But a surface

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Abstract

BUT A SURFACE is a product that offers a surface which helps users to switch between positions they like freely when working from home with devices like laptops.

Under the COVID-19 pandemic, working from home has become a “new normal”. Compared with working in the office or school, people usually perform more relaxed in positions like sitting casually on lounge chairs or sofas when working from home digitally with devices like laptops or tablets. At this time, a platform which holds their devices on a proper position would further improve their working experience to work with comfort as well as fit.

This product consists of an aluminum-alloy body with rubber anti-slip strips to bring a mechanical aesthetics while keeping reliable. Compared with traditional foldable tables, it has a compact size and brings more portability. In default state, it works as a laptop stand on the desk to offer a better viewing/typing angle, and by pressing the control handles, its height could be adjusted without moving away things on it, making the process much simpler than traditional products.

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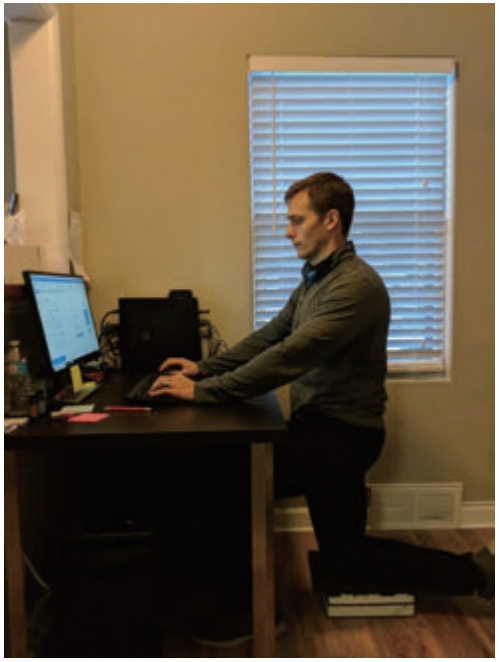
2.1 Initial idea

The initial idea is to give a low cost “partial substitute” for study chairs to solve the problem on physical fitness caused by sitting for too long like lower back pain. It origins from my personal experience that I usually feel uncomfortable when sitting for a long time, and during the COVID-19 pandemic when nobody notifies me to take a rest (like a 10-minute course break) this problem becomes even worse.

The product should help people to keep their back upright and switch their posture without interrupting the ongoing work, and one solution could be changing people’s working posture from sitting to kneeling (picture 1). It is based on my personal experience that I start to kneel when feeling uncomfortable several years ago. It does not have great influence on my working efficiency while do help me to keep my back more comfortable.

The only problem is the ground is tough and I have to put my slippers under my knee to relieve the pain of pressing on hard surface, so the design concept could be a kneeling pad which not only provides comfort to knees but keeps a proper height for working as well.



(Picture 1: a man working while keeping the kneeling posture. Burr, 2020)

2.2 Competitors

Regarding the “kneelling” posture, there are 2 competitors offering similar function:

Kneeling pad (picture 2). It is mainly used for protecting people’s knee and relieve pain when they are doing physical works in kneeling position like gardening, cleaning, etc.

Kneeling chair (picture 3). It targets at the similar problem how to guide people to keep their backs upright. The users need to put their knees on the kneeling pad and this posture would force them to keep their back straight.

(Picture 2: a kneeling pad on the market. Anon, n.d.)

(Picture 3: a kneeling chair on the market. Anon, n.d.)

2.3 Reflection

For this initial idea, the supervisor and examiner suggested 2 directions to explore.

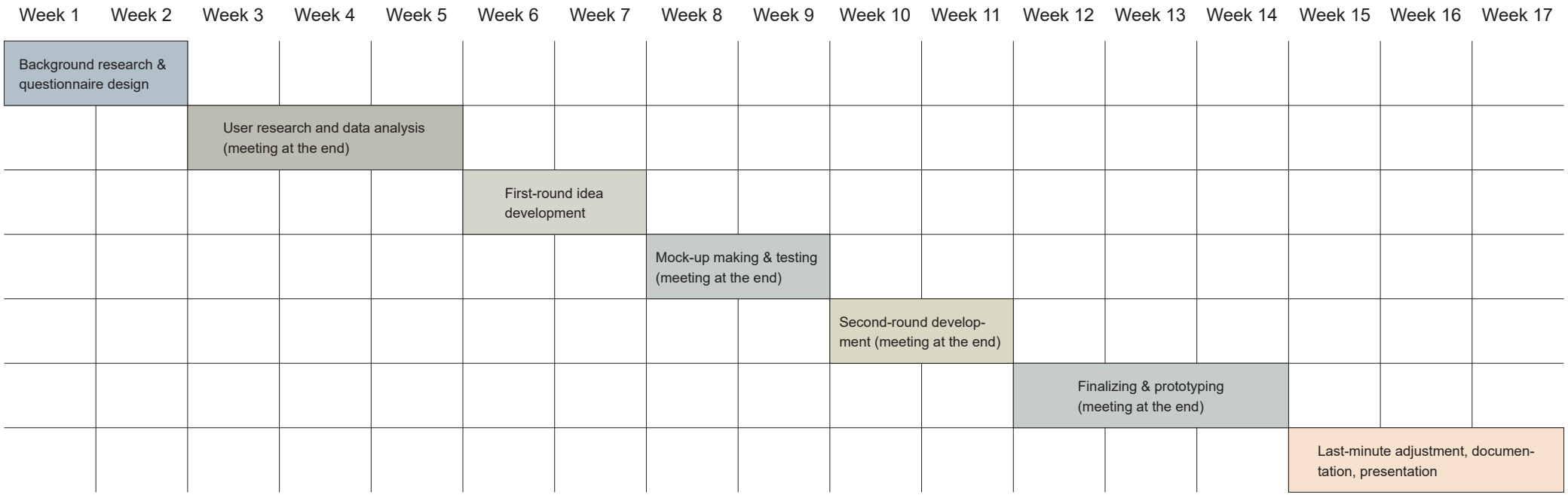
In all, the concept “kneeling” is a kind of posture. So, for further research, I should focus on different postures people act, and explore when, why people do them.

The first direction is to develop the stories behind “kneeling”, as this posture carries special meanings in some civilizations such as representing the gap of identities. If we want to encourage people for switching to kneeling, is there any meanings we can bring to a modern society?

The second direction is to expand the concept to all postures at home. When people are at home, they conduct different postures for different reasons, and what make them feel most comfortable? It could be further developed as all the positions, which includes both postures and locations to dig on people’s behavior at home, especially under this COVID-19 background when people are spending more time at home.

2.4 Timetable

There are 17 weeks for developing the project, and there should be 5 meetings with supervisor and 3 meetings with examiner (including the 1st round meeting on January).



The timetable is well-followed before the second-round development, but I failed to keep it up after that due to some personal reasons, and one meeting with examiner is missing.

3.1 Topic definition

I defined my topic as “Physical Position Transition in Home Environment”, which will focus on people’s behavior on physical position at home. It will include how people act in different positions at home and why they change their position during home time.

The topic is even more valuable under this pandemic as people are spending more time at home due to governmental restrictions like work from home. These policies are affecting people’s activities at home that the percentage of activities for working/studying increases. Exploring the impacts brought by these changes and offer a design proposal to help people creating a better life quality at home will be the target of this project.

3.2 User definition

As the initial idea and topic definition are both motivated by people’s lifestyle during the work-from-home period, the target group of the proposal will be people who are now working/studying from home. But considering the activities at home is a broad topic which is tightly related to everyone, all people could be the potential users.

3.3 Scenario research

After brief user research, I concluded several activities and postures that are commonly conducted at home now.
After works/courses were turned remotely, there are 3 main areas for activities at home:
- Working/studying
- Leisure
- Housework

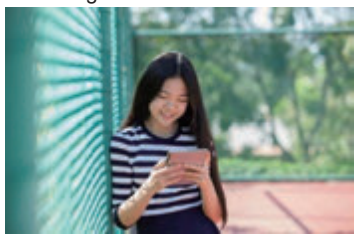
And for postures, there are also several typical postures:

