

THE PEAK

CALM TECHNOLOGY

FINAL REPORT - 17.06.2019

GROUP B - 3729593 - MENG RU ZHENG

MASTER OF DESIGN INNOVATION AND TECHNOLOGY



TABLE OF CONTENTS

ABSTRACT

1

PART 1 - RESEARCH

INTRODUCTION

2

TASK 1 - METHODOLOGY ACQUIRING

3

1.1 - ACTIONS ON SURFACES

3

1.2 - PROXEMICS AND TEMPORALITY

5

1.3 - DYNAMICS AND TRANSITIONS

6

1.4 - PATTERNS AND RHYTHMS

6

TASK 2 - SPACE ANALYSIS

8

2.1 - ACTIONS AND SURFACES

8

2.2 - PROXEMICS, TEMPORALITY AND SOCIAL INTERACTIONS

10

2.3 - PATTERNS AND RHYTHMS

10

CONCLUSION

10

PART 2 - SOLUTION EXPLORATION

INTRODUCTION

17

TASK 3 - DESIGNING INTERACTIONS IN THE GRIMSHAW APARTMENT

19

3.1 - MAPPING ACTIONS AND SURFACES

19

3.2 - SMART HOME SYSTEM LEARNING FROM UPDATING DATA

20

3.3 - INTERACTIONS AND STATE DIAGRAMS

21

CONCLUSION

23

REFERENCE

23

ABSTRACT

Calm computing is used where the interaction between the technology and its users occurs in the user's periphery rather than constantly at the center of attention, which informs users but doesn't demand users' focus. Compared with interruptive technology, which disturb users attention with too many devices, this project aims at embedding calm technology into surfaces within interior environment to create livable domestic space.

Ethnographic study, research documentary and persona are the methods used for data collecting

and human-centered analyzing. Then interactive graphics based on java are devised as low-resolution interface.

A series of prototype tests reveal that dwellers' daily routine could provide customized calm interaction as key finding, so that room could be regarded as a calm-interface. In a more livable domestic environment, calm technology allows habitants to accomplish daily goals with less mental cost. (Amber Case, 2016)

PART 1 - RESEARCH

INTRODUCTION

Problems are caused by interruptive technology is attention span, stress and lack of sleep in contemporary society, (Amber Case, 2016) hence exploration about how calm technology could solve these problems are in urgency.

In part one, the purpose of research phase is to seek opportunities for applying interactive calm computing realistically to the surfaces in a domestic apartment, by exploring the interactions between physical human activities and surfaces within a specific site. As a cooperation between RMIT University and enterprise, Grimshaw provide a tiny house named "The Peak" with low density in Melbourne, which lead the project to an implementation based on an affordable and sustainable tiny home for young people priced out of the housing market in Australia's cities.

The exploration in this part is divided into 2 processes - methodology acquiring and space analysis. Ethnographic study, research documentary and persona are the methods used for data collecting and human-centered analyzing.

