12-14-2021

Health, Productivity, and Engagement: Using Modular Product Design to Integrally Improve the Workplace Environment

Xinyue Guo
xg1699@rit.edu

R I T

Health, Productivity, and Engagement: Using Modular Product Design to Integrally Improve the Workplace Environment

by

Xinyue Guo

A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Fine Art in Industrial Design

School/Department of Design | Industrial Design

College of Art and Design

Rochester Institute of Technology

Rochester, NY

December 14, 2021

Committee Approval:

Stan Rickel

Stan Rickel 2021.11.29

Chief Thesis Advisor

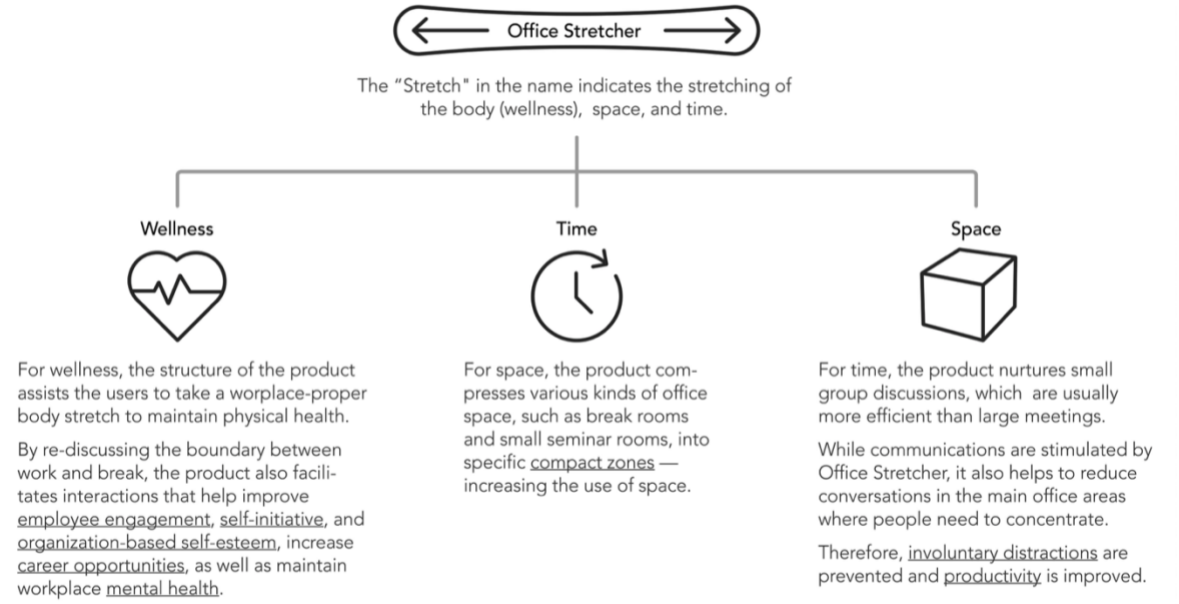
Alex Lobos

Alex Lobos 2021.11.29

Graduate Director

Abstract

With the fast pace of city life and workplace stress, there are growing concerns in relation to well-being and staying healthy. As a space that has relatively undefined functions in a work environment, breakrooms are increasingly expected to contribute to reducing these concerns. However, the vast majority of workplace breakrooms that exist are insufficiently designed achieving only basic functions such as sitting and eating. This thesis questions why existing workplace breakrooms are so neglected, when they have great potential to play a much more important role in the workplace. Firstly, this thesis discusses current literature and qualitative research on the users' expectations for breakrooms and their current status. Secondly, it studies different academic fields including health, career development, workplace behavior, and public awareness of the workplace environment as well as abstract insights from the study. Thirdly, it digests these insights and ideates design solutions from them. The design solutions take ergonomics as the most fundamental theoretical basis, develop in the modular furniture design direction, and explore the innovative interactions between the users and the objects. Finally, this thesis proposes an integrated design solution in the form of a 3D-frame-shaped modular product. The final solution identifies more possibilities in the limited space of breakrooms to maximize their efficient utilization. It tries to impact the macroscopic working environment and social awareness by re-discussing the boundary between work and breaks.



Keyword

workplace environment, workplace well-being, modular furniture, tangible interaction design, office health

Introduction

More than half of the world's population live in cities with more people still moving into cities. By 2050, two-thirds of the planet will be city dwellers.[1] People today are generally facing ever-increasing pressure both mentally and physically, which is particularly evident in people who live

1 World's Busiest Cities, British Broadcasting Corporation, 2017

and work in busy metropolises. This project is designed to help build a better working environment in crowded, chaotic, and complex cities.

Besides conventional work spaces such as office rooms and conference rooms, breakrooms are also common components of the working environment. A proper break from work is good for numerous different reasons and people nowadays recognize that. Most existing workplace break rooms are insufficiently designed and therefore meet only basic needs. The author has applied research, study, and design to create a better workplace environment.

1. Problem domain

1.1 Inspiration

Below is the experience the author had that inspired her to eventually make this project.

"It was noon on August 21, 2017. I was at 'Momosan Ramen & Sake' – a restaurant in Manhattan, New York. Even though I used to live in Shanghai where the population density is 2,059 people per square kilometer, I still experienced the most crowded and noisy restaurant environment in my whole life there. People had to speak loudly to hear each other even though they sat together. However, at 1 pm, the restaurant was almost empty. People who were eating and talking there left within about 20 minutes. Because the restaurant is located in one of the Manhattan business districts, it can be speculated that they are employees of the nearby offices. When I thought of the employees working hard in the morning and still working hard in the

afternoon after this quick and noisy lunch, I decided to make a design to provide them with a better workplace environment."

1.2 Background study

Today, many companies have already realized the importance of keeping employees healthy, satisfied, and motivated. A proper break from work can not only maintain health but also provide refreshment and productivity. Even a short break can improve concentration, alertness, and work speed as well as decrease stress and on-the-job accidents etc. A break is not sheer altruism at work; instead, organizations are simply recognizing that improving employee satisfaction will improve the bottom-line profit.[2] For these benefits, many companies have already allocated a specific area for breaks and some states in the US such as California require that both meal and rest breaks be given to employees, by law.[3]

picture 1

Although federal law does not currently require employers to provide meal, lunch, or break periods for their employees[4], there are minimum paid rest period requirements under state law for adult employees in the private sector as shown in green (as shown in picture 1).[5]

2 Kroemer, K. H. E., and Anne D. Kroemer. Office ergonomics: ease and efficiency at work. Boca Raton, FL: CRC Press, Taylor & Francis Group, 2017.

3 "State Laws on Meal and Rest Breaks". Workplace Fairness.

4 https://www.employmentlawhandbook.com/wage-and-hour-laws/meal-and-break-laws/

5 https://www.dol.gov/whd/state/rest.htm

It can be seen that people are already aware that alternating work with rest benefits both work outcomes and individual health. But this awareness has neither been embodied in the design of the breakrooms nor peoples' everyday work. The break areas are not attentively designed or organized, at the same time, employees have not yet developed the habit of using them. A survey of 200 office workers at organizations of all sizes across the U.S. and Canada by Harvard Medical School and Forbes magazine shows that 90% of employers encourage breaks; 59% of respondents believe regular breaks would improve workplace happiness; and 37% believe regular breaks would improve health. But it also shows that more than 25% of workers don't take a break other than lunch.[6]

1.3 Problem statement

The potential of existing break rooms is often ignored and therefore their utilization efficiency is low. Most of the existing break rooms are inattentively designed only meeting basic functions including seating, snacks, and drinks.

2. Research

2.1 Observations of existing breakrooms

6 "How to Create Ultimate Break Room at Work." Pinterest. September 18, 2017. Accessed September 27, 2017. https://www.pinterest.de/pin/513832638728002001/.

Below are two examples of existing breakroom styles in the current workplace environment (as shown in picture 2 and picture 3).[7,8] They both have tables, food, and bulletin boards. The first one is the type of break room for self-prepared food and gives a more homelike environment. There is no space specifically organized for socializing. The second one is the type of break room serving fast snacks and is more commercialized. It has seats and tables for people to rest and have conversations. Neither of these two typical breakrooms provides mental or physical stress relief that is proved to be important in the workplace.

picture 2

7 Employee break room at the National Weather Service Weather Forecast Office in Elko, Nevada (NWS WFO LKN)

8 Canyon Park Technology Center office break room

picture 3

2.2 Survey of people's attitude and behavior to breaks

The survey quoted in 1.2 shows that there is a big difference between people's recognition of breaks and their actual reactions to them. That is to say, there are gaps between individuals' thoughts and their behaviors in organizations. Anne D. Kroemer and Karl H.E. Kroemer made a basic organizational model that can help depict the internal and external elements that define an organization.[9] (as shown in diagram 1) This basic organizational model shows that ideally there are three aspects of an individual − thoughts, feelings, and behaviors should reach a harmonious state. But the reality is that individuals tend to do what they believe is not good for themselves. The below looks at the reasons for this contradiction and its relationship with

9 Kroemer, K. H. E., and Anne D. Kroemer. *Office ergonomics: ease and efficiency at work*. Boca Raton, FL: CRC Press, Taylor & Francis Group, 2017.

break room (hereinafter referred to as “workplace break area” for sometimes it can be an area, not an actual “room” organized for breaks). The author gets insights from a further study of the basic organizational model that will be included in the ensuing chapter 2.3.1.