- Sitting formally

- Sitting casually

- Standing

- Leaning



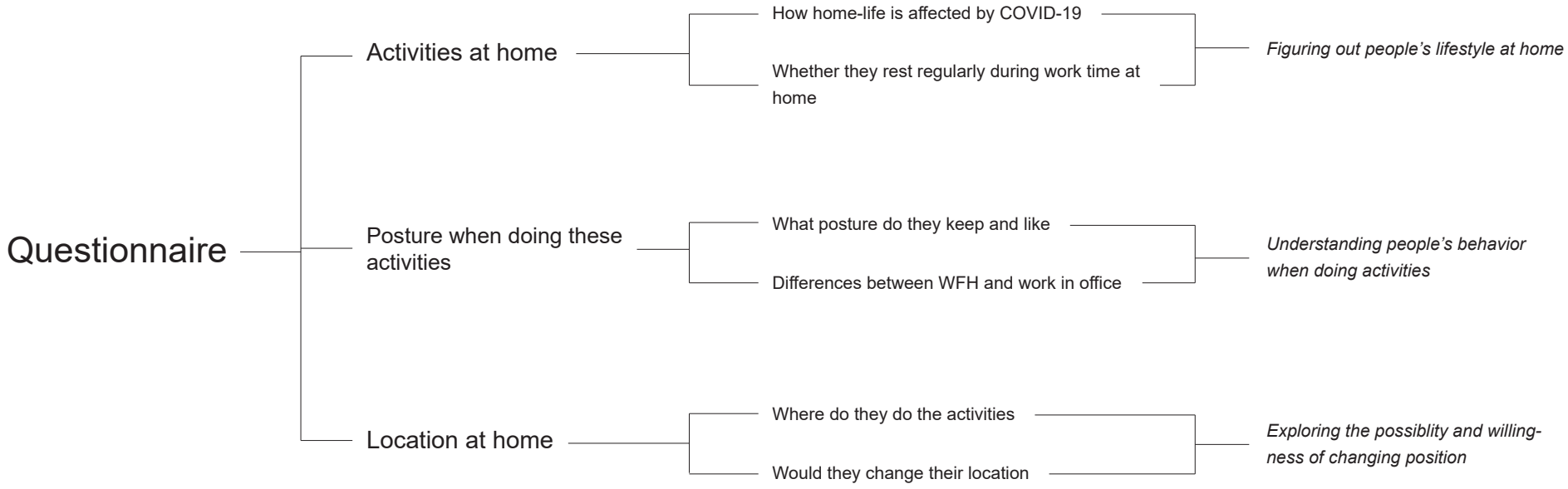
- Kneeling

- Lying

(Picture 4~9: pictures showing different postures)

3.4 Questionnaire

The questionnaire is based on the scenario research and it is divided into 4 parts:



Result

The questionnaire consists of several choices questions and short-answer questions. Here I would select some key figures and representative answers from the result of questionnaires.

90% *time at home is extended due to the pandemic*

50% *now spend most of their time studying/working*

52% *rest regularly during their study time*

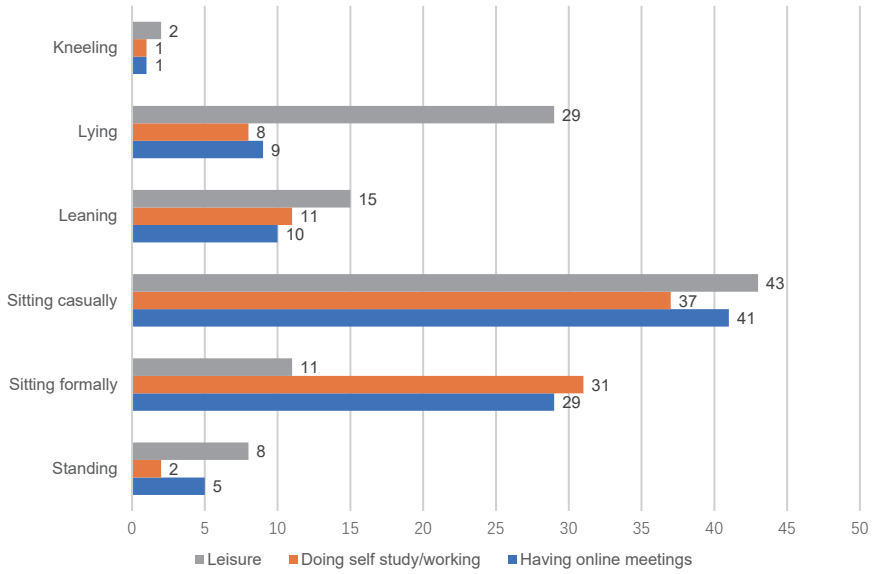
75% *switch their posture when studying/working*

80% *have different position between WFH and in office*

69% *have a fixed position*

52% *consider changing their position for activities*

Posture of people when conducting different activities



Representative answers

“I lay on my bed and play on my phone during leisure time”

“I like lying and sitting casually. They are relaxing”
“I try to sit up straight because i worry about my posture in the future”
“I don’t like sitting formally, it starts hurting after a while”
“It's uncomfortable to be in the same position for too long.”
“When at home, I change position and posture more often since no one is watching me compared with sitting in office. Plus I sit more casually, which would not be accepted at a wprk place or uni environment.”

“Working at my desk, resting differs between arm chair, desk and bed”
“To feel relaxed in the sofa, to feel more constrained on studying”
“I dont have many options, i try to keep work activity and leisure activity seperate”

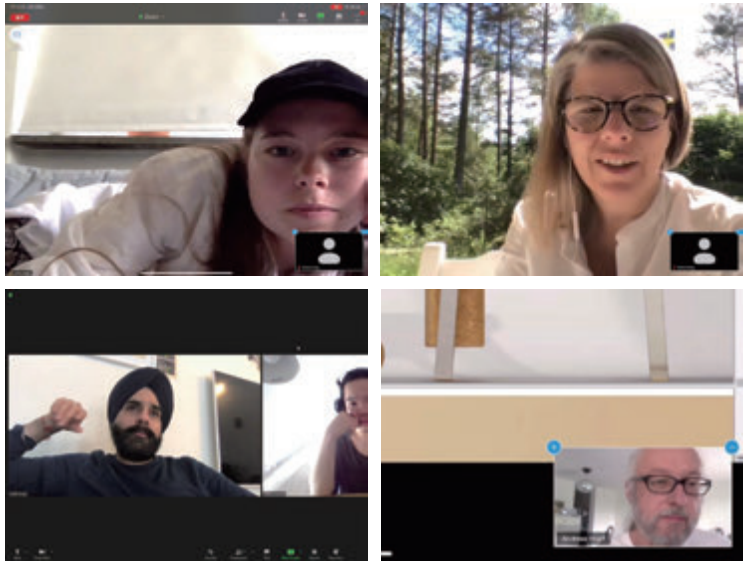
Conclusions

Most people are affected by the pandemic, and it is shown by the extension of hom study time. Sitting casually is the most welcomed posture for most of the activities, and people do this because it is comfortable. Most people switch their posture and act more casual at home because of different environment. People prefer fixed positions for activities, but they might also change them.

3.5 User observation & interview

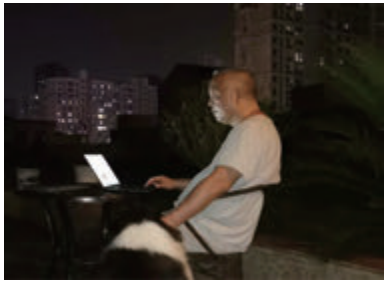
Here are some screenshots from the MA graduation project and some courses last year.

In these selected examples, people had meetings when lying on the bed, sitting outside, on the sofa or moving around. Compared with meeting in the office or in the school, working from home offers more flexibility to people's posture and position, and because of this, some people prefer more casual ways to have their works and act in the positions they feel comfortable or like when having online meetings at home. It shows the possibility of designing a product helping them enjoying more comfort when conducting these activities.



(Picture 10~13: captures from various online courses/meetings showing people's posture when WFH)

Interviews

Jianfeng, working in state-owned enterprise.

He sometimes works at home with his laptop, mainly reads and edits documents.

He works on the desk or on the table in the yard.

He prefers staying outside for better air quality and time with pet. Also, as he smokes, working outside would not affect family members.

(Picture 14~18: portraits of the interviewees and their posture when being interviewed)

Weijie, a university student in China who was studying at home when being interviewd.

He studied in his room, and he was doing his homework with books and pen in the picture.

This is the daily posture he keeps, and he said that this is “sitting casually”.

He doesn’t care about his posture when he focuses on his work and hasn’t think about switching it.


Gus, a university student in Sweden living in a student house.

He usually studies in his corridor room.

When being interviewed, he sat in the lounge to avoid sunlight which shined on his desk.

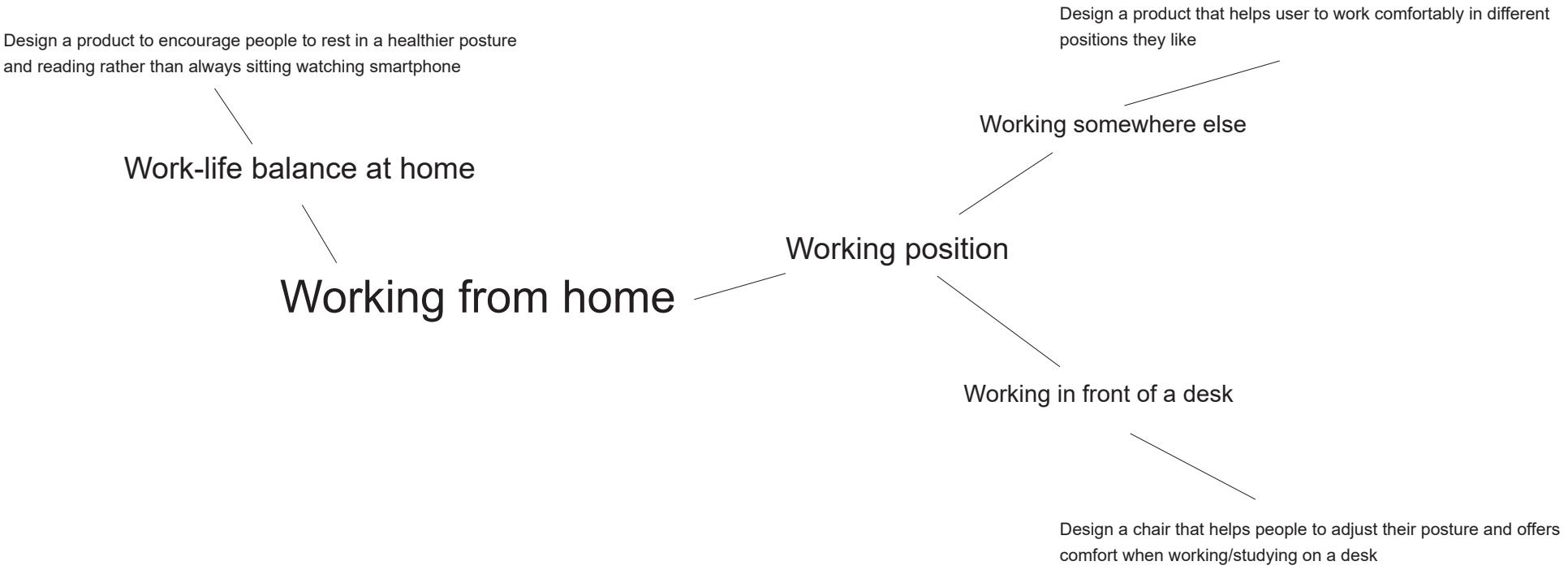
The posture affected his efficiency, but it was relaxing.

