is laser-cut from clear (or coloured) acrylic and held to the frame via small aluminium mounts and screws. This means that if the pegboard feature is not desired, it can be removed, making the booth lighter and providing the user with more space to pin up paper work materials on the RPET panel below.

The felt storage basket features hooks held in with a stitched fabric tab. This allows it to hang off two M6 eye bolts on the back of the central ABS frame, so that it can be easily installed/removed.



Eye bolt and hook

Light Bar

The light bar is implemented by securing a WS2821B LED strip between an extruded aluminium channel and extruded polycarbonate snap-fit diffuser. The snap-fit diffuser ensures that the light is soft and easy on the eyes. This assembly is then glued into the ABS frame with 2-part epoxy, and wiring soldered to the LED strip terminals. Wiring is neatly hidden by the RPET panels, and is channelled in an elastic sleeve across the hinges.

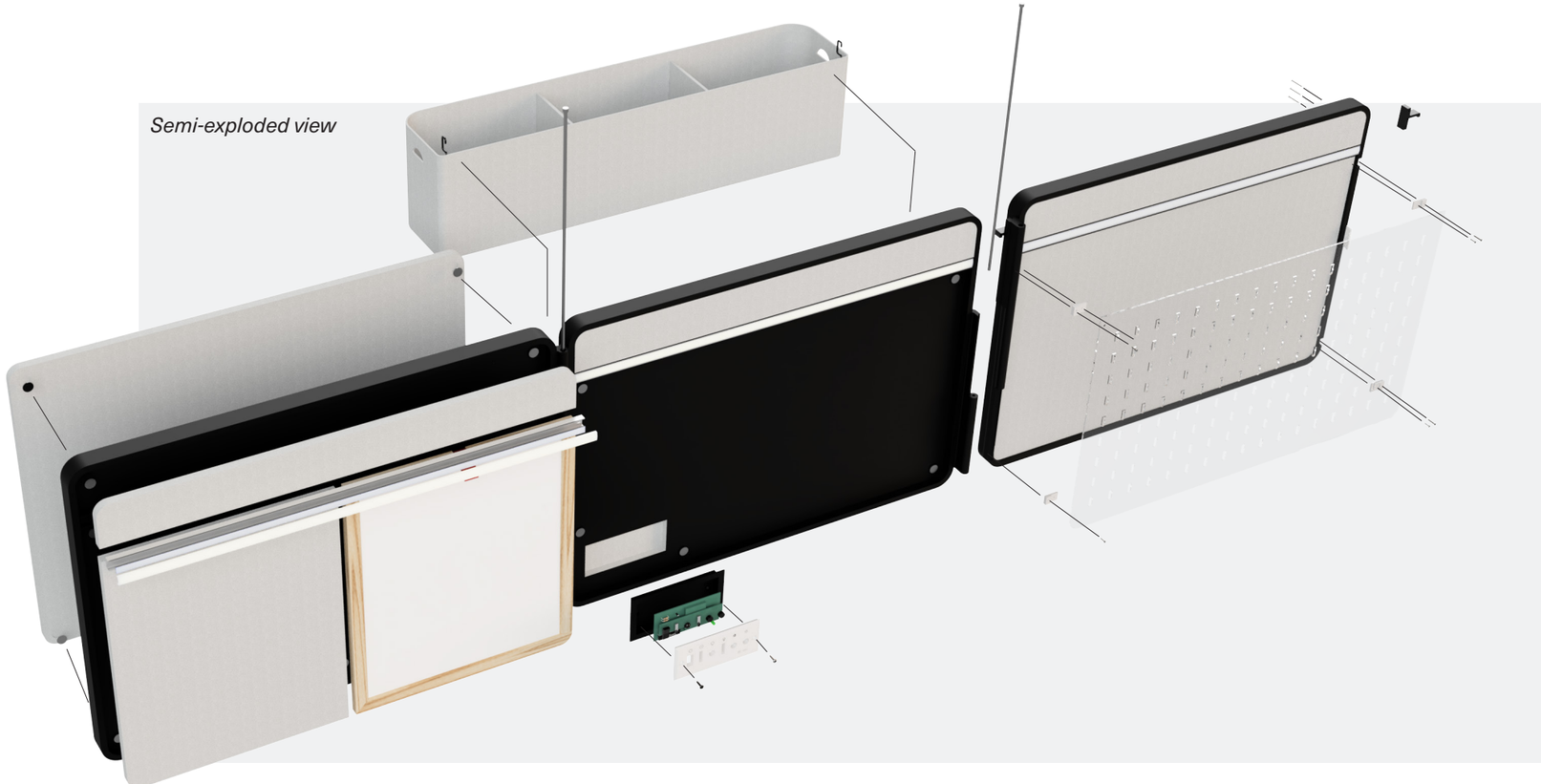
Elastic wire channel

Design for Disassembly/Cleaning

All RPET panels and the whiteboard assembly are held in the frame with 8 x 1 mm neodymium magnetic discs. This ensures that the whiteboard can be easily written on, and the RPET panels can be removed for cleaning or disassembly when required. These are adhered to the components with 2-part epoxy adhesive.