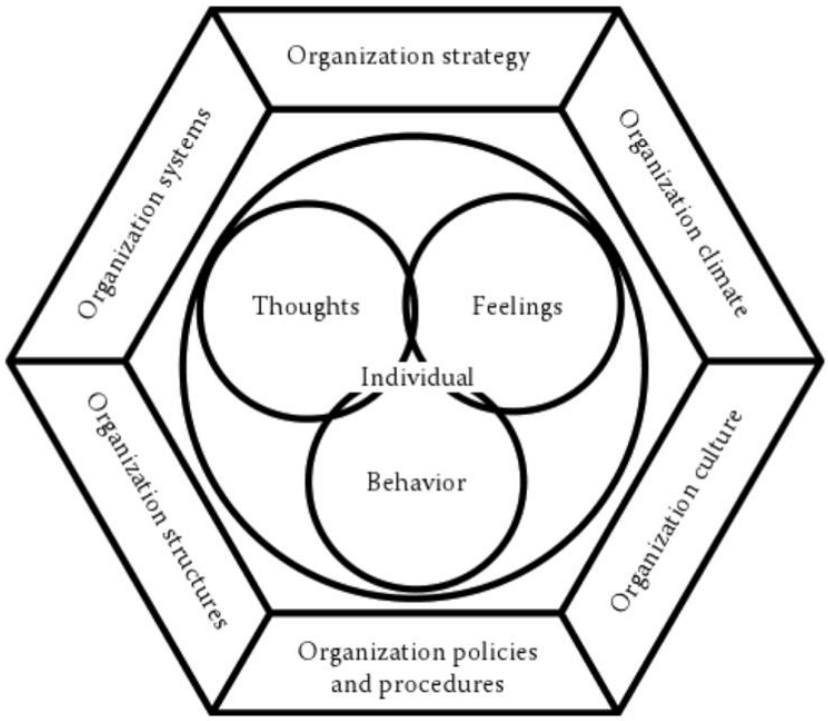


diagram 1 Basic organizational model

2.3 Literature review (critical insights)

2.3.1 Notion of workplace psychological health

By analyzing the basic organizational model, including both the individuals and the environment - the organization where the person operates in were looked into to create a better workplace experience.

As shown in above diagram 1 the individual is at the center of the organization's operations. Ultimately, companies are made not of the external elements of theories, structures, and machines but instead of living, breathing— and interacting— people. People affect the organization and the way it functions, and in turn, the organization affects these individuals. Because of these bidirectional influences, the work of helping people stay healthy (both mentally and physically), keeping them satisfied, and helping them interact with each other successfully at work matters to both individuals and the companies.

However, as the two examples above show, the typical existing workplace break areas provides elements such as coffee and snacks to build a physically safe workplace, but rare elements can be found that help form a psychologically safe environment. A psychologically healthy workplace is one in which employees have the ability, freedom, and comfort level to think, feel, and behave in a manner that enables effective performance in all areas of life and work. This type of environment is where employees feel safe, respected, and appreciated by their leader and the organization, which in turn enhances productivity and morale, increases positive work attendance records, and creates fewer short and long-term disability claims.[10]

Workplace mental health is important for many professional reasons. It is important for building and maintaining professional networks that include and support all workers, helping

10 Lisa Y. Adams, Msc Rn Lisa y Adams Phd, Workplace Mental Health Manual for Nurse Managers. Springer Publishing Company, 2014.

to avoid conflict among colleagues, multitasking, increasing focus and concentration, and promoting patience and respect between colleagues.[11]

Although society today is talking more and more about mental health, and we have made great progress from the days when mental health was an avoided topic, it is just easier for employers to only consider the physical environment and ignore the psychological one. The reasons may be that improving the workplace break areas costs time and effort for the employer, and they believe spending time in the workplace break areas will reduce productivity, which has actually been approved wrong.

In response to this situation, this project is developed in consideration of both physical and psychological health in the workplace. Research shows that there are several principles and concepts that are important to achieve a psychologically healthy workplace. These principles include making information available, developing or enforcing standards and best practices, supporting early intervention, ensuring fair and equitable claims practices, promoting mental health services, offering and enhancing educational efforts, having supportive people at work whom colleagues can talk to, open communication, and positive work culture.[12] A primary focus on needs; recognition that health is determined by many interdependent factors; promotion of employer and employee joint responsibility; and assessment, evaluation, and continued quality improvement are integral.[13] Because the functions of the workplace break

11 Advisory, Conciliation, and Arbitration Service, 2013

12 Lisa Y. Adams, Msc Rn Lisa y Adams Phd, Workplace Mental Health Manual for Nurse Managers. Springer Publishing Company, 2014.

13 National Quality Institute, 2012

area are relatively undefined while other parts of the work environment are more specific (office rooms are work zones; conference rooms are meeting zones; dining halls are for meals etc.), it is more expected to make a revolution to play its full potential and to achieve the above principles. This project will be part of the revolution that improves workplace break areas from monotonous to diversification. Therefore, according to the above principles and the human engineering theories, this project widely explores interpersonal interaction as well as the interactions between people and objects. During the exploration process, combined with continuous research, these interactions were found to not only contribute to the sustainability of good workplace health but also to influence workplace behaviors and staff engagement positively.

2.3.2 Notion of workplace engagement

Research shows that group activities in the workplace such as peer appraisals and small group discussions can help reduce involuntary interruptions made by the managers and other coworkers as well as increase the organization-based self-esteem (OBSE).[14] These activities also follow the principles of achieving psychologically healthy workplaces. Workplace break areas are considered the most appropriate site for these activities within the workplace environment because of their potential in functionality.

As a type of feedback system in the performance appraisal process, peer appraisal provides insight into an individual's interpersonal interactions and skills and helps with team building.

14 https://economictimes.indiatimes.com/definition/peer-appraisal

Good peer appraisal helps to create a closely-knit team environment where people provide support to each other and are committed to the organizational goals.[15]

This project provides a tangible product design for a small group of people to gather around so that the staff have a space where they can have face-to-face peer appraisals in a more participatory way. Different from writing appraisals down in a static document, this face-to-face communication minimizes the chances of misunderstanding and gives more opportunity to get involved. People have a greater sense of engagement and feel more responsible when they provide insight into teammates' interpersonal interactions and skills.[16]

It helps to build an individual's organizational-based self-esteem through their participation in activities like peer appraisals as well.[17] Organization-based self-esteem (OBSE) is a role-specific type of self-esteem that describes employees' beliefs about their value and competence as a member of an organization. It is positively related to job satisfaction, organizational commitment, job involvement, performance, and organizational citizenship behavior. While simply taking a break can provide a psychological and physical refresh, regular and informal organizational interventions held in the workplace break areas can increase the perception of autonomy or support and may lead to greater OBSE among employees.[18] These activities can be organized or spontaneous. And unlike other team-building activities, they don't need a large amount of time and can make use of the break time. They also don't need a special place or a

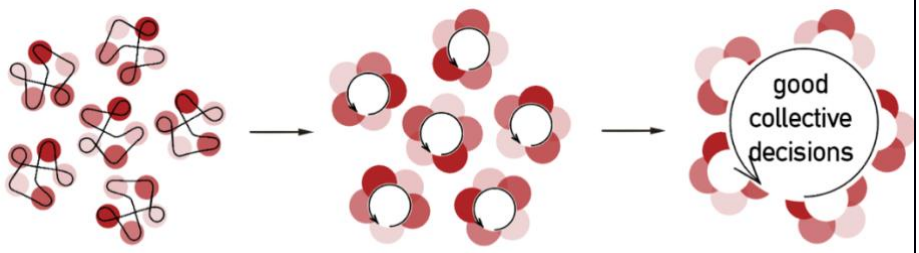
15 https://economictimes.indiatimes.com/definition/peer-appraisal
16 Peer Appraisal: An Uncommon But Useful Approach to Performance Evaluation
17 http://www.ioatwork.com/organization-based-self-esteem-its-good-for-me-and-the-bottom-line/
18 http://www.ioatwork.com/organization-based-self-esteem-its-good-for-me-and-the-bottom-line/

large amount of space. Thus, integrating breaks with organizational activities like peer appraisals and organizational interventions can not only save time and space, but also help increase staff engagement and OBSE.

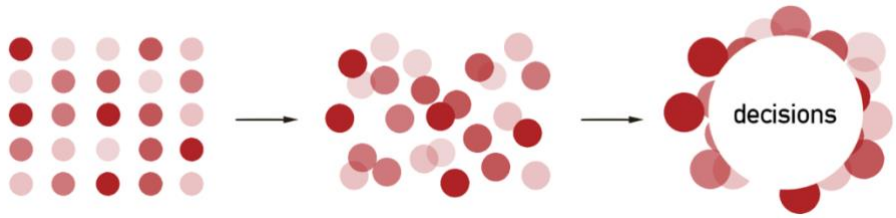
2.3.3 Notion of workplace productivity

A small group discussion is another type of activity that can be integrated into a short break from work. Neuroscientists Mariano Sigman and Dan Ariely inquire how people interact to reach decisions by performing experiments with live crowds around the world. They found that the same crowd of people collectively comes up with better judgments after discussing with others in small groups made up of three to five people.[19] (as shown in Form 1)

Form 1 Small group discussions help achieve good collective decisions

Experimental group	Form people into small groups	Discuss in small groups firstly	Comprehend the results of small groups into collective decisions
			
Control	The same group of people	Discuss freely	Average result =group decision

19 Mariano Sigman, Dan Arienly, "How can groups make good decisions?" TED TALK, 2017

group	

Based on this experiment, small group discussions are believed to be another type of positive organizational activity that people can leverage to build a better workplace environment. On the one hand, the small group discussion helps to bring better decisions; on the other hand, it helps increase workplace productivity. By talking about the meeting content in advance in the workplace break area at a flexible time, staff can make more efficient use of the official meeting time with a preliminary conclusion. Furthermore, when the staff have the consciousness of small group discussions, they will look for opportunities to talk to others in the workplace break area instead of interrupting others from work in the office area where people try to focus. That means that small group discussions can help reduce workplace involuntary interruptions. A diagram is made to visualize the relationship between each research insight (as shown in diagram 2).