He kept this for 30 minutes and went back.

From the interview we can see that the reason affecting people’s choice of positions is comfort, that people are always seeking for a place that brings comfort to them. Weijie feels fine in his room so he doesn’t change, Jianfeng feels more comfortable outside so he changes, while Gus changes because it is not comfortable sitting inside his room.

4.1 Brainstorming

The core idea of this project is to make people's life working at home comfortable.



4.2 Proposals

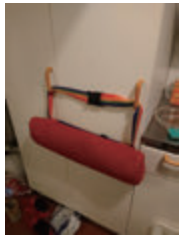
Work-life balance

The idea is based on the result from questionnaire that many people spend their leisure/break time sitting, watching their smartphone. I hope the product could help them to spend this time standing and reading, guiding to a better living behavior.

(Picture 19: a leaning pad. Shot in Lund C)

Case study: leaning pad in Lund C

This is a leaning pad in Lund Central Station which is used for people to wait for trains with comfort by leaning on it. Compared with seats, it has simpler structure and saves more space. From my experience, it is comfortable to use but a bit high.



(Picture 20: a leaning pad. mock-up)

Mock-up

- The height adjustment is important to fit different people, and it affects much on the comfort.

- the space between back and wall is important, and in the mock-up the gap is too narrow, affecting the experience.

Solution 1: the combination of book shelf and leaning pad

The idea comes from bookshelf ladder. It could be on both the side of a bookshelf and the front of it. It could look like a library ladder that people can lean on it and enjoy their leisure time reading.

(Picture 21, 22: library ladders. Kim, 2014)

(Picture 23: sketches of solution 1)

Solution 2: a separated leaning pad

This design can be set beside common walls, and it works in different situation: study, bedroom, living room, etc. Its height could be adjusted. Storage function could also be added in it to make good use even when people are not using it.

(Picture 24: height-adjustment)

(Picture 25: sketches of solution 2)

(Picture 26: draft of solution 2)

Reflection

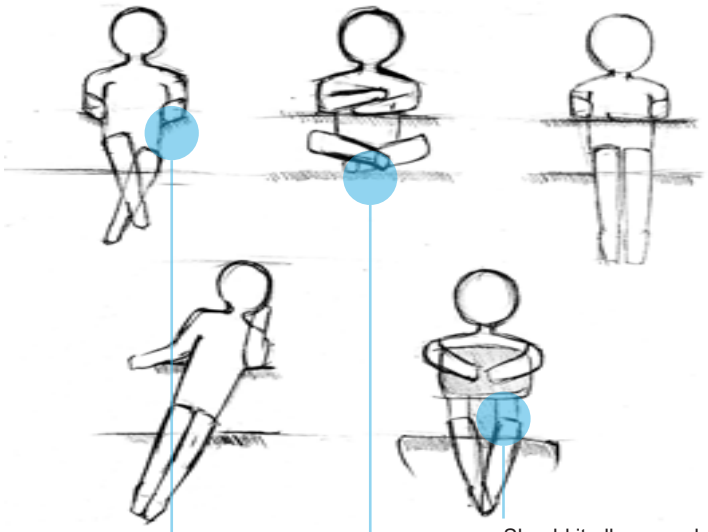
In public space, the leaning pads are mainly used for short-time activities like waiting. If it is tranfered into home environment, more consideration is needed for what it is used as there are few short-time activities at home.

Working in front of the desk

The idea is based on the result of questionnaire that people like sitting casually and adjust their posture.
The target is to design a chair that allows people to adjust their posture freely and sit in a cozy position.

Posture people usually keep when sitting

From the sketches we can discover some points that should be illustrated in the proposals for a chair that can allow people to sit casually in comfort.



(Picture 27: sketches of different postures)

Should it allow people to rotate it and lean on the backrest?

Should it have enough width for people putting their legs on?

Should it have armrest for people to rest their arms?

Competitors

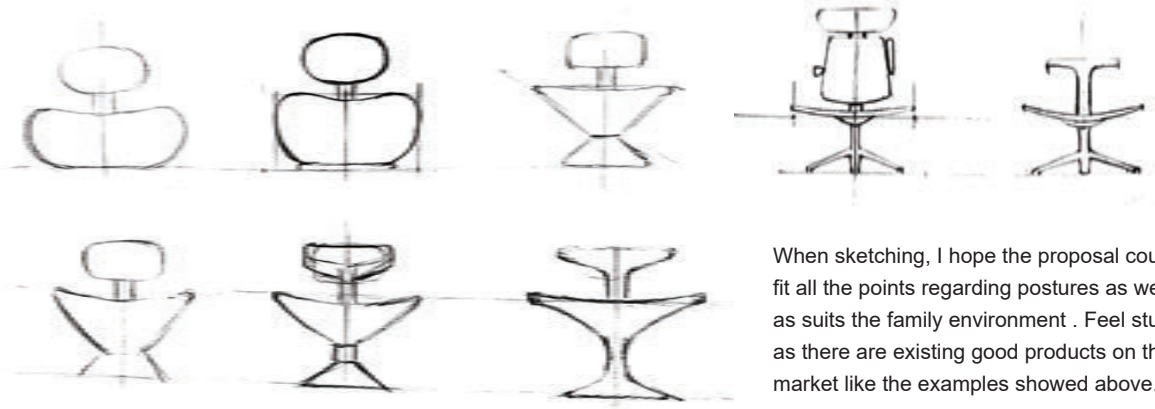
The “BeYou” chair can transform to multiple forms to fit different postures with the help of its mechanical structure. It also works well as a traditional office chair.

(Picture 28: “BeYou” transforming chair. Mitra, 2021)

The famous HÅG Capisco chair designed by Peter Opsvik allows people to sit in different postures without changing the chair, as he said “Every posture is wrong after minutes ”

(Picture 29: HÅG Capisco chair. Anon. n.d.)

Idea development



When sketching, I hope the proposal could fit all the points regarding postures as well as suits the family environment . Feel stuck as there are existing good products on the market like the examples showed above.

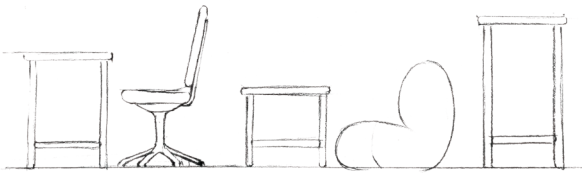
(Picture 30 & 31: Sketches of this direction)

Working somewhere else

The idea is based on the user observation and interview that people would like to change position when dealing with some works (like online meeting). The target is to develop a product that allows people to work in wherever they like comfortably.

Scenarios and function

From the observation it can be seen that people could work when sitting on the sofa, lounge chair, bed, outdoor or moving around, so the product could cover these scenarios.



(Picture 32: sketches of different scenarios)

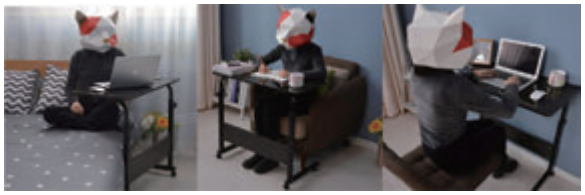
The sketches shows that one key difference between different scenarios is the height of working surface, so the height of the product should be adjustable and movable.

(Picture 33: mock-up regarding the size)

The product should work with most of the daily works at home, including studying, using laptops, etc. Here I made a mock-up to show the proper size of it: carrying a laptop and mouse.

Competitors

There are some adjustable small tables that fit the scenarios and function, and they can be separated into 2 sides by its flexibility and complexity.



(Picture 34: a laptop table with adjustable structure on the market. Anon. n.d.)