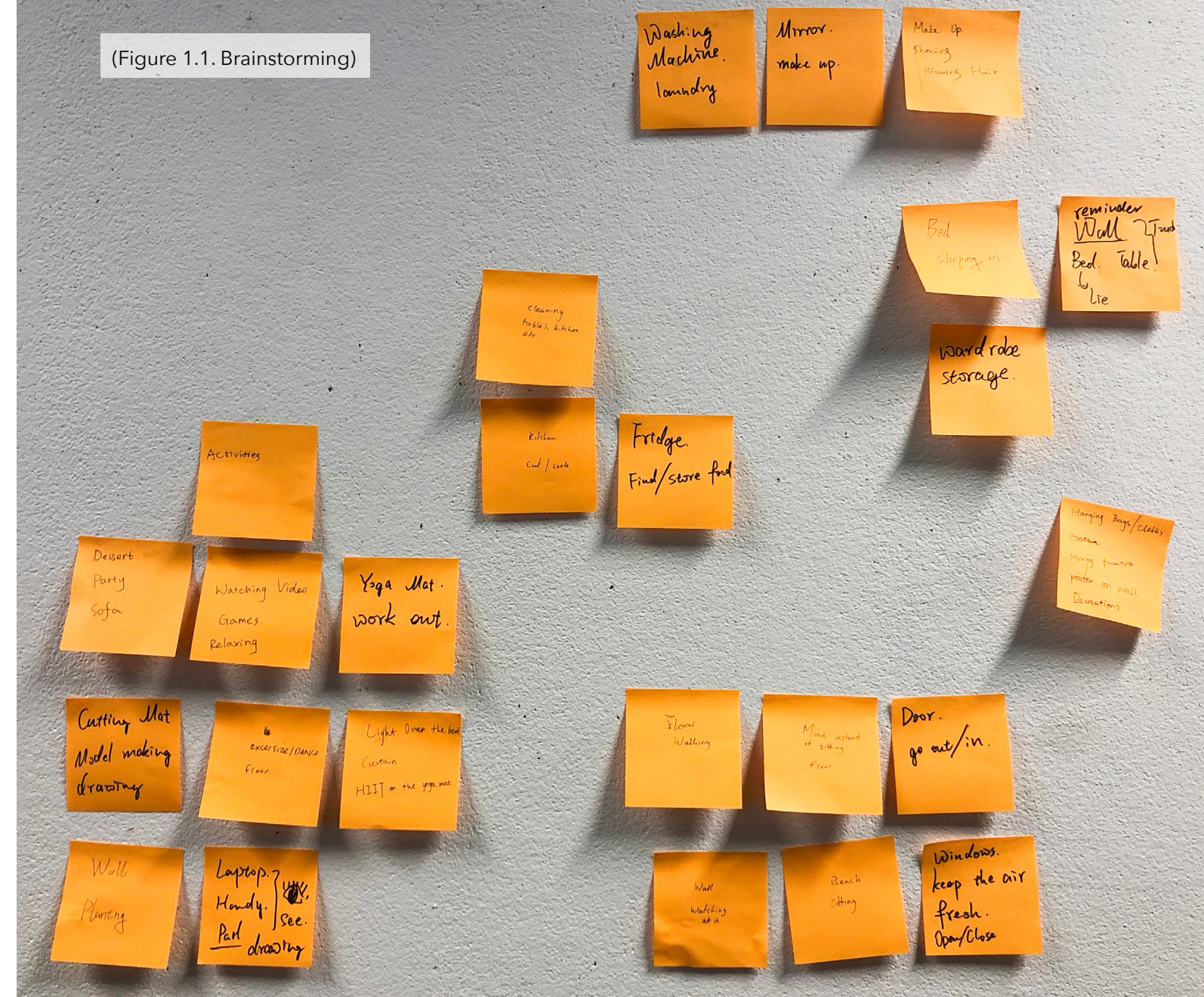
With a lot of field works, desk research and focus discussions as academic support, findings were obtained that several surfaces in the chosen house could be regarded as interesting potential application for calm technology, such as sound, light, vibration, colors even smells reflection, to enhance calming experience or transform spatial environment between calming and utilitarian modes automatically as a "smart home".

There are different opinions among people in terms of calm-technology design proposition. On one hand, most people especially who live in metropolis are suffering psychological anxiety. On the other hand, some individuals still take a skeptical attitude about absolute automatic "smart home" so far. Those people argue that current technology development still cannot support a complex automatic system even artificial intelligence in use. This argument is valuable for our project considering whether low-resolution interaction could support an automatic adjustable "smart home". Nevertheless, calm-technology with low-resolution interaction still could make a space livable when users are offered with semi-automatic

options in this project.

Along with potential implementation as a customizable interior design within "The Peak", it is expected that these research methodology and design proposition could have potential applications in human-centered design and service design, since domestic apartment could be one touch point within a systemic livable environment. Examples from Weiser and Brown (1997) shows that calm-technology is already actionable and useful supported with case study: William Gaver's "Ludic Design" motivates people from curiosity, exploration and reflection; "Inner Office Windows" creates a two-way channel for circumstances showing about the environment and connects people inside to the nearby world; and "Dangling String" provides a background of data weather about internet using condition. As client brief, this project could be used in "The Peak" tiny house in short-term vision, providing potential young customers affordable, modular and pre-fabricated home, as well as efficient usability space with high-quality lifestyle. In addition to individual domestic space, it is also valuable to consider a series of "The Peak" houses' interaction in a suburb community with calm technology. In long-term vision, it is hoped that calm technology could acquire smarter automatic solutions in the future adapting human's emotional transition and peripheral natural environment based on algorithm.