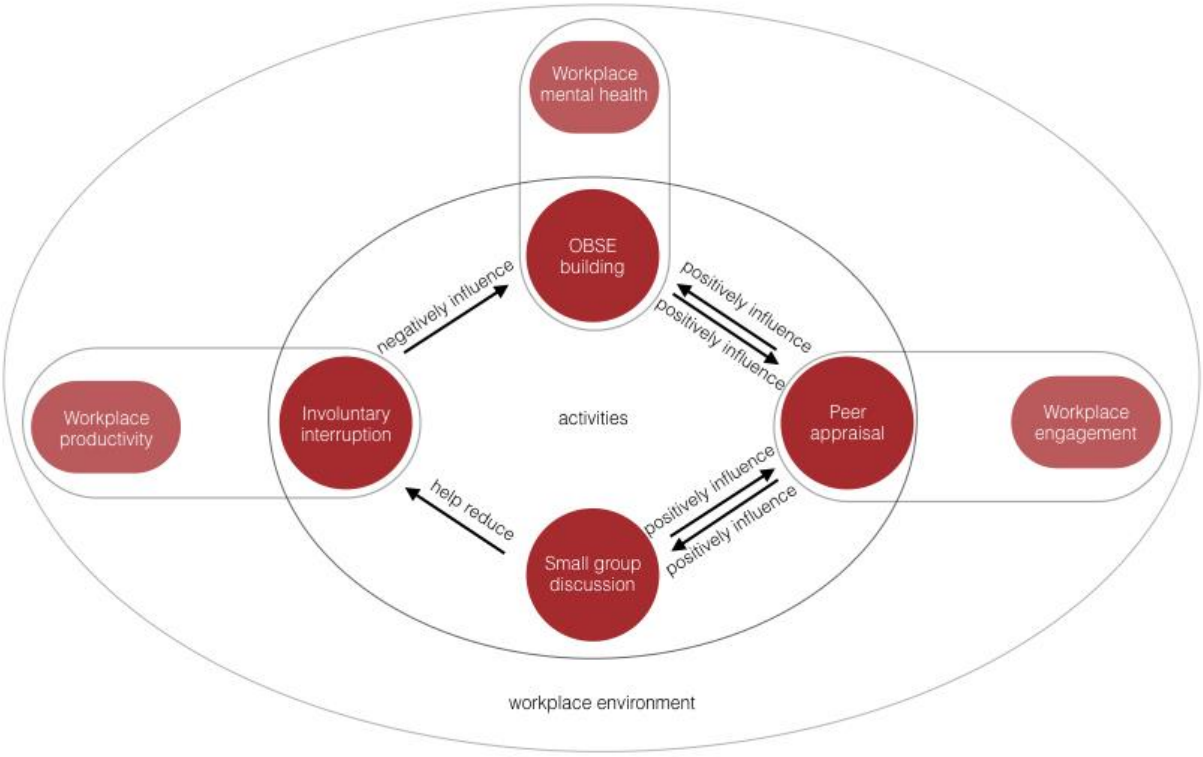


diagram 2

2.4 User Interview

After the secondary research, semi-structured interviews were conducted to figure out the user needs and study the specific user pain points regarding the current situation of workplace break areas. A semi-structured format was chosen so that there could be more consistency across the questions as well as the potential to explore the problem space. There were four target users interviewed in total. The results and the insights of the interview are presented below.

2.4.1 Interviewee 1 - Jinsong Zhao

Jinsong was 46 years old, working as a creative director at Aurora Group, one of the leading brands of the Office Automation industry in Asia. He managed a team of 14 people and had his

own office in the group's Shanghai branch. As a mid-level manager, he felt that his days were filled with big and small meetings. He said that he felt nothing could be done but attending meetings every day.

Summary: Jinsong is a manager who wanted to improve work efficiency

2.4.2 Interviewee 2 - Chelsea Lee

Chelsea worked at a startup design studio as a 3D designer, and she was 28. Instead of having a break room, her company only provided a small break area beside the office tables. Chelsea said she would still talk about work with her colleagues while taking breaks. For her, the breakroom is just another office room with coffee and tea.

Summary: Chelsea is an entry-level employee who needed more real breaks from work.

2.4.3 Interviewee 3 - Summer Shen

Summer worked at Vogue China as a journalist, and she was 25 years old. She liked to do some stretches such as simple yoga movements to get rid of her body stiffness during work breaks. She sometimes goes to the restroom to do the stretches if there were people in the break room to avoid awkwardness.

Summary: Summer is a yoga enthusiast who wanted more space and equipment.

2.4.4 Interviewee 4 - Harrison Yang

Harrison works at Citibank London as a junior data analyst, and he is 26. He said that he is often interrupted by his manager during work and asked to do something else such as write a

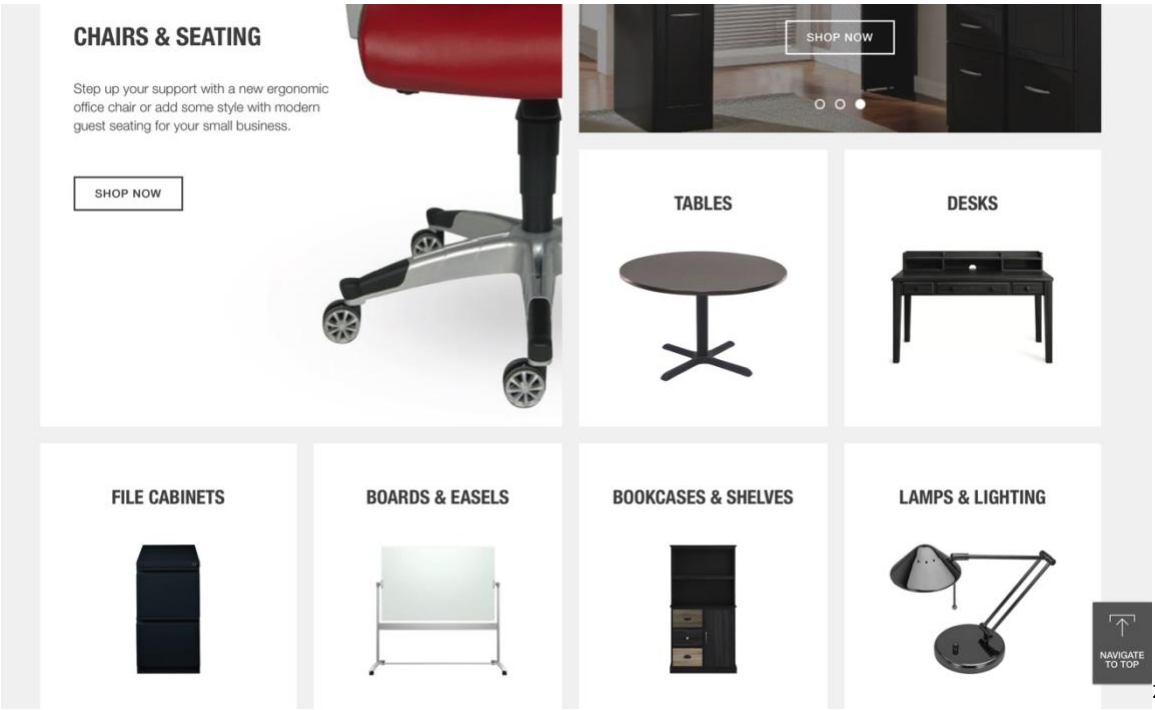
quick report. This interruption can annoy him. And in the break room, he likes to take a break from work or deal with some personal issues.

Summary: Harrison is an individual contributor who is tired of workplace interruptions.

2.5 Benchmarking

There were limited categories for office furniture and supplies on the current market, which mainly included seating, desk and table, cabinet, and shelf (as shown in picture 4). While products specifically designed for the workplace break area could hardly be found in the market, there were designs published in professional journals, that explore innovative solutions for offices and break areas. For example, there is a table designed for break rooms and it has three desktops at different levels and the designer raises distinct interactions between the user and the object (as shown in picture 5

picture 6).



20

picture 4


21


22

picture 5

picture 6

20 https://www.staples.com/Furniture-Chairs-Cabinets/cat_SC2
21 Asensio, Oscar, and Montse Borràs. Office Furniture Design. Gloucester, MA: Rockport, 2006.