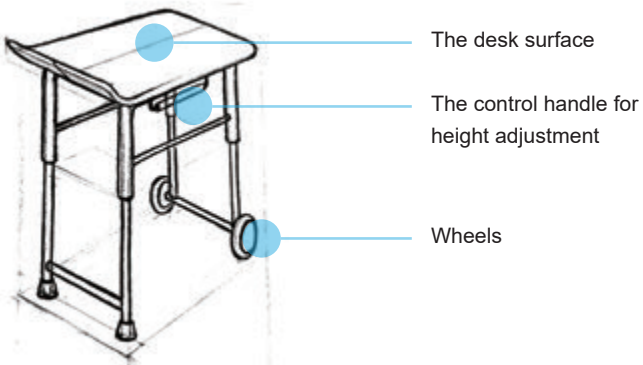
The first kind in the picture 35 can be used in various scenarios. It has simple structure, but can only be adjusted by loosing the screws, setting up to proper height and tightening it again, which limits its flexibility.

(Picture 35: a laptop table with air pump on the market. Anon. n.d.)

The first kind in the picture 36 uses a air pump structure, making it simpler to use. There are also some electricity-driven products, and they have more complex structure.

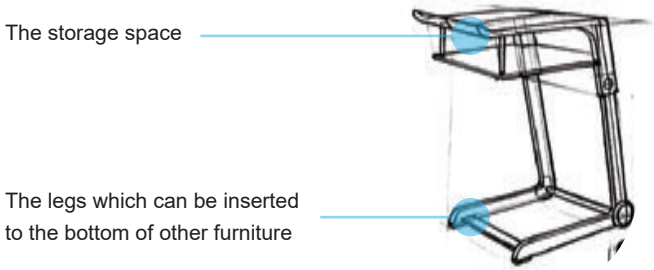
Proposals

The idea is to find a “middle status” of these competitors: its height is adjusted by simple. mechanical structures and operated with a simple grip, and then user can move it up and down.



(Picture 36: first sketch)

The first sketch can meet some problems in narrow spaces like between the coffee table and sofa, so the second one tried to solve it with a changed leg structure together with added more function.



(Picture 37: second sketch)

5.1 Idea and sketches

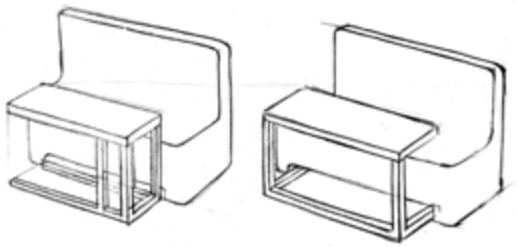
Direction selection

I finally decided to focus on changing the working surface by designing a product helping people gaining better working experience in positions they like.

Reflection on the 3rd direction

One problem is that it cannot fit all the scenarios like sitting on the bed, and it is still hard to be moved around in narrow spaces. The leg structure illustrated in picture 38 could be a solution, but such solution must select the direction of insertion.

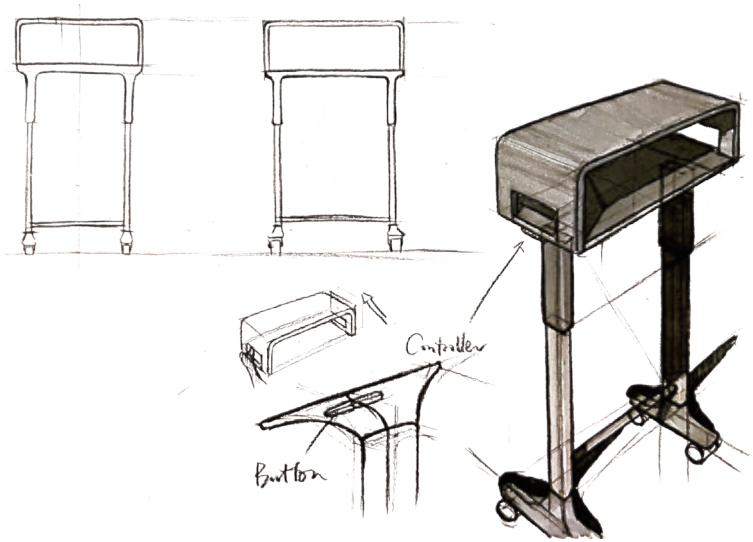
(Picture 38: another adjustable table. Anon. n.d.)



(Picture 39: sketch showing the difference of 2 directions of insertion)

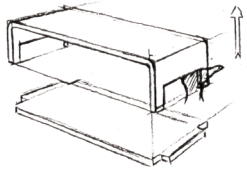
Compared with the product in picture 35, this table has longer depth, which makes it easier to use beside beds. However, when it comes to scenarios like a sofa or lounge chair, it might not be used easily (like illustrated in picture 40). Also, when using this product, people have to sit near the edge of bed, which makes it less convenient with a foldable tiny laptop desk.

Concept development



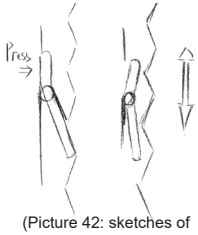
The idea is to split the original proposal into 2 parts. Under common conditions, it works as a movable tiny table with a trolly-like structure. It can be moved up and down by pressing the button, while the wheels help to move it around in the home space. In this form, it mainly works as a sofa-side table.

(Picture 40: sketches of the proposal)



(Picture 41: sketches of the detachable table)

When user want to work on the bed, they can lift on the detachable upper table and move it with their stuffs like laptop on it.



(Picture 42: sketches of the height control structure)

It uses a simple structure to control the height of the working surface to fit different purposes. User can move it easily by pressing and moving it.

5.2 Mock-ups

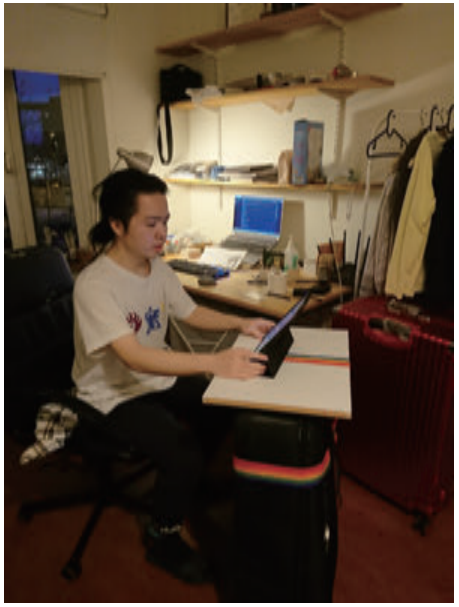
This mock-up is mainly used for discussing its flexibility in different scenarios.

When working as a unity

When combined together, it can be used when the user is standing and moving around (like from one room to another)

When the table is detached

The table can be detached as a footstool while using the trolly as the surface



It can also work as a common table for sitting posture. Except from removing the upper table, user can reach it by adjusting its height as well.

The detached part can be used when sitting on the bed, sofa or standing by the windowsill.

(Picture 43~47: mock-ups showing how the proposal works in different scenarios)

5.3 Reflections

To analyse the proposal, I need to think about the definition of the product: must, should, could, might

Must

Offer a working surface for people in positions they like comfortably

Should

Be easily carried around

Could

Offer as much choices as possible

Might

Be cheap?

What are people doing now to solve this need?

Which position do people do/like?

In the mock-up, only “standing and working” requires the trolly part, and most only need the upper table

It should be light and compact

Users prefer something simple

Use existing stuffs around them or tools with other purposes (like adjusting the height) with simple structure

Is the trolly necessary?

(Picture 48: someone working on her bed. Anon, 2020)

(Picture 49: someone using books to adjust the height of laptop. Kobos, 2021)

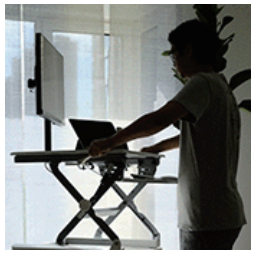
(Picture 50: someone working on the sofa with a IKEA laptop stand under it. Anon, n.d.)

6.1 Questionnaire

The questionnaire is used to answer the “MUST” question: which position do people do/like.

I selected 7 common positions at home:

Sit on the toilet

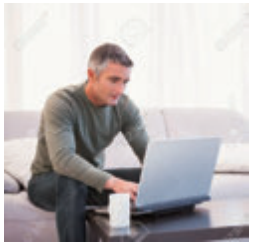


Stand and move

Sit on the bed

Stand by the windowsill

Sit on sofa using additional table



Sit on sofa using coffee table

Sit on lounge chair

These positions cover most of the positions people stay at home when they are working in a casual status (the toilet one is for fun), and user are allowed to select whatever they like.

Except this, I also asked the willingness of purchasing a new product for better experience when working from home in these positions.

Results

Here is the result for people’s preference on positions.

From the result it can be seen that most of people prefer sitting and standing by the windowsill, and maybe it is because they hope to enjoy the natural scenery outside especialy under the COVID-19 pandemic as they are restricted at home. So the product would mainly focus on these 2 directions, which means that the user would not need a product with support from ground. ***The trolly structure is not necessary.***

Also, half (46%) of the interviewees only have moderate willingness of buying a new product, so it might need to be multi-functional to give additional reason for buying it, and the cost might be controlled as well.