Electronic Sub-Assembly

The electronics are held within a compression-moulded housing that is glued into a cut space in the ABS frame with 2-part epoxy glue. The electronics themselves are laid out on a 2-level stacked PCB, which snap-fits into the housing. An injection-moulded ABS cover is screwed into the housing, allowing the electronic touch points to protrude through.



Semi-exploded view

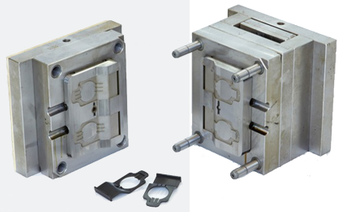
Materials and Manufacture

Key Points

Frame Manufacturing

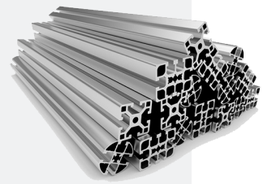
A variety of manufacturing processes were considered for the framing. Advice was gathered from a number of sources, including the Reid workshop and manufacturers. **CNC machining** was considered, but the sizeable returns to hold the acoustic panels would mean that the process was inherently wasteful. **Aluminium sand-casting** was also looked at, and was feasible, but meant that the product would be extremely heavy and the process far too costly. **Injection moulding** was initially seen as unsuitable due to high tooling costs. Cost-aside, this manufacturing method was highly suited to the component, as it would allow very cheap mass manufacture - as unit costs are generally low. The form would require a large injection moulding machine, capable of exerting over 1200 tonnes of force - according to one manufacturer.

I reached out manufacturers in Europe and Asia, asking for quotes and advice. I was given reassurance and a quote from a company based in Zhejiang, China, who would manufacture the tooling for free if a substantial order of 10,000 products was made. The unit cost for a full, 3 panel product would be **£13.02** - which I believe is reasonable. For a smaller run, the tooling cost would sit at approximately £7200 **(7.2p per part, for a mould with a life of 100,000 units)** - which in terms of manufacturing set-up cost, I would say is allowable.



Extrusion

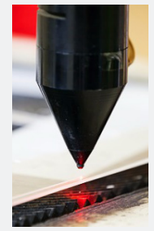
Extrusion is a forming process where metal or plastic is held in a cavity and then only allowed to flow out through a shaped exit. This produces components of continuous cross section. As both the LED channel and diffuser have continuous cross sections - extrusion is the obvious choice. **Advantages include low cost per part, continuous operation and good surface finish.** Many existing LED channel/diffuser solutions already utilise extrusion as the method of manufacture. The manufacture of these components would very likely be outsourced to a specialist. There is also the possibility of redesigning the framing so that a commercially-available LED channel can be cut to size and used.



Laser-cutting

Laser-cutting is a hugely popular method of cutting intricate patterns into acrylic. The tolerances achievable with a high-quality laser-cutter can be as low as 0.1 mm, making it one of, if not the most, accurate cutting method. The pegboard panel is 3 mm thick, which is perfectly within the capabilities of a low-wattage laser-cutting system. The holes for fixings can also be laser-cut, eliminating the need for drilling - which can be difficult with acrylic.

Pegboard Panel Cutting Profile



ABS

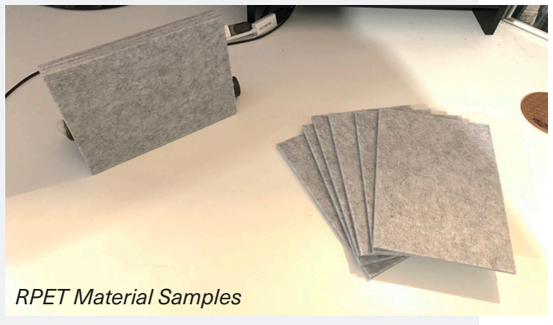
ABS is a good choice for the outer framing due to its low weight, high stiffness and strength and formability. It can be pigmented to almost any colour and a variety of surface finishes are possible. The outer-facing surfaces of the framing are to be finished with 600 grit stone to **SPI-C1, a fine matte finish.** This standard surface finish is highly compatible with ABS.

The validity of this choice was verified by manufacturers via email correspondence.

Eames DSW-inspired chair in matte ABS

Recycled Polyester Panelling

RPET was the clear winner in a list of potential materials for the acoustic panelling. Made from recycled plastic bottles, it is **100% recyclable and long-lasting**. Its sound-absorbing qualities make it a mainstay of the acoustic treatment market, and it can be manufactured to act as a pinboard. The manufacture of the panels could either be outsourced to a specialist, or they could be cut from sheets and then milled to form the returns for the magnet discs. Some manufacturers of RPET are more environmentally-friendly than others - so care would have to be taken to select one with high standards. Material samples returned that the aesthetic and feel of the material was exactly what I was looking for.



RPET Material Samples

Ultrasonic Welding

Ultrasonic welding is a way of permanently joining plastics and metals by applying ultrasonic acoustic vibrations while holding two components together under constant pressure. It is a much faster and safer process than traditional welding, and is a cost-effective method of joining as no fasteners, solder or adhesive is required. A rough estimate from an American company suggested a cost of approximately 18p per component - meaning the cost of installing the hinges onto the ABS frame would be **approx. 72p per product.**

Hinges to be ultrasonically-welded