2.6 Conclusion of the research

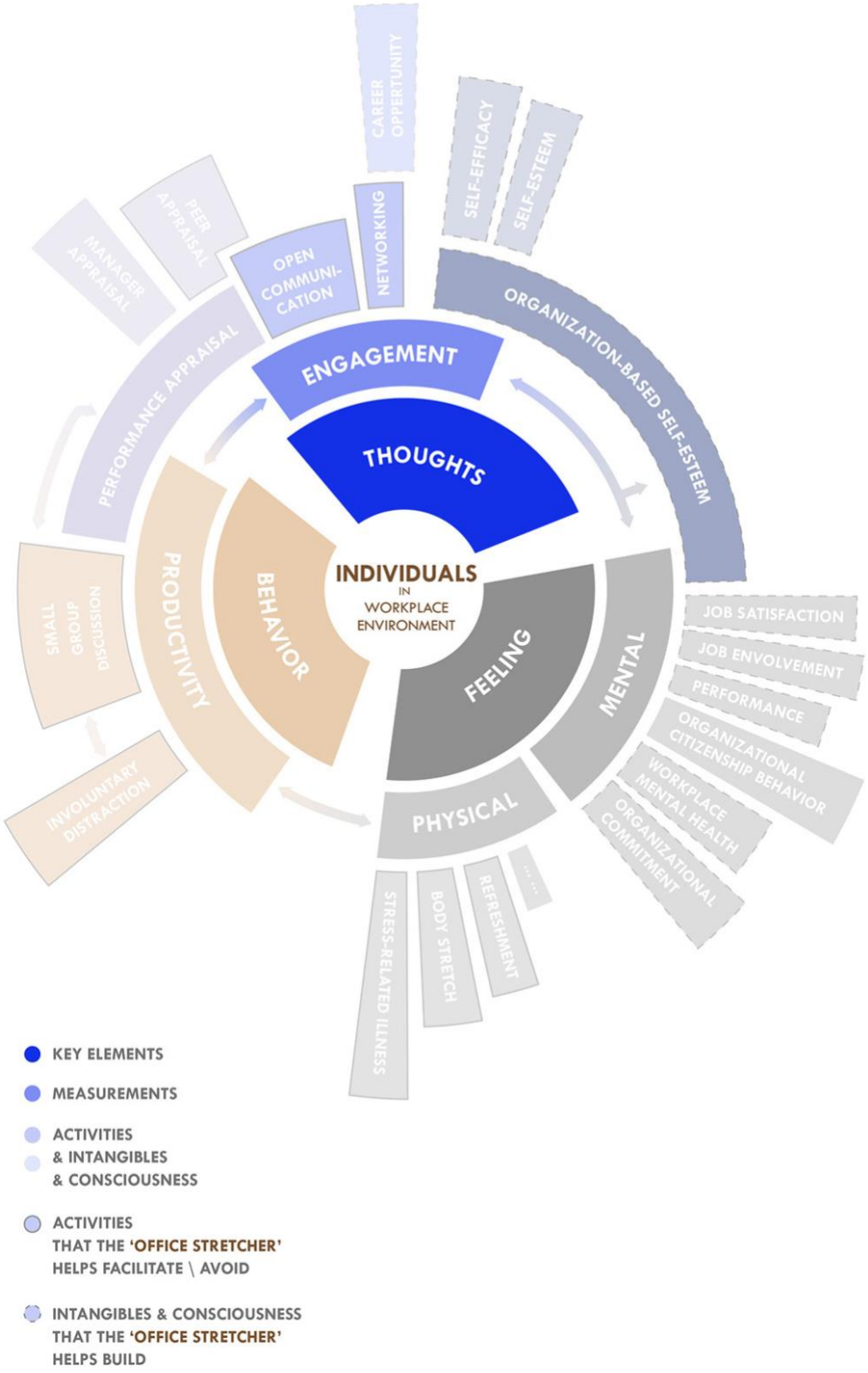


diagram 3

After integrating the research results and the insights, the overall findings were developed into a diagram by visualizing the relationships between each piece of the information (as shown above in diagram 3). In the diagram, the more central elements are at a higher-level hierarchy in this study of the workplace environment, and the individual is at the center of this diagram. The fact that an individual is at the center of the organization's operation determines that this thesis project is working on a human-centered design.

3. Design Initiation

3.1 Project rationale

A proper break from work is good for lots of reasons.

↓

Most of the existing "workplace break areas" are insufficiently designed.

↓

Need to maximize the utilization efficiency and explore more functional possibilities of the "workplace break area".

3.2 Design proposal

This project will design an integrated solution for workplace break areas to optimize space utilization and provide unlimited functional possibilities including improving health, motivating interactions, refreshing, increasing productivity, and facilitating networking. The end goal is to create a better work environment to benefit both employers and employees.

3.3

Brainstorm

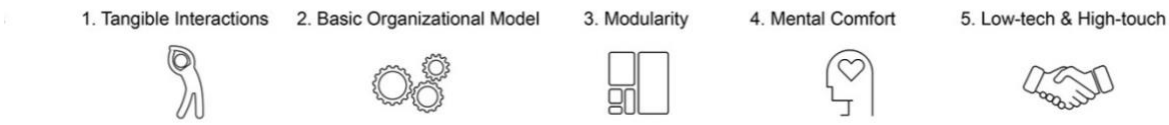
picture 7 brainstorm

4. Design process

4.1 Design Goals

The design aims to find a method that breaks the boundaries between work and rest to build better workplace environments where individuals are more engaged, more efficient, and maintain both physical and mental health. The design concepts will comprehend various academic fields including health, furniture design, interaction design, and workplace psychology. The final product aims to gradually help the individuals to realize that work and rest can happen simultaneously, anytime, anywhere, and, to work with a more flexible

and efficient style. It should emphasize the importance of exploring the possibilities in the workplace and leveraging the most succinct and direct structure and materials without relying on any high-tech solutions. Furthermore, despite the traditional body postures in the office such as sitting and standing, more innovative ones should be involved in the design. Below is a conclusive list presenting the five key design goals (as shown in picture 8).

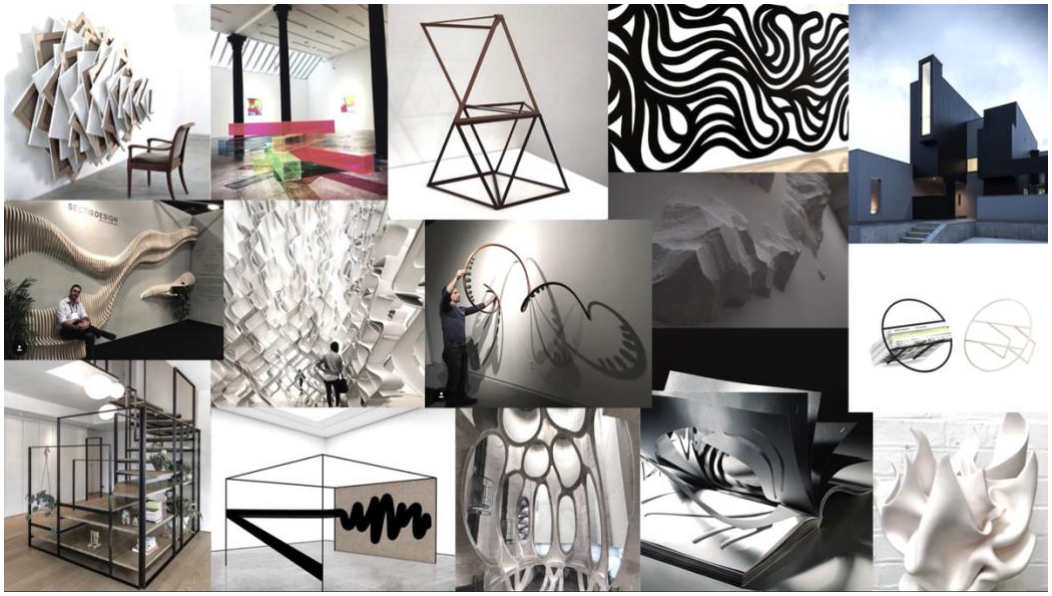


picture 8 key design goals

4.2 Form exploration

4.2.1 Inspiration and mood board

The author took inspiration from interactive installation art and believed there were design opportunities by functionalizing those artistic forms. Furthermore, she thought that the integration of fine art and product design was meaningful to both of these two fields. Leveraging the form and spirit of art pieces in the design of daily objects, the beauty of art can be brought to the users' everyday life. Meanwhile, including practicality in artworks will stimulate their original vitality and help the development of interactive installation art. Below is a mood board made for this project that collects various forms from the field of interactive installation art (as shown in picture 9).



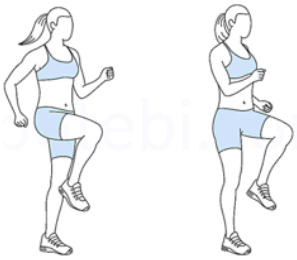
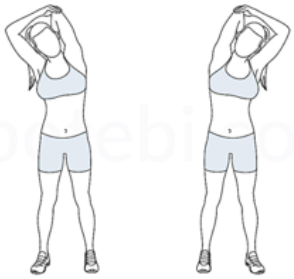
picture 9

4.2.2 Research of body postures

Besides the traditional body postures people use in the workplace such as sitting and standing, the author explored more unconventional ones such as yoga and fitness postures to involve healthy and innovative interactions in the design. Below are three examples of innovative postures that are both office-appropriate and good for health. (as shown in form 2).

form 2

Name of the body postures	Illustrator	Primary muscle	Secondary muscle

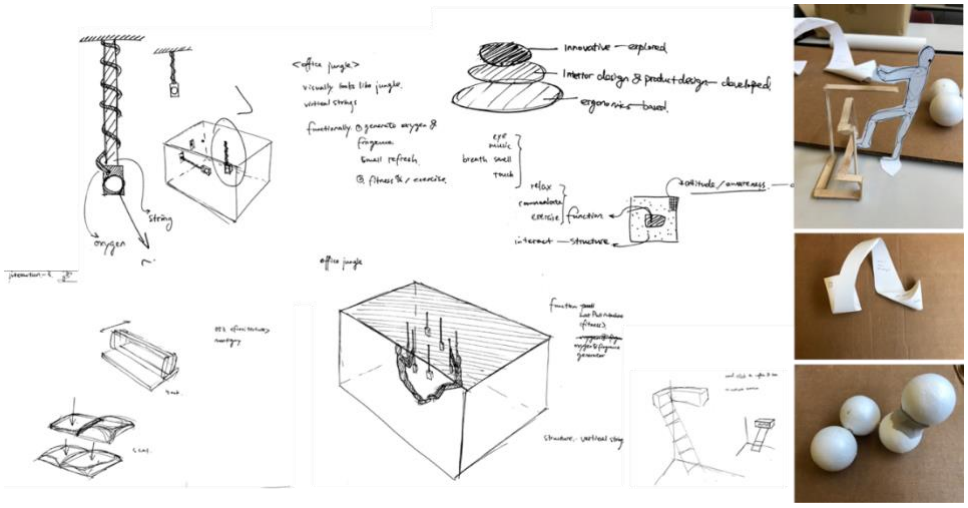
Neck stretch		Neck	Shoulders
Run in place		Thigh muscles	Abs, back, arms
Triceps stretch		Triceps	_