(Picture 51: sit on the toilet. Milkovasa, n.d.)
(Picture 52: push the table with computer on it. 老着急, 2020)
(Picture 53: sit on the bed. Anon, n.d.)
(Picture 54: stand by windowsill. Contrastwerkstatt, n.d)
(Picture 55: sit on sofa using additional table. Anon, n.d.)
(Picture 56: sit on sofa using coffee table. Wavebreak Media Ltd, n.d.)
(Picture 57: sit on lounge chair. Daniel, 2021)

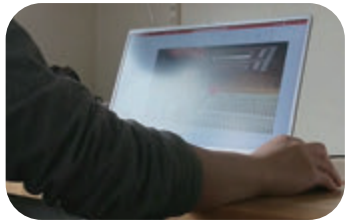
6.2 User context

User activity: working

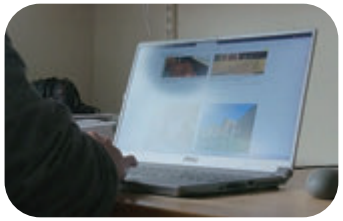
Here are the main activities of WFH users and they possible posture when working with a laptop without more external devices (like a keyboard or monitor)

Having online meetings/courses

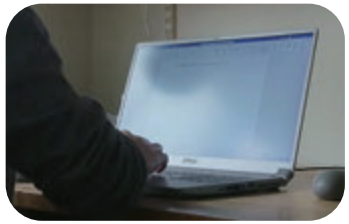
Doing heavy works (like CAD work)



Making presentation slides



Reading webpages/articles



Editing documents

It seems that most of the simple works can be treated without mouses, but whether the space for mouse is needed still needs consideration.

“Mouse is good, but when moving it around I prefer using the trackpad.”
- when interviewing a friend

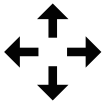
(Picture 58~62: the posture and products involved when conducting different activities)

User activity: switching

From ergonomics perspective, the differences between positions is the height of the working surface, as the working height of sitting and standing are obviously different. So if users want to switch between positions with comfort, they need to have a working surface with proper height, which means they might need something to adjust the height of the working surface.

User context

Flexibility
It should at least be easy to switch between the preferred scenarios



Mobility
It should be compact to be moved between different scenarios

Usability
It should be easy to use for everyone who need to work/study at home

Space
It should not take too much space

Size
It should at least be eligible to hold the laptop on it

7.1 Product definition

From the “MUST SHOULD COULD” and second round user research, I decided to discard the trolly structure but keep the upper table, which will be re-designed as a product that can hold at least a laptop and used in scenarios users like to offer more comfort when they are working digitally from home. To fulfill this target, its height should be adjustable to suit different environments. Also, it should be compact.

7.2 Competitors

Here I select 2 kinds of product series: foldable laptop table and laptop stand. Both partly suits the newly-defined user context, and they also have their own working purpose.

(Picture 63: a snapshot of google picture searching “foldable laptop table”)

Foldable laptop table

This is the most-selected product for offering comfort when working in scenarios like sitting on bed on the market.

Material: usually wood, plastic or metal

Size: larger than a laptop to support other objects like cup, mouse, etc. Width: 50~60cm; Depth: 30~40cm

Pros:
Simple structure. Usually user only needs to pull out the legs.
Easy to store. It can be folded and inserted into narrow spaces.

Cons:
Height adjustment. Most of them only have fixed height, or it would be much complex.
Relatively fixed form. Products look similar.

(Picture 64: a snapshot of google picture searching “laptop stand”)

Laptop stand

As the user research shows that most of the low-intensity works don’t require a mouse, maybe a laptop stand that is only used for laptops could be enough. It is used for holding the laptop and offering a better viewing angle.

Material: usually wood, plastic or metal

Size: could be smaller than a laptop. No specific size.

Pros:
Compact. They don’t occupy much space.
More ideas. Relatively more ideas for selection.

Cons:
Scenario. Usually they can only work on the table
Flexibility and complexity. Those who have more flexibility are usually more complex with mechanical structures.

Common problem

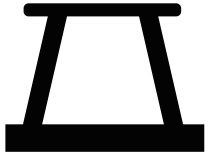
For both of these 2 kinds of products, when the user want to adjust it, they have to move away the stuffs on it before adjusting it, which adds some work amount, and it could be a design point.

7.3 Design Analysis

Geometry restriction

For postures like sitting on the bed, user would put their legs under the product so that they don't need to have them pressed on the legs. So the width for legs should be more than 48cm (Chen, n.d.), while the height should be around 26cm, a common height of existing products.

(Picture 65: windowsill. Anon, n.d.)



A common height for a windowsill is 75~80cm (Anon, n.d.), while the proper height for people standing working is about 107.5cm
(Chen, 2017. Calculated by averaging the number of 5% and 95%), so the maximum height should be more than 30cm to make sure its flexibility in scenarios like standing by the windowsill.

Design points

As mentioned before, one problem of existing products is that users have to experience a "move away" process during the height-adjustment period, so the idea is how to adjust the height for switching between different positions while avoiding this troublesome process.

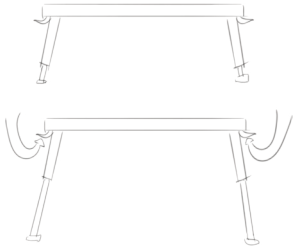
7.4 Structure development

The requirement for the structure is: can be extended to more than 30cm, while the extension process could be finished without the “moving away” process.

- Should be extended to more than 30cm
- Should proceed without the “moving away” process
- Could be as simple as possible with intuitive mechanics

Here are the existing structures that might be used on this product:

(Picture 66: a adjustable armrest)

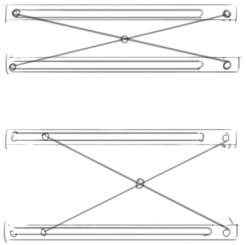


(Picture 67: sketch show how it works)

This is a common structure widely used in many situations for height/length adjustment. By pressing the button, its height could be adjusted easily. However, to cover the height, it must have an initial height so the product might not be that compact on the table.

+ simple structure
+ easy to use
- the minimum height is too large

(Picture 68: a foldable door. Anon, n.d.)



(Picture 69: sketch shows how it works)

This is a structure mainly used for outdoor doors. With its foldable structure, its size is compact when folded, and can cover a large scale of height. But such structure usually have it exposed, which looks mechanical.

+ highest adjusting range
+ compact when folded
- complex & ugly structure

(Picture 70: another foldable door. Anon, 2017)

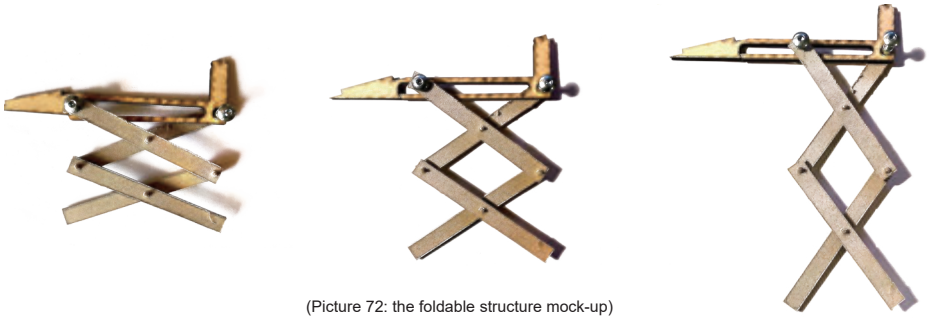
(Picture 71: sketch show how it works)

This is a structure used in scenarios like the door for the yard or the door on the plane. It also saves space and offers more possiblity on appearance, but its height is limited.

+ compact when folded
+ many choices for forms
- covers minimum height

All these structures rely on gravity which means they will automatically fall down when released.

For the function consideration and context of space saving, I choose the solution in the middle.



(Picture 72: the foldable structure mock-up)

The structure is locked when not adding force on it. While the user do so, it will fall down under the gravity. By loosing it, it will be locked again.

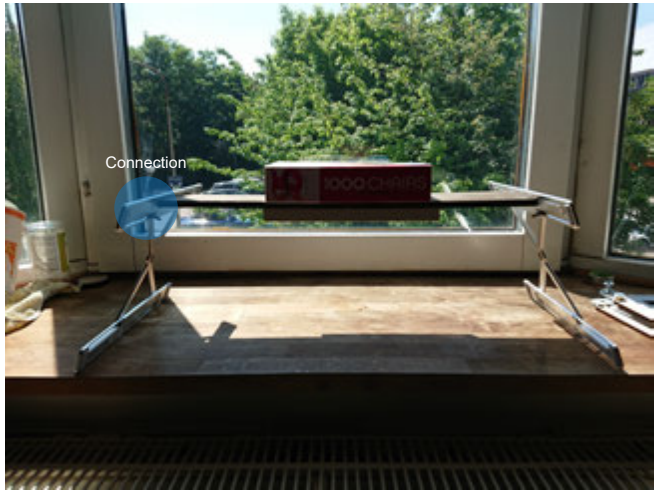
(Picture 73: the lock structure)

(Picture 74, 75: the mock-up showing how it works)

Mock-up

(Picture 76: structural mock-up 1)

This mock-up is used to see whether the structure could be strong enough to hold the laptop, and it show that this structure is strong enough to hold the laptop without deformation.