(Figure 1.1. Brainstorming)



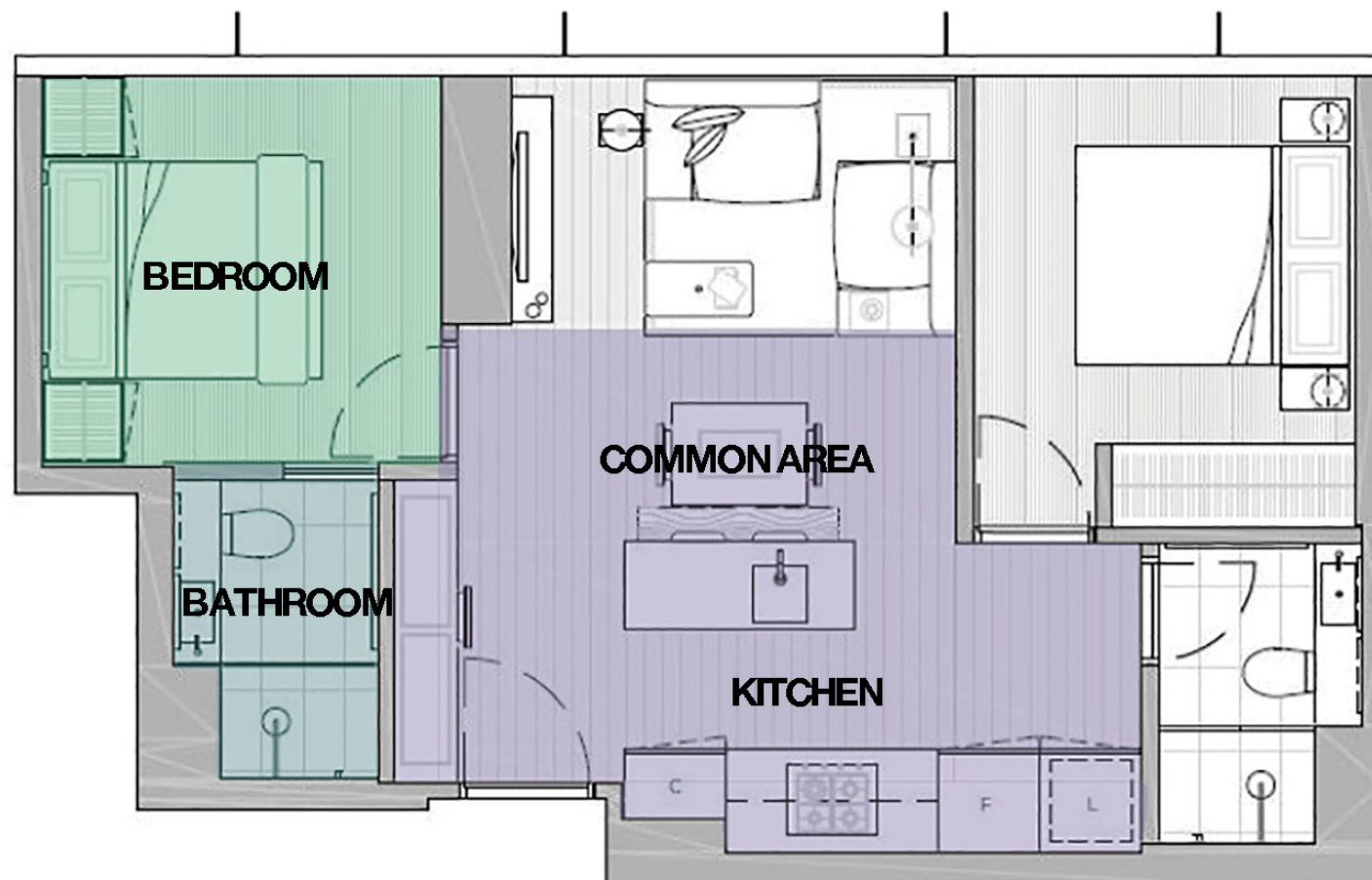
TASK 1 - METHODOLOGY ACQUIRING

1.1 - ACTIONS ON SURFACES

This research stage aims to explore opportunities in terms of human actions on surfaces within current apartment. In this stage, a typical apartment that belongs to one of our group mates (Xiao Ying, Li) is chosen for spatial analysis.

Comparing our initial information from group brainstorming (Figure 1.1.) and real domestic spaces of the chosen apartment (Figure 1.2.). We listed existing users' interactions with surfaces

within this domestic space and analyze potential activities, which could be used to provide calming experience based on spatial inspiration. Because of housing shortage in Melbourne CBD, living room in this apartment is used as a bedroom, so that there are three people share their lives in this apartment. Interesting themes are found within this domestic mixed-use space both interpersonally and personally.