22

22 https://www.spotebi.com/exercise-guide/leg-exercises/

4.3 Ideation

The idea aims to explore the possible forms and functions for this project, and it was presented by quick hand sketches and quick 3D mockups (as shown in picture 10 initial ideation).



picture 10 initial ideation

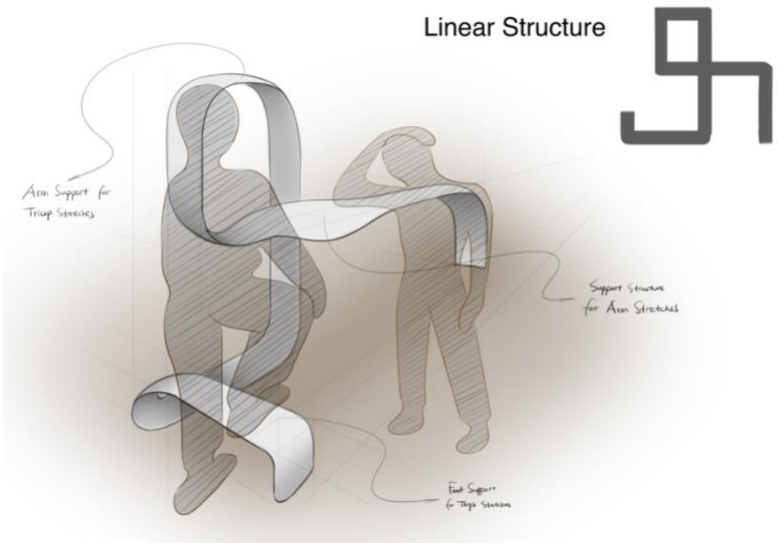
4.4 Preliminary concepts

4.4.1 Concept 1 – The Linear Structure

The linear structure concept is designed to build a three-dimensional frame-structured modular product that provides the supports needed for the users' body stretching gestures such as the ones shown in form 2. Through modularity, the product can accommodate a number of users ranging from two to five, which is suitable for small group activities such as peer appraisals and pre-meeting discussions. Below is the sketch and the quick 3D

mockup of this concept (as shown in picture 11

picture 12).



picture 11

picture 12

4.4.2 Concept 2 – The Circular Structure

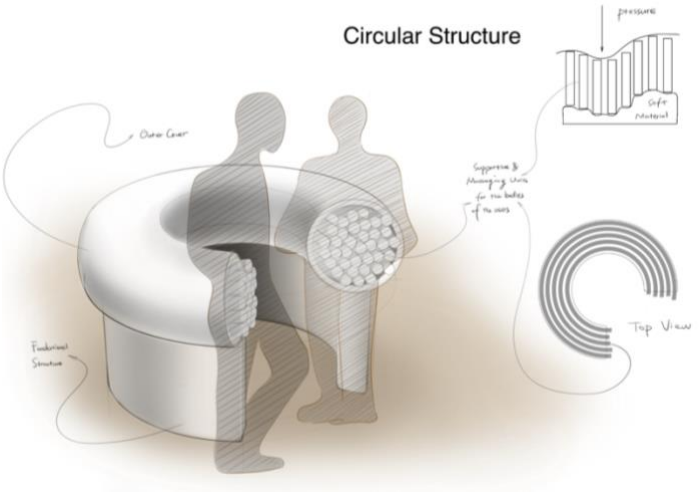
The structure inspiration of the circular structure concept is the CHIQUITA stool designed by Kenneth Cobonpue (as shown in picture 13, picture 14, and picture 15). In this concept, there are rattan poles covered in a shell-shaped structure as shown in the sketch and the quick 3D mockup (see picture 16 and picture 17). When a user leans on one side of the product, he/she actually leans on the rattan poles and the poles move inside the shell. If there is another user leaning on the other side of the product spontaneously, he/she will feel the movement of the poles. This kind of

motion is supposed to help motivate communication between the users in the workplace environment.

picture 13

picture 14

picture 15



picture 16

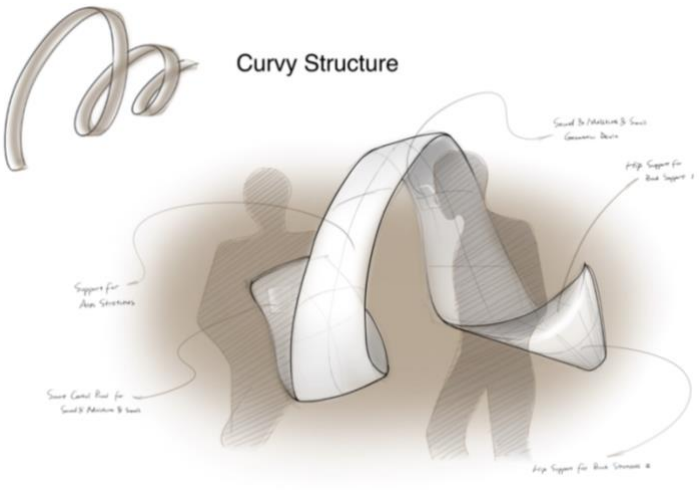
picture 17

4.4.3 Concept 3 – The Curvy Structure

The structure inspiration of the curvy structure concept is a sculpture made from a piece of wood, created by Jesse Walp, a sculptor (as shown in picture 18). Leveraging different parts

of the continuous spiral structure, people can get the body support they need for multiple resting positions as shown in the sketch and the quick 3D mockup below (as shown in picture 19 and picture 20).

picture 18



picture 19

picture 20

4.5 Concept evaluation

Leveraging the method of a decision matrix, the three preliminary concepts were evaluated from six perspectives including functionality, mass production cost, manufacturing complexity, design opportunity, space consumption, and possibility for modularity. Below is the evaluation result (as shown in

	Linear Structure	**Circular Structure**	**Curvy Structure**
Functionality (weight: 5)	5	3	4
Mass production cost (weight: 5)	5	4	4
Manufacturing complexity (weight: 5)	5	4	3
Design opportunity (weight: 3)	5	2	5

Space utilization (weight: 2)	3	4	5
Possibility for modularity (weight: 3)	5	1	3
Score	**111**	**72**	**69**

form 3 Decision matrix).

form 3 Decision matrix

	Linear Structure	**Circular Structure**	**Curvy Structure**
Functionality (weight: 5)	5	3	4
Mass production cost (weight: 5)	5	4	4
Manufacturing complexity (weight: 5)	5	4	3
Design opportunity (weight: 3)	5	2	5
Space utilization (weight: 2)	3	4	5
Possibility for modularity (weight: 3)	5	1	3
Score	**111**	**72**	**69**

Notes: evaluation criteria -

for *functionality*, the better the concept will function, the higher the score will be.

for *mass production cost*, the lower the estimated cost of the concept, the higher the score will be.

for *manufacturing complexity*, the easier to manufacture, the higher the score will be.

for *design opportunity*, the more design opportunity the concept was expected to have, the higher the score will be.

for *space utilization*, the higher space utilization of the concept, the higher the score will be.

for the *possibility of modularity*, the more possibility for the concept to be developed into a modular product, the higher the score will be.

Based on the evaluation result, the Linear Structure concept was selected as the final choice for the next step of development.

5. First-round usability tests

5.1 Testing Method

The UX methods used in the first-round usability tests were field observations and user interviews.

To observe users' reactions toward the Linear Structure concept, a full-scale test prototype was made with two-by-four lumbers. The full-scale prototype was placed in the public area of the RIT CAD school building and it welcomed all students and faculty to interact with it. There were no instructions or interruptions during this testing process, which means, the users were completely free to decide how they were going to interact with the product, which part of the product they would like to use, how long they would like to use it, and even, whether to use it or not. All the interactions were spontaneous activities. And with the permission of the users, all the observations were photo-documented for later study.

After the field observations, user interviews were conducted to assess what users felt and thought when they were using the product.

5.2 Testing plan

Please see the below form for the detailed testing plan.

Form 4

Aspects to Test	**Methods and Goals**
Structure	The full-scale prototype will be placed at different open areas on campus and users' reactions towards the prototype will be recorded. Users will be welcomed and be given as much freedom as possible to interact with the prototype. The observation will focus on how people interact with the prototype and how they interact with each other around the prototype. The detailed observation aspects include but are not limited to: users' gestures, how users interact with each other around the prototype, what their relative positions are, and activities users do around the object. By observing the users' behaviors, the end goal is to figure out the parts of the overall structure that are more attractive for users to determine which parts to focus on in the next step, and which parts can be streamlined.
Material	Since the current prototype tends to fall at a certain turning point, some additional support needs to be added to improve the balance of the whole structure or the overall material needs to be changed into one that is more malleable and consistent, such as metal. As other materials and manufacturing methods, such as metal casting, may require higher production costs, production time, and transportation costs etc., these factors should also be included in the final consideration along with the user testing results. The end goal is to comprehensively evaluate which solution provides a better way to improve the balance of the product, by modifying the structure or changing the material.

Function	User interviews will be conducted to figure out if the users need any attached functions such as a calming scent, relaxing sound, different humidity, or different temperatures. The end goal is to gain more empathy with the users and learn about their ultimate needs from user interviews.
Shape	For now, the shape of the final concept is all linear. It needs to be tested whether the users would like it to have more curvy shapes to feel warmer and more welcoming or if they appreciate the architectural aesthetics of the current linear design better. Also, it needs to be taken into consideration that curvy shapes are harder for production, especially for mass production, and they have higher costs. The end goal is to get user feedback from user interviews, and then come up with a comprehensive shape solution for the next step of concept development.