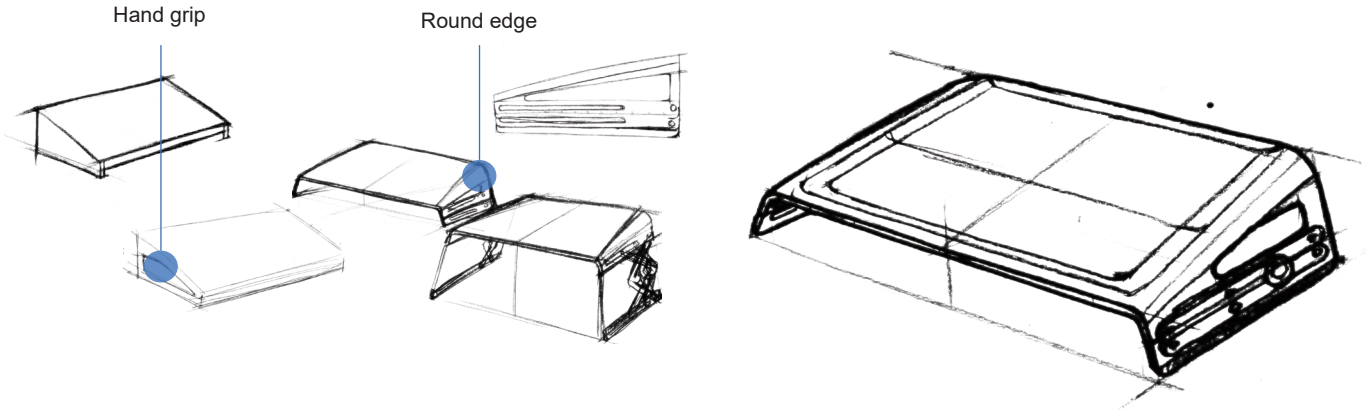
(Picture 77: structural mock-up 2)

This mock-up is used to see whether the structure is stable enough. As the wood board is narrow and the connection structure made of nails is not strong enough, I use the book to add weight on it. The test shows that it shakes slightly, and it seems that it occurs mainly on the unstable connection. More tests are required.

(Picture 78: structural mock-up detail)

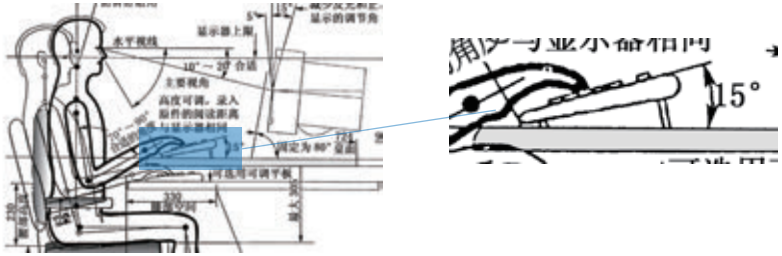
Here I use the screw structure to fix the position. As it is tighten by hand it is not that stable, but it worked during the experiment, and the designed structure would be more stable than it.

7.5 Sketches



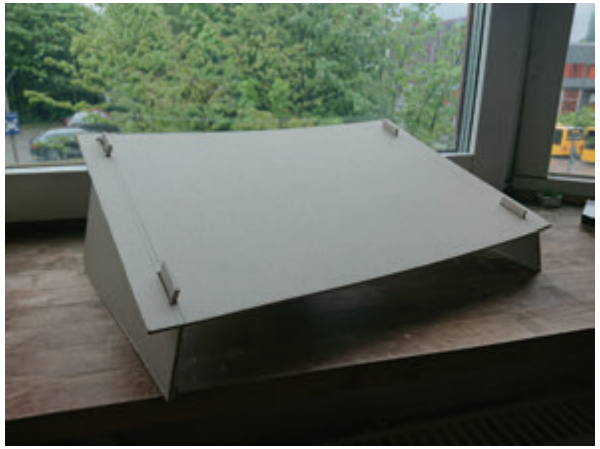
(Picture 79: idea development sketch)

The idea is to design a compact “table” which work as a laptop stand for better viewing angle, while it can be expanded to work as a table in the scenarios people like as well.



(Picture 80: geometry of a working place for digital works. Chen, 2017)

It has a 15 degree angle, which is not only a proper angle for typing (BakkerElkhuizen, n.d.), but also a common angle used by desk manufactures for a better reading/writing experience.



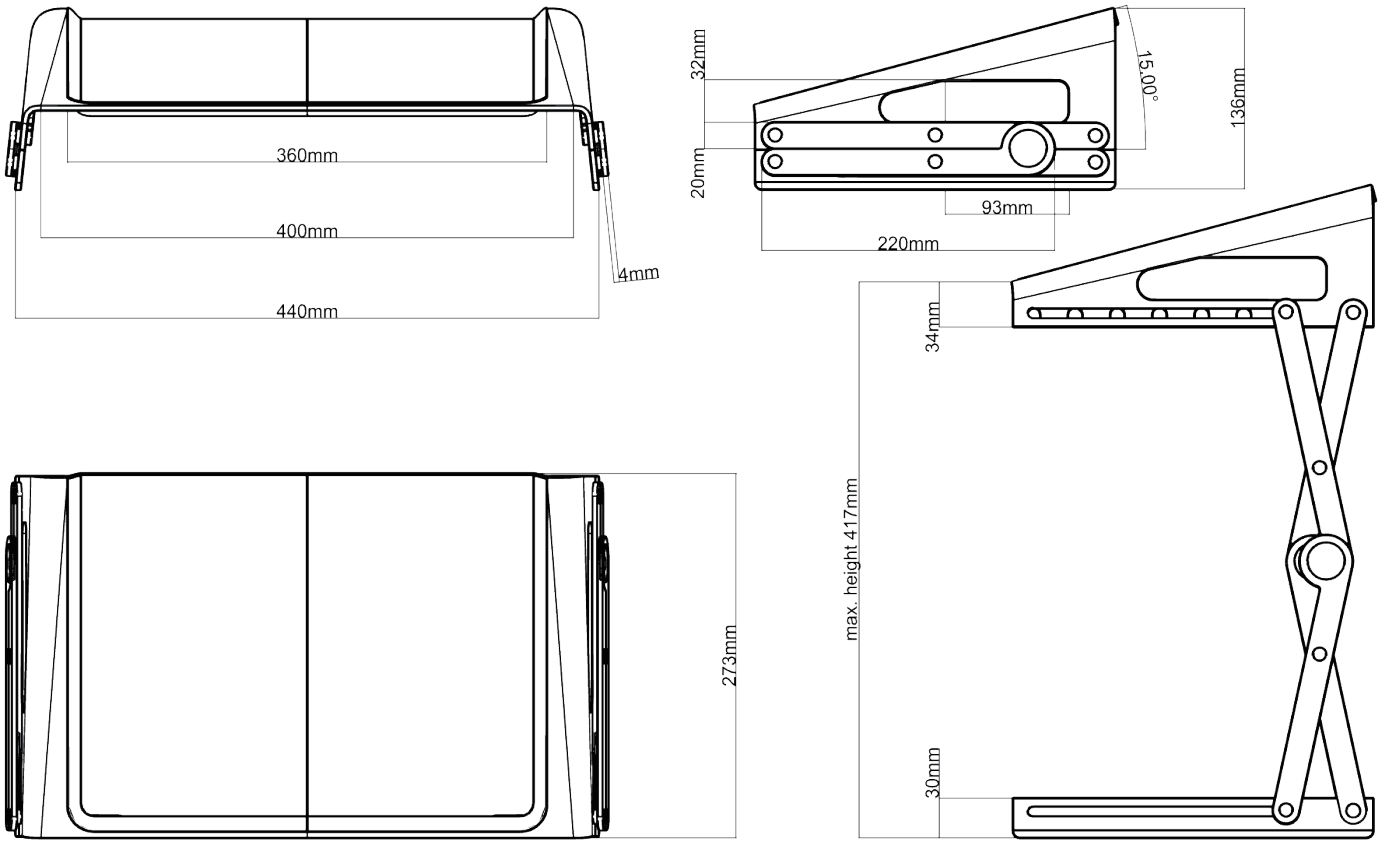
(Picture 81, 82: 1:1 form mock-up)

7.6 CAD modeling & rendering

(Picture 83: rendering of the concept)

The name of this concept is “But a Surface”. It means that it is a surface used for holding the objects on a proper height for comfortable working.

Size (Geometry)



(Picture 84: geometry and three-views of the concept)

Height: 13.6cm
Width: 44cm(min), 51.4cm(max)
Width of the laptop slot: 36cm - can hold the majority of laptops on the market
Depth: 27.3cm
Weight: 2.2kg

As mouse is not necessary for low-intensity work, to reduce the size of it, I think it is a better choice to reduce the area of the product until it can hold only the laptop. It also helps reducing weight.

The height covers the scenarios mentioned before. Also, I refer to products existing on the market, where the maximum height of a adjustable desk is usually 120cm, while the height of windowsill in my corridor is 70cm, so I tried to expand the maximum height to 41.7cm. For general environments, the level 2 or 3 (whose height are 24.8cm and 31.3cm) would be enough.