(Figure 1.2. Floor plan)



(Figure 1.3. Actions on Surfaces)

As was found above, activities in existing domestic space could be divided into two groups, which are social interaction and mindfulness. In common area, both social interaction and mindfulness could happen and transform from each other, while private space, namely bedroom and bathroom could be regarded as space for mindfulness. As social interactions there are interesting activities such as cooking, eating together, playing games together, talking, having drink and watch movie

1.2 - PROXEMICS AND TEMPORALITY

The objective of proxemics and temporality research is to analyze user's actions based on space and time. With the evidence of user diary and spoken words we can acquire the information about how user interacts with surfaces daily within the existing apartment and surfaces, which establishes when and how the interaction occurs in terms of our finding in task 1.1.

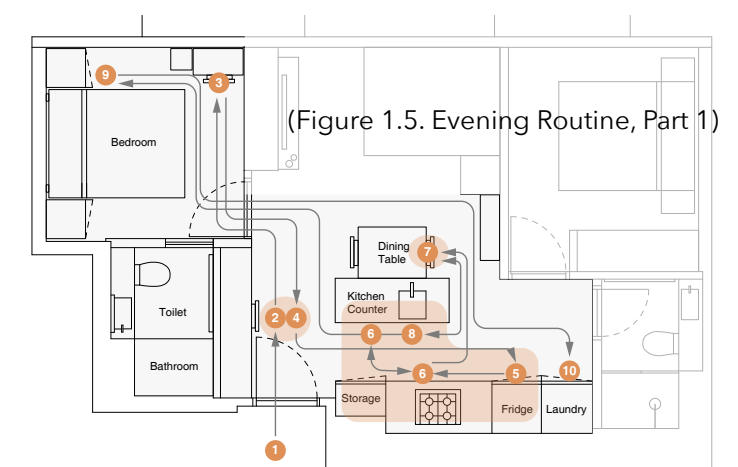
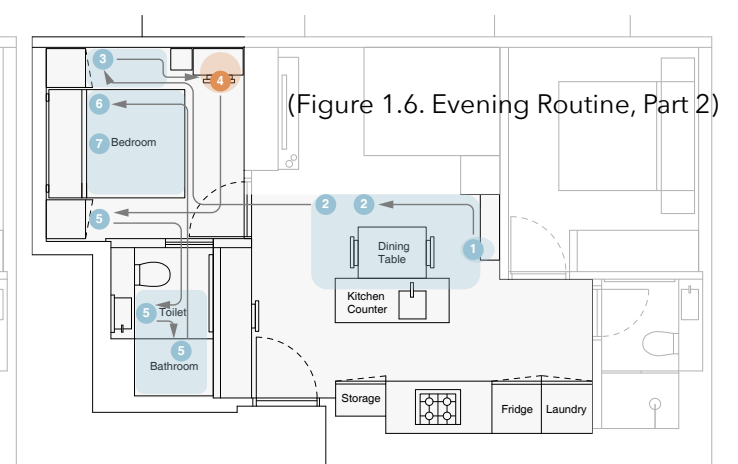
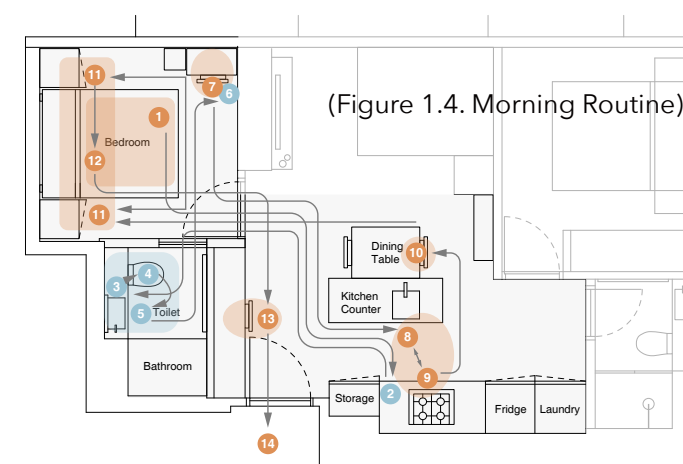
After a discussion focus on users realistic daily routine, information is collected and visualized into ethnographic diagram based on floor plan. (Crabtree2003) Timeline in a whole day is divided into two parts: morning routine demonstrates users ritual before going to school; evening routine demonstrate ritual after coming back from school.