5.3 Testing process and documentation

5.3.1 User interaction

During the process participants were tested using the prototype, and their interactions were photo-documented for further study. The results are as shown in

picture 21. After participants finished using the product, semi-structured user interviews were conducted to learn more about their overall user experience and their answers to the questions raised in Form 4. After that, following the voluntary principle, they were asked to provide their information including name, height, weight, age, and gender so the design could be developed to suit a wide variety of users. The results are organized into form 5.

picture 21

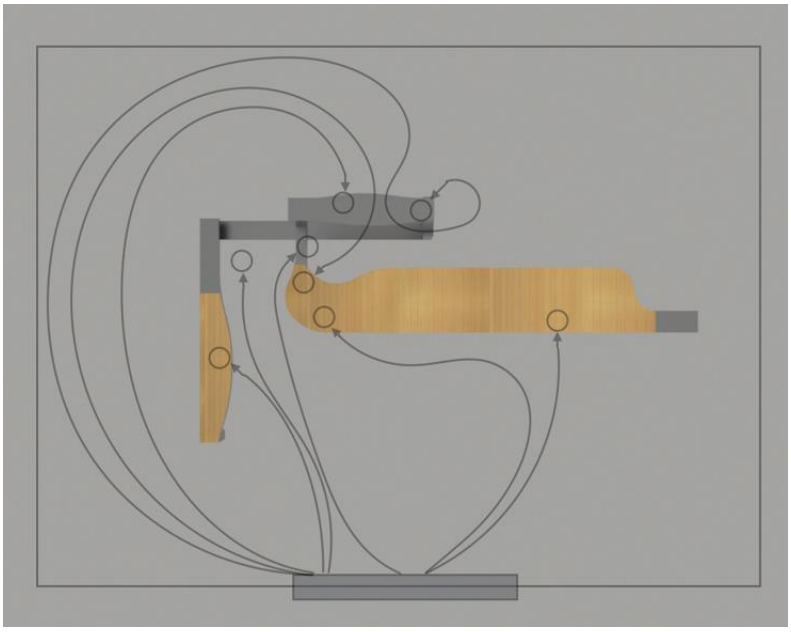
Name	Height	Weight	Age	Gender
Elmie				F
Maittrayee	5'	51kg	26	F
Jimmy	5'7"	65kg	25	M
Vincy				F
Mintes	5'8"	68kg	26	M
Weiying	5'4"	60kg	25	F
Meng	5'5"	57kg	25	F
Lily	5'7"	54kg	24	F

form 5

5.3.2 Path and interaction mapping

After the testing, a user path and interaction map were made (as shown in picture 22 user path and interaction mapping) to summarize users' trajectories. In this mapping, the lines represent the users' path of getting access to the product and the circles represent the spots that users remained. A trend can be seen from the mapping that users tended to approach to the product from the left side and they preferred to stay on its left side.

In summary, this mapping visually documented that, compared to the right part of the prototype, there were more users walking by and interacting with the left part of it.



picture 22 user path and interaction mapping

5.4 Insights of the first-round usability tests

5.4.1 Users interacted with the product generally as it is designed to be used.

By observing the user interactions during the testing and looking into the photos afterwards, it can be found that although the body positions the participants used during the testing were more natural and casual, generally, users were enjoying using the prototype as it was intended to be used, which was office-appropriate stretching on necks, triceps, and thighs.

5.4.2 Users can be creative and beyond

The users reported that they felt refreshed and relaxed while using the product. In this relaxing atmosphere, some users came up with innovative ways to interact with the prototype, which were not the preset ones but also encouraged, because they are suitable for the workplace environment as well. Furthermore, the innovative interactions users came up with added even more fun to the overall user experience.

5.4.3 Less is less

While we have talked a lot about “less is more” in design, sometimes less is just less. In this project, although the product’s original structure had a strong simplicity, there was an unstable joint on one of the corners. Therefore, some support needs to be added to the joint to improve stability and help the product function better.

This insight also aligns with the concept of “form follows function”.

5.4.4 The product structure can be simplified

The user path and interaction mapping (as shown in picture 22) indicated that the left part of the prototype attracted more users and had a more approachability-inviting quality compared to the right part. Also, considering the footprint of the product, the structure could be simplified by only keeping the more attractive part of the product. In this way, the product could be more space-saving, and consequently adapt to more offices of different sizes.

5.4.5 Modularity creates more possibilities

Developed based on the testing insight in 5.4.3, this product can be further designed modularly so it can fit different sized offices no matter if they have small break areas or large bream rooms.

6. Concept iterations

6.1 Iteration directions

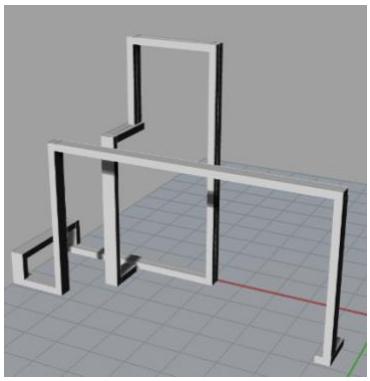
Based on the insights of the first-round usability tests, iterations will be conducted in the following four directions:

- Improve stability of the product structure
- To improve space utilization, simplify the overall product structure
- Develop the preliminary concept into a modular solution, allowing users to build products of different sizes according to their unique needs
- Design a user guideline to inspire users with some recommended interactions

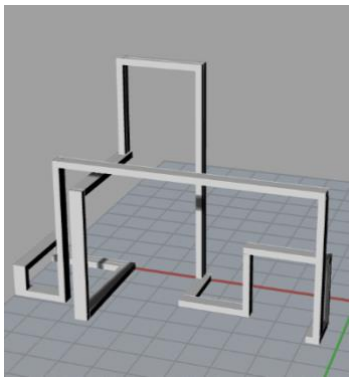
6.2 Iterative process

6.2.1 Iteration step 1 - Stability

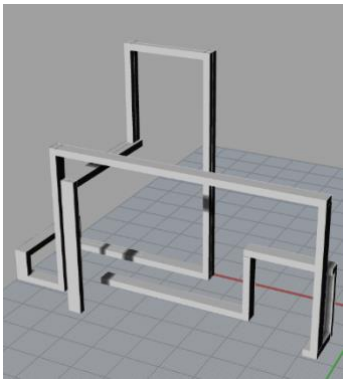
By adding support to the unstable place and integrating it with the rest of the structure in three different methods, there were three iterated versions that perform better at balance and stability (low-fidelity prototypes as shown in picture 23, picture 24, picture 25).



picture 23 version 1-1



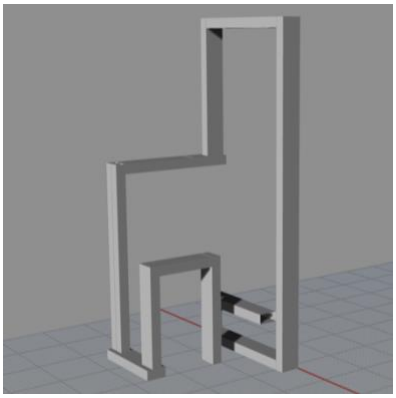
picture 24 version 1-2



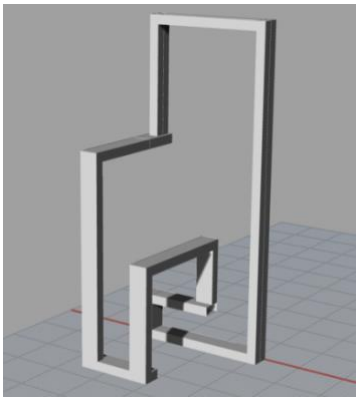
picture 25 version 1-3

6.2.2 Iteration step 2 - Simplicity

To improve office space utilization, the product structure was simplified by only keeping the parts that stimulate more user interactions. Based on the first round of iteration, there were two iterated versions that performed better at space utilization (low-fidelity prototypes as shown in picture 26, picture 27). Compared to version 2-1, version 2-2 was composed of a continuous end-to-end structure, as a result, in terms of functionality, it had a more stable structure, in terms of form, it had more consistency. Therefore, version 2-2 was selected for the next step of development.



picture 26 version 2-1

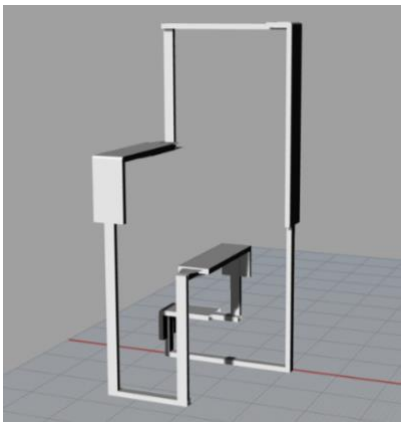


picture 27 version 2-2

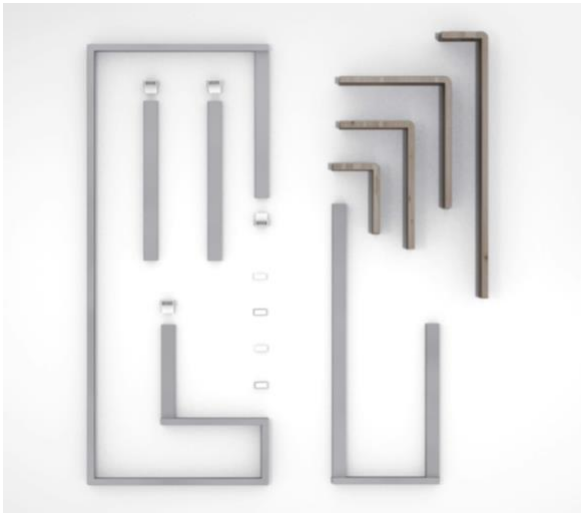
6.2.3 Iteration step 3 - Modularity

Based on the second round of iteration, platforms were added to version 2-2 where users usually need more body support or places to put things (as shown in picture 28).