Space

(Picture 85: geometry and three-views of the concept)

When not moving it around, it works as a laptop stand without occupying much desk are.

Mobility

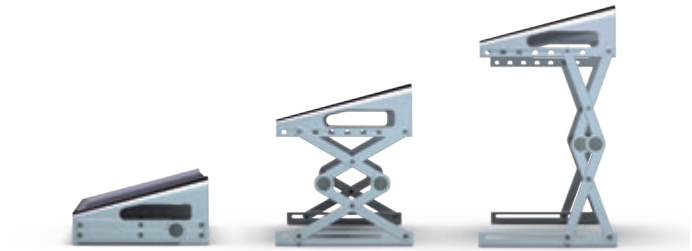
(Picture 86: rendering showing how people hold it)

With the help of the hand grips in both sides and relatively light weight (2.2kg), it can be easily carried around.

Usability

The lock is controlled by a rotation structure. When pressing it, it will be loosened, and the legs will fall down to the designated height. (see detail in the appendix)

(Picture 87: rendering showing how the control structure works)

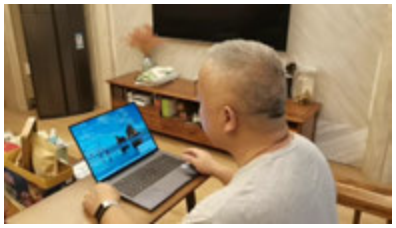


(Picture 88: rendering showing the status of different height)

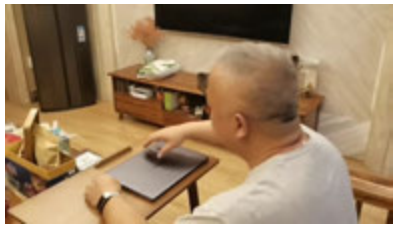
The friction is considered, so when dropping down, the speed would not be too fast, and when using it, user needs to add a force downward to give a initial speed. (see video in the appendix)

Compared with traditional products requiring the “move away” step, user can adjust its height with his/her laptop on it.

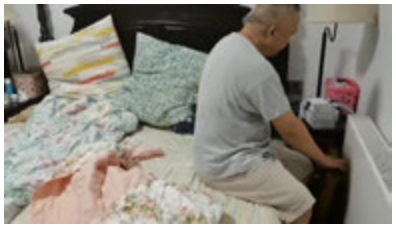
Traditional product



Work on the desk



Close laptop



Put laptop on the bed and draw out the table

Unfold the table

Bring back the laptop onto the table

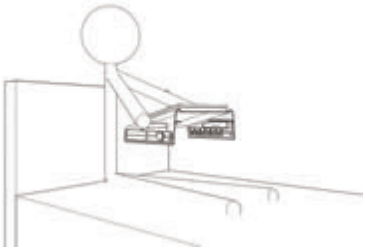
Put laptop on the bed and fold the table

Put back the table

But a Surface

Work on the desk

Close laptop



Move both of them together

Press the button and release the legs

Move to other places & repeat

Press and unfold it by pushing down

(Picture 89~93: photos showing how a traditional laptop table works)
(Picture 94~99: illustrations showing how But a Surface works)

Flexibility

(Picture 100: rendering showing how product works in different scenarios)

It can be seen from the renderings that it can work in different scenarios like studying in front of a desk, on the sofa, in front of the windowsill. These are the most welcomed scenarios

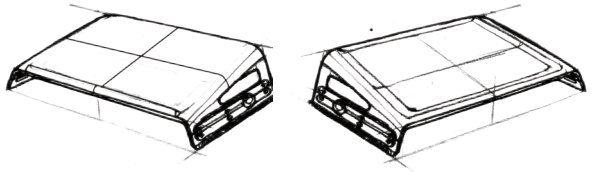
Anti-slippery


(Picture 101: the mock-up of it)

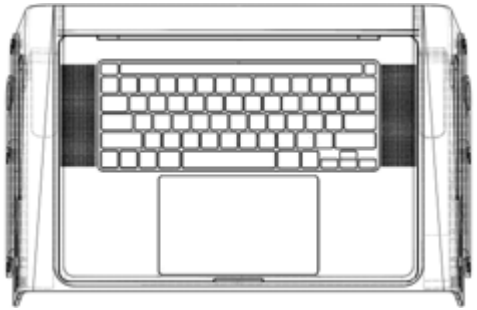
For such a product, it is important that the laptop would not fall down from the product, so a structure should be added to avoid it. (like shown in the mock-up)

The common way is to add a rubber bar in the front of it, but when sketching from its front view, I feel it not appealing. SO instead, I decided to add a concave structure on it and add rubber anti-slipping strip around the bevel.


(Picture 102: the comparison of front view of 3 proposals of the anti-slippery structure)


(Picture 103: the comparison of 2 solutions in perspective)

From the sketches of front view it can be seen that the concave structure offers a better appearance as it has smooth curve, forming a stronger sense of unity rather than simply adding several parts on one object. It also allows products of different sizes from iPad to Macbook 16.

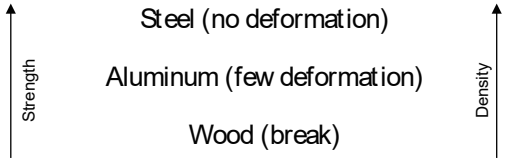

(Picture 104: how a MacBook 16 fits the concave)


(Picture 105: how a iPad Pro 12.9 fits the concave)

7.7 CMF

Material

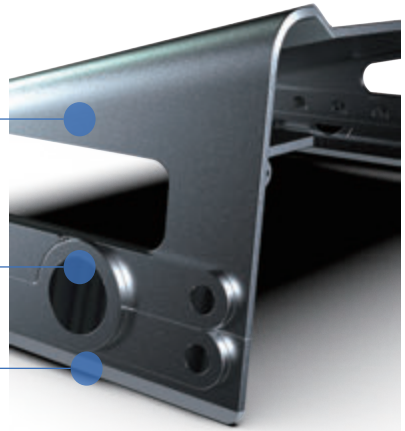
For this product, the material selection is restricted by its mechanical properties. As I cannot make full-functional prototypes now, I can only take advantages of existing products. Considering from both intensity and density, aluminum alloy is selected.



Color & finishing

The color is the original color of aluminum alloy with rough surface, while the color of rubber is brighter than the body to make a contrast. This is a common match for a laptop stand who wants to show the high-tech aesthetics.

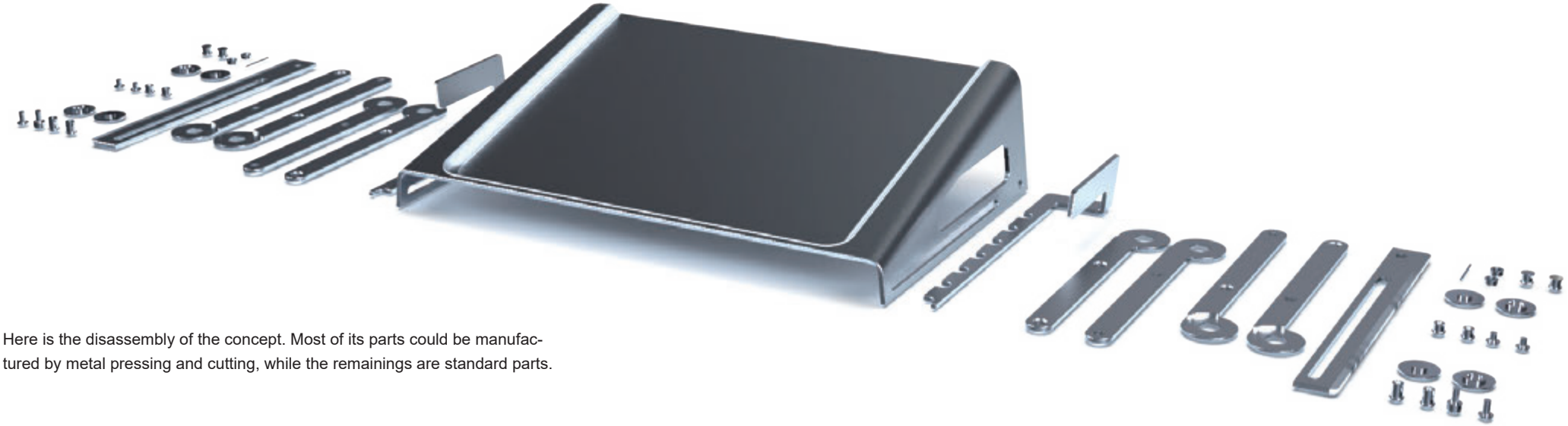
(Picture 106: rendering)



(Picture 107: rendering)

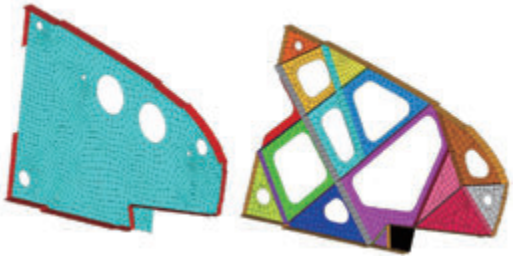
(Picture 108: a laptop stand with similar aesthetics. Satechi, n.d.)