Based on users movement, activities are categorized into fast-paced activities, during which users expressed that they must do something derived from tasks or chores, and slow-paced activities, which are regarded by users as ludic experience. Timer, associated by user's diary manually, could pick up movement of these activities. After conversation with users about their emotion, fast-paced activities were renamed as utilitarian activities, while slow-paced activities were renamed as calming activities. In the diagram below (Figure 1.4. Figure1.5. Figure1.6),

together. As a contrast, watching view outside, listening to music, taking a shower, meditating, exercise and reading books are regarded as mindfulness. These finding contains some of activities engaging with electronic devices which draw users focus attention, and provide us opportunities for applying calm technology with low resolution human-machine interaction and creating new change.

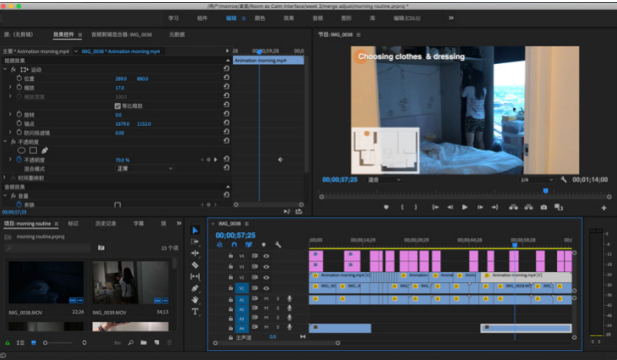
orange represent utilitarian activities, while blue stands for calming activities. Points with numbers demonstrate locations and orders about where and when these activities occur, and the color shades describe how large area these activities need.

The outcome from the ethnographic information shows that common space and bedroom could be used both for utilitarian activities and calming activities, especially an obvious overlapping space in bedroom, whereas bathroom is used for calming activities in user's daily routine.



1.3 – DYNAMICS AND TRANSITIONS

This phase of study is undertaken to test and verify relationship among users experience, interactions, surfaces and space by collecting audio-visual data with shadowing design documentaries. (Raijmakers2006) Through video recording in the studied apartment first-hand data about activity on key surfaces is collected, after that spatial dynamics



(Figure 1.7. Footage editing)

1.4 - PATTERNS AND RHYTHMS

Categorizing data collected from habitant’s daily routine into patterns and rhythms in this task, characteristics of calming activities and utilitarian are identified for potential habitants’ condition recognition and opportunities for transforming room conditions.

With the same color metaphor as previous ethnography, patterns are categorized into utilitarian patterns and calming patterns comparing with each other day and evening.

In terms of morning routine it is obvious that utilitarian patterns involve more items and more actions at the same time with high brightness. In addition more sound and faster movement reveals a sense of urgency, as well as open windows and fresh air could be transition from calming patterns to utilitarian patterns. As a comparison, less action, less sound and slow movement involved with low brightness during calming activities. Water boiling and use of cup could be key transition items from utilitarian activities to calming activities. Coming down to evening routine, besides similar difference with morning routine utilitarian patterns are focus near kitchen surfaces such as cutting

and emotional transitions was analyzed by editing video footages, users movements and floor plan.