Also, the structure was refined with modular components including pre-welded carbon steel tubes, plastic connectors, and grooved wooden boards that can be assembled with recessed steel tubes (as shown in and picture 30). With the modularity and the self-assembly feature, users can customize the product to meet specific size and structure characteristic to suit their accommodation as needed.



picture 28 version 3

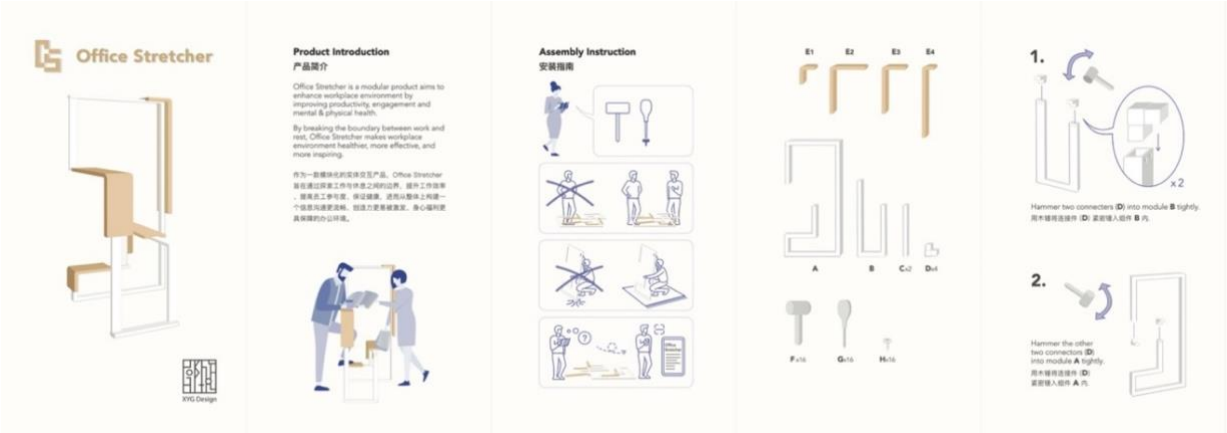


picture 29 modular components

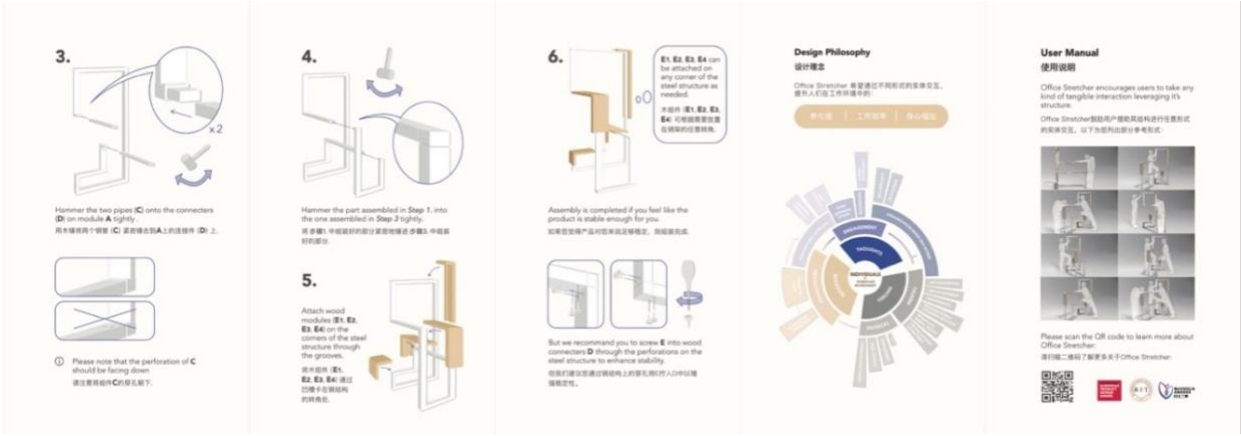
picture 30 exploded view

6.2.4 Iteration step 4 – User instruction

A user instruction guide was designed and included in the product package to provide the users with information including product introduction, assembly instructions, design philosophy, and a user manual (as shown in picture 31 and picture 32).



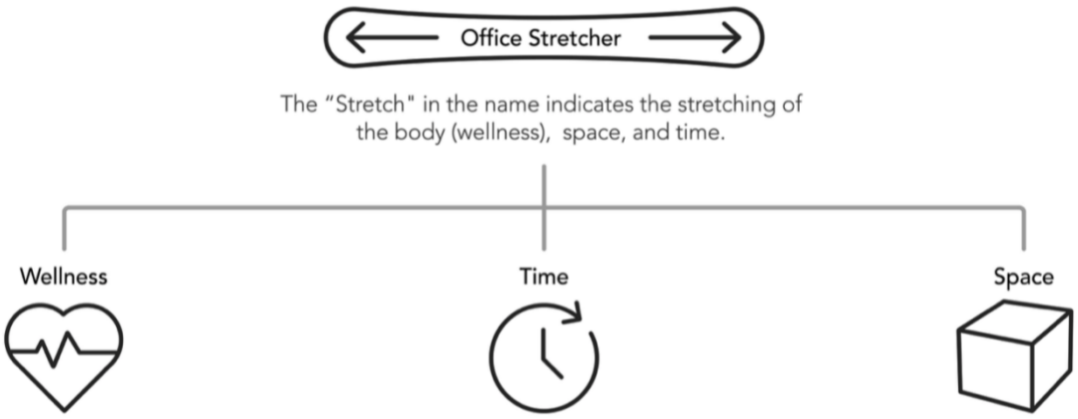
picture 31 user instruction 1/2



picture 32 user instruction 2/2

7. Final design

7.1 Product name and its meaning



The product was named “Office Stretcher”.

The “Stretch" in the name indicates the stretching of the body (wellness), space, and time.

For ‘wellness”, the three-dimensional frame structure of the product assists the users to take workplace-proper body stretches to maintain physical health. By re-discussing the boundary between work and break, the product also facilitates activities such as peer appraisals, small group communications, pre-meeting discussions, and professional networking. These

activities can help improve employee engagement, self-initiative, and organization-based self-esteem, increase career opportunities, and furthermore, help maintain workplace mental health.

For “space”, the product comprises of various kinds of office space such as the break rooms where there are not well-defined functions into a specific compact zone, consequently, increasing office space utilization.

For “time”, the product nurtures small group discussions, which are usually more efficient than large meetings. Furthermore, while communications are stimulated by the product, random talks in the main office areas where people try to concentrate on individual work can be reduced. Therefore, involuntary distractions are prevented, and productivity is improved.

7.2 Product design

Through the purity of form, the structure and the material of "Office Stretcher" enable a minimalist aesthetic. This multifunctional product benefits both individuals and organizations by facilitating tangible interactions. The combination of classic geometric forms and the welcoming color and material promotes the users to interact with the product as well as interact with each other. And the wood components can be placed at any corner of the steel structure as needed. It is simple in structure and easy to self-assemble. It is easy for the users to use and transform. Furthermore, with the modularity, it adapts to different sizes

of office space and accommodates different quantities of users. See below picture 33-37 and video 1 for more visuals.

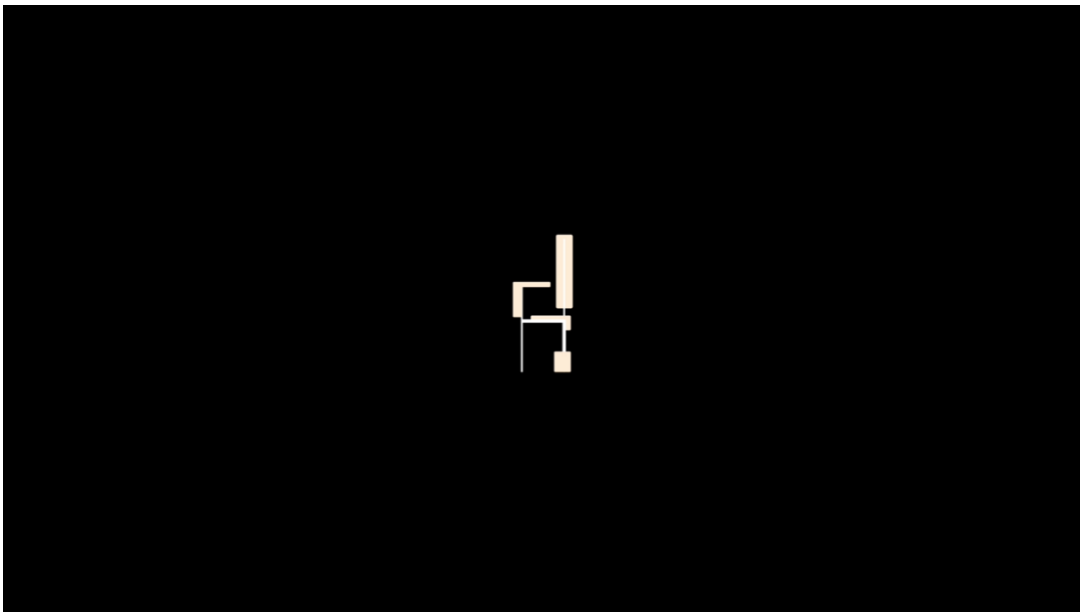
picture 33 final product design rendering

picture 34 product detail rendering

picture 35 examples of user interactions

picture 36 user-case scenario storyboard

picture 37 scenario rendering



video 1 introductory video https://www.youtube.com/watch?v=T-lRmuavUa8

8. Prototype, manufacture, and real-life application

8.1 Prototyping

The manufacturing process includes welding and coating carbon steel tubes, woodworking, and molding plastic connectors (process photo documentation as shown in picture 38; final prototype including the breakdown view, assembled view, and usage examples as shown in picture 39, picture 40, and picture 41).