7.8 Structure and disassembly



Here is the disassembly of the concept. Most of its parts could be manufactured by metal pressing and cutting, while the remainings are standard parts.

The product might be further simplified by applying topology optimization on its top surface. It will not only help reducing weight but assist heat dissipation. As it requires accurate simulation, here I only propose the possiblity.



(Picture 109: the disassembly of the concept)
(Picture 110: topology used for reducing the weight of a aviation part. Liu, n.d.)

8. Feedback

Here I will record the feedbacks given by the jury after the presentation, and give some short explanations.

“Without access to workshop and solid prototype, it is hard to estimate the strength of the product”

I continued testing with new mock-ups after the presentation, and as mentioned in the mockup page, the structure is stable vertically, but it shakes horizontally. It could be caused by the weak connection of the mockup or the structure itself. So I agree that it has the possibility of being unstable under current design, and further test is required if I want to turn this concept into a product.

“It has the possibility of cutting fingers”

If used correctly, I do not think it has a high risk of cutting fingers.

As shown in the picture, the part that user operate is different from the foldable legs, so as long as it is operated correctly, there would not be safety problems.

But I agree that it might be dangerous for kids who might wrongly use it, and I don’t have solid ideas about it now. Maybe adjusting the friction so that it would not fall down so fast could help a bit.

“The interviewees are limited to people around, especially family members”

I agree that it is a mistake, and I do use myself as reference too much while the topic is a worldwide problem plus I hope the potential buyer could be all who like to change position when WFH rather than my family.

“Working position and ergonomics, whether people understand it and do it”

From the results of short answers in the questionnaire, it can be seen that actually the reason for people switching position or sitting in a relaxing posture is not for ergonomics consideration, but more for comfort. Confort is not equal to “correct”, as some cozy postures loved by people could actually be harmful (like the picture on the right). When thinking about keeping fit, people would choose to sit formally in front of a desk because its height and shape are designed for that.

For this product, I hope to reach it from both ergonomics that helps putting everything on a proper height, and comfort that user don’t need to put their laptop on the legs. They are sometimes equal (for example people keeping their head down is neither healthy nor comfortable, and my proposal mainly targets at these scenarios), but sometimes not.

(Picture 111: “Ge You Tang”. Anon, n.d.)

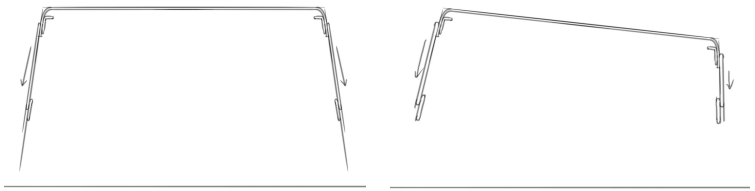
“The product is mainly manufactured by metal machining (hard tooling), which could be expensive”

The price could be a problem, as the 2nd round user research shows that the willingness of buying a new product is not that high, and the price would definitely be a factor affecting people’s decision. The problem is that I am not sure about the cost of hard tooling, because it is strange that 2 product with similar structure (they also have similar structure of my proposal) could have a huge price gap, like the foldable laptop stand I bought in Sweden for prototyping costed me 400kr while a similar product from HP sold in China costs less than 100kr. So I think the cost and price might be affected by many factors. In all, for the price, my idea is that it should be controlled to encourage people to buy it.

“When releasing the controller and have legs dropped down, how to control the height and avoid different height on different sides”

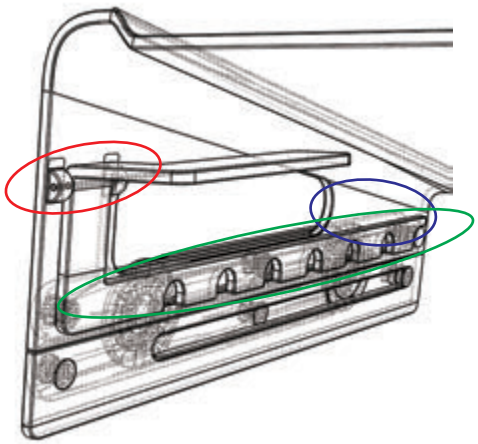
As there are several “levels” on the locking structure, the heights are designed, which means that users can only choose from those levels. When operating it, the user first hold the product to the height they want, release it, then they need to find the nearest level and lock it.

For the second question, it might not be a big problem unless user is operating it in a wrong way like the sketch shows, or they will fall down similar height then locked at the same level.



(Picture 112: sketches showing how legs would fall down)

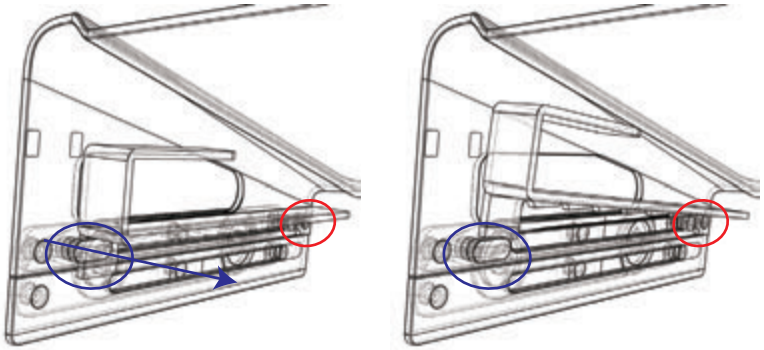
“The pivot part could be too fragile and is involving unnecessary welding”



(Picture 113: sketch showing the problems)

Here the problem is that the part in red circle, which is the only pivot of the rotating structure, is too weak to support the long lock structure in green circle, and it might cause deformation after using it for a period. Also, the welded structure in red circle is also adding the workload of manufacture.

The suggestion is to add another pivot in the blue circle area to give additional support to the lock structure.

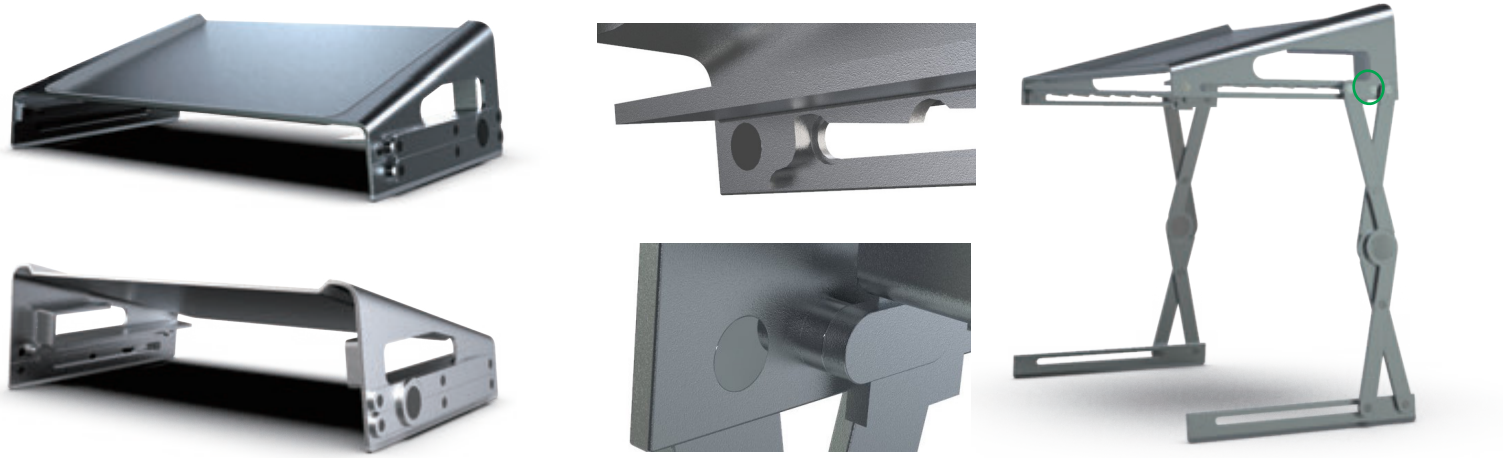


(Picture 114: sketch showing the new structure)

I re-designed the rotation structure and changed the direction of rotation. Now it has a rotation pivot in the front (red circle) and a lock structure near the end (blue circle) to avoid users adding forces vertically (blue arrow) and destroy the structure.

Changing the structure doesn’t make many differences on the appearance, and the hole is covered by the legs when folded (see rendering below). The green circle shows where the hole is drilled.

Also, the maximum height reduces as the legs are shortened (from 44cm to 38cm). According to the design research in P22, it still fits most of the scenarios.



(Picture 115: new renderings)

9. Appendix

Questionnaire links:
Questionnaire 1: https://forms.gle/GSiLJ92zzGtHEtuS9
Questionnaire 2: https://forms.gle/bFqyadZSmacBSuuv6

Questionnaire results: (there are 2 answers for each questionnaire because they are distributed in 2 platforms)
https://drive.google.com/drive/folders/1RrkQ_r4-r-JEArN-JG9CBX1-dRJBnKj2R?usp=sharing

Some videos:
https://drive.google.com/drive/folders/17BWtCdWmuZKJ39hp-drhp-SVchNvytwFn?usp=sharing

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