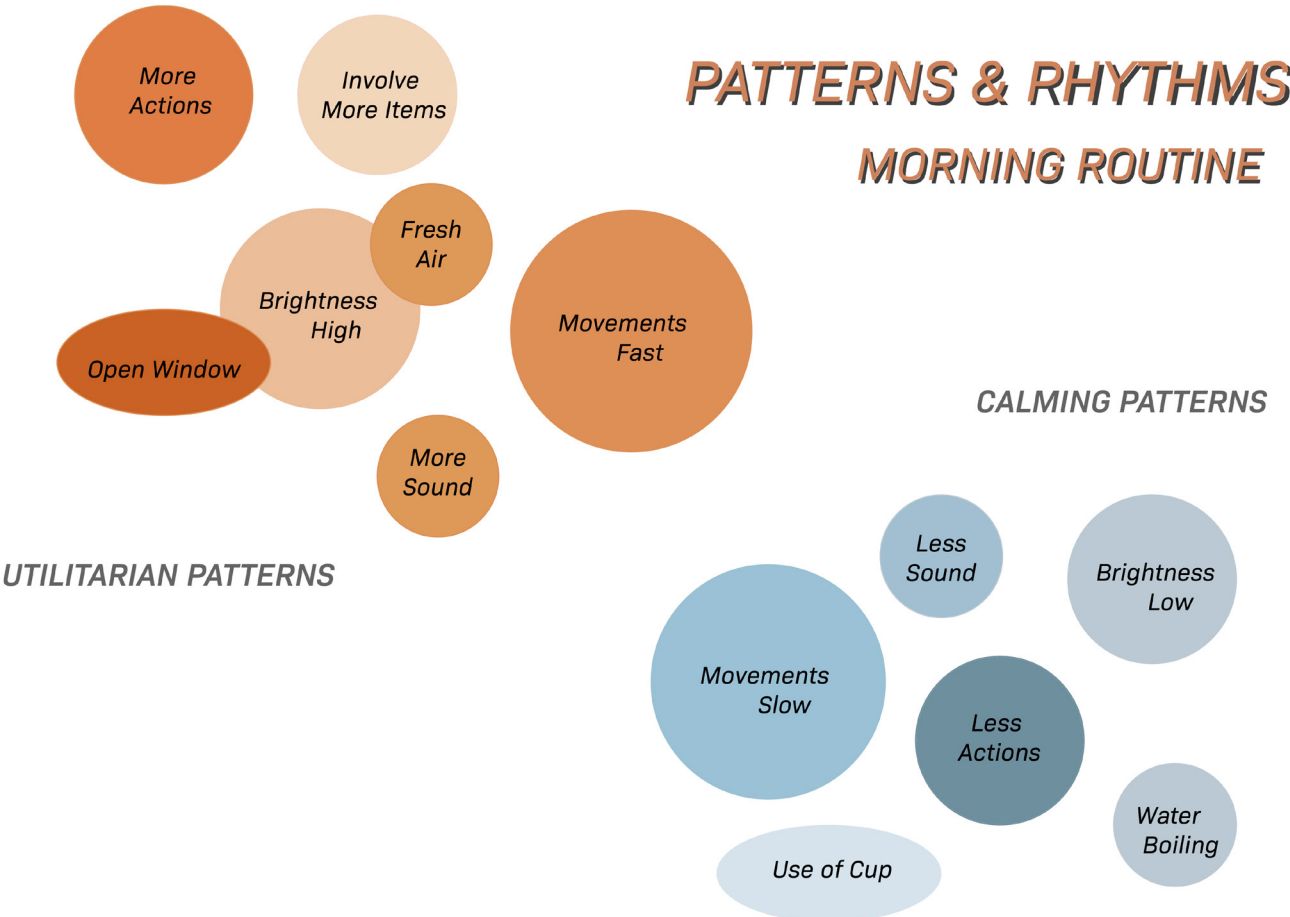
Obvious information is found when we combine proxemics and temporality study with dynamics and transition study. It is revealed that attention can change at different time in common area and bedroom. Evidence in the video shows that a lot of utilitarian and calming activities happen near the French windows of users bedroom, which could be regarded as key surface. In the organized video footage some unconscious insight became revealable such as taking cup on different surfaces, soundscape while making food, multiple social activities both utilitarian and calming, walking on carpet without shoes and yoga mat.

These spatial dynamics and attentional transition can be synthesized into intrinsic phenomenon in next research phase.

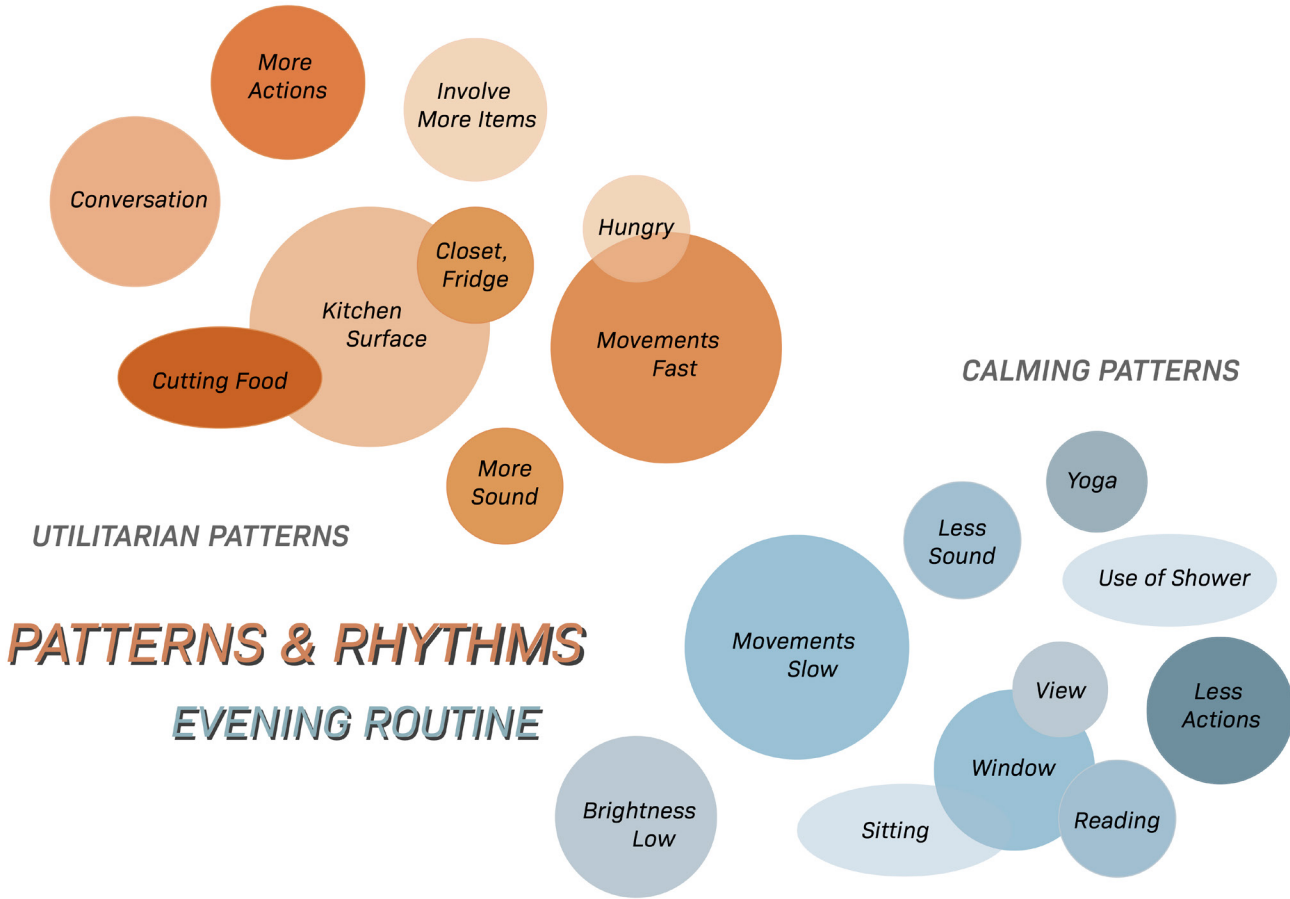
food, picking stuff from closet and fridge, while calming patterns are less focus near window in bedroom. Sometimes calming patterns are separate at flexible locations for yoga. Finally, this synthesized information offers us insight for further opportunity evolution.

As a conclusion, four initial design opportunities could be took consideration. Firstly, utilitarian actions could be transformed into calming experiences, which could reduce anxiety through transforming high-resolution attention into low-resolution peripheral attention. Secondly, calming morning ritual could be enhanced to strengthen users delight experience at a start of a day. Thirdly, creating calming experience after utilitarian actions could refresh users mind during tiring period. Finally, different surfaces could be used to create calming ludic experience inspiring curiosity, exploration and aesthetic appreciation when users could enjoy their everyday life.

Further low-resolution interaction could be under consideration such as light, sound, vibration and colors. We still need more detailed research and test in depth involving calm-technology solutions.



(Figure 1.8. Patterns and rhythms of morning routine)



(Figure 1.9. Patterns and rhythms of evening routine)

TASK 2 - SPACE ANALYSIS

2.1 - ACTIONS AND SURFACES

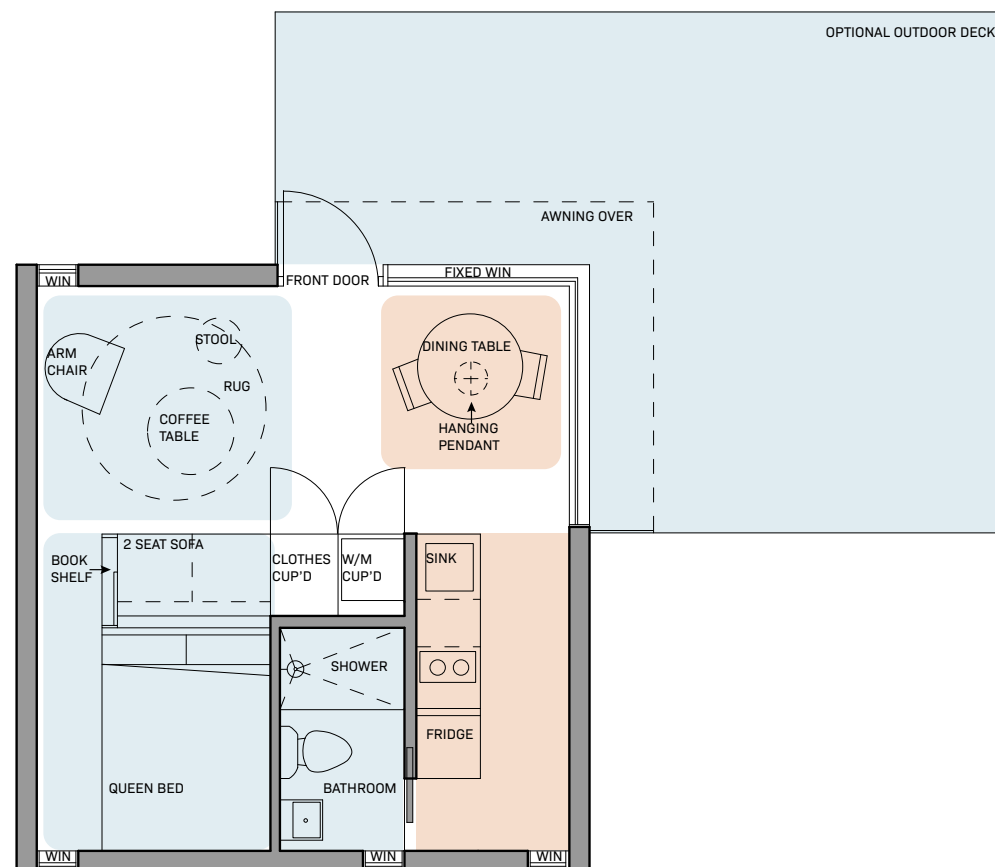
Task 2 aims to explore design opportunities for a chosen space, namely "The Peak" tiny house, provided by Grimshaw in the aftermath of methodology acquiring from task 1.

According to Grimshaw's site introduction, crucial identity of "The Peak" is found which is described below. Firstly, it is a 35-metre-square micro home with efficient spatial usability providing an affordable and livable option for young people priced out of the housing market in Australia's cities. Secondly, this pre-fabricated modular architecture offers customizable possibility, which reveals that actions based on spatial flexibility should be considered. Finally, materials of surfaces should be integrated with potential calm-interaction such as timber.

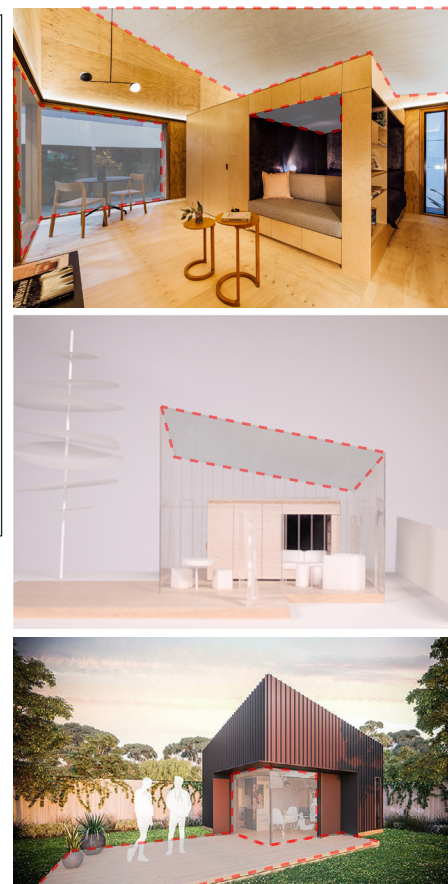
Potential activities in "The Peak" are mapped from outcome of task 1 as the floor plan below. (Figure

2.1.) The orange shadowing space represents potential space for utilitarian activities, while the blue shadowing space for calming activities. Other interesting surfaces are found such as sloped ceiling, bedroom ceiling, upper surface, French windows and outdoor surface regarded as characteristics of "The Peak" which could potentially be embedded with calm technology.

The outcome of this task is two personas (Figure 2.2.) and possible actions on surfaces (Figure 2.3.) which leading further ethnographic analysis about proxemics, temporality and social interactions.