picture 38 prototype making process

picture 39 final prototype – breakdown view, assembled view, and usage example 1/3

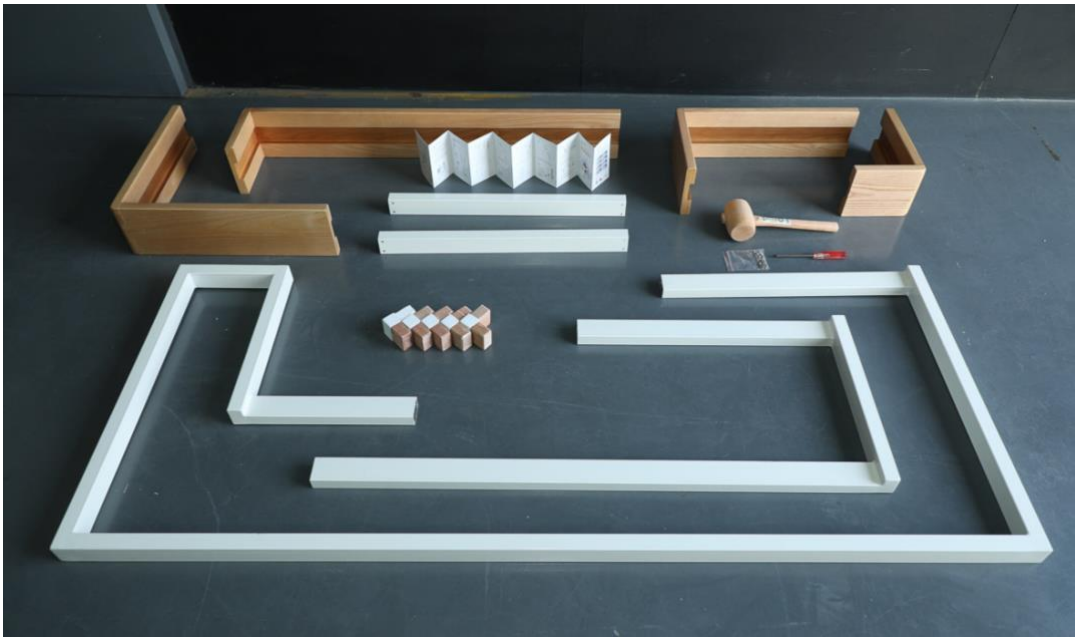
picture 40 usage example 2/3

picture 41 usage example 3/3

8.2 Manufacture

After the self-made prototype, Office Stretcher was sent to a factory located in Guangdong province, China for mass production. See below picture 42 for the photo documentation of the manufacturing process and see picture 43-45 for the final products and the whole product packages that were ready for shipping.

picture 42 manufacture process



picture 43 final product mass production components

picture 44 details of the product components

picture 45 product packaging

8.3 Real-life application

To collect user feedback of the final design, mass-produced Office Stretchers were sent to three organizations for the second-round usability test including Tongji University school library, Shanghai Aurora Plaza, and a startup company in Shanghai. Please see below picture 46-49 for product unboxing, assembling, and user interaction.

picture 46 product unboxing

picture 47 assembling process

picture 48 assembled product

picture 49 user interaction

From the photo documentation of the second-round usability test, it can be seen that compared to the first-round usability testing, users came up with more innovative ways to use the product – they even put the product right side up and used it for more leg and lower body stretching.

Below are the insights of the second-round usability test:

- Screws and pre-drilled holes on the steel tubes are needed to help reinforce the connections between the tubes together with the wood.

- Office Stretcher still has a lot of potential for various interactions waiting to be discovered. More interactive possibilities could be provided to the users. At the same time, it is necessary to let the users know that they can be as creative with the product as they like.

Conclusions

9.1 Impact of the work

Office Stretcher provides a new method for people to interact in an office environment and it helps to make full use of the workplace break area. It turns a break into a type of social behavior. A well-spent break with the product improves people's time utilization, enhances the relationship between people, improves team cohesion, and personal OBSE (organization-based self-esteem).[23] Furthermore, it expands the boundaries of ways to achieve a better work environment and contributes to increasing productivity and staff engagement.

9.2 Important insights

Through this design project, I've enhanced the basic organizational model made by Anne D. Kroemer and Karl H.E. Kroemer by finding out the interrelation of the three different aspects of the individuals in the workplace environment. Instead of independently existing, these three aspects influence each other (as shown in diagram 4). That is to say, if one aspect is improved, the other two will be improved correspondingly.

23 Bowling, N. A., Eschleman, K. J., Wang, Q., Kirkendall, C., & Alarcon, G. (2010). A meta-analysis of the predictors and consequences of organization-based self-esteem.

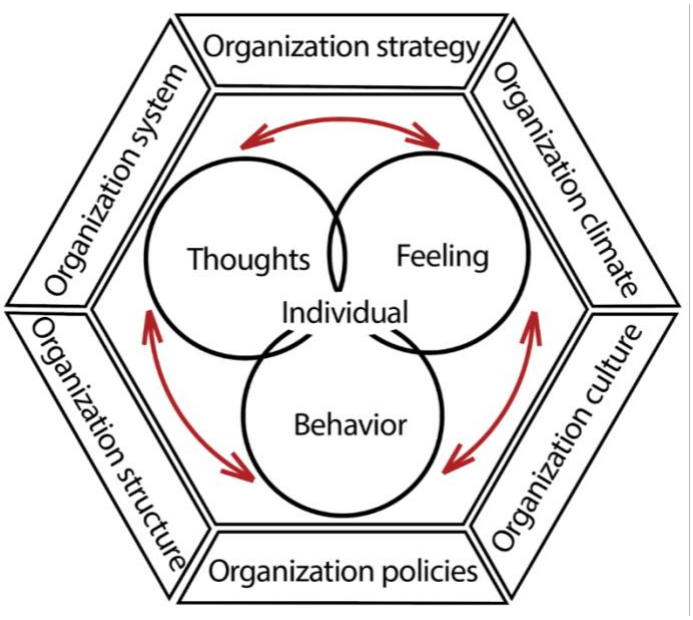


diagram 4

This project also studies the relation of organizational elements and organizational activities including OBSE building, involuntary interruption, peer appraisals, and small group discussion and how they impact on improving the workplace environment integrally (as shown in diagram 3 in 2.6).

9.3 Project outcome and recognitions

The outcome of this project is a piece of modular self-assembled innovative furniture designed for workplace break areas. It was selected as Silver in Office Equipment/Furnishing/Modules in the European Product Design Award 2019. It also won the first prize in the Magnolia Design Awards 2020 with project development funding.

Reference

1. Yudina, Anna. Furnitecture: furniture that transforms space. NY, NY: Thames & Hudson, 2015.

2. Lauson, Cliff. Light show. London: Hayward Publishing, 2013.

3. "How to Create Ultimate Break Room at Work." Pinterest. September 18, 2017. Accessed September 27, 2017. https://www.pinterest.de/pin/513832638728002001/.

4. "Break room." Pinterest. September 18, 2017. Accessed September 27, 2017. https://www.pinterest.de/pin/513832638728002172/.

5. SULLY, ANTHONY. INTERIOR DESIGN: conceptual basis. S.l.: SPRINGER INTERNATIONAL PU, 2016.

6. Booth, Sam, and Drew Plunkett. Furniture for interior design: London: Laurence King Pub. 2014.

7. Knackstedt, Mary V. The interior design business handbook a complete guide to profitability. Hoboken (N.J.): J. Wiley & Sons, 2013.

8. Li, Jane. Furniture design now. Hong Kong: Artpower International, 2017.

9. Office furniture design. Gloucester: Rockport, 2007.

10. Seim, Rikke, Ole Broberg, and Vibeke Andersen. "Ergonomics in Design Processes: The Journey from Ergonomist toward workspace designer." Human Factors and Ergonomics in Manufacturing & Service Industries 24, no. 6 (2012): 656-70. doi:10.1002/hfm.20508.

11. Yudina, Anna. Lumitecture: Illuminating Interiors for Designers and Architects. London: Thames & Hudson, 2016.

12. "State Laws on Meal and Rest Breaks". Workplace Fairness.

13. https://www.employmentlawhandbook.com/wage-and-hour-laws/meal-and-break-laws/

14. https://www.dol.gov/whd/state/rest.htm

15. Lisa Y. Adams, Msc Rn Lisa y Adams Phd, Workplace Mental Health Manual for Nurse Managers. Springer Publishing Company, 2014.

16. Bowling, N. A., Eschleman, K. J., Wang, Q., Kirkendall, C., & Alarcon, G. (2010). A meta-analysis of the predictors and consequences of organization-based self-esteem.

17. Journal of Occupational and Organizational Psychology, 83(3), 601-626.

18. Pierce, J. L., Gardner, D. G., Cummings, L. L., & Dunham, R. B. (1989). Organization-based self-esteem: Construct definition, measurement, and validation. Academy of Management journal, 32(3), 622-648.

19. Pierce, J. L., & Gardner, D. G. (2004). Self-esteem within the work and organizational context: A review of the organization-based self-esteem literature. Journal of management, 30(5), 591-622.

20. Asensio, Oscar, and Montse Borràs. Office Furniture Design. Gloucester, MA: Rockport, 2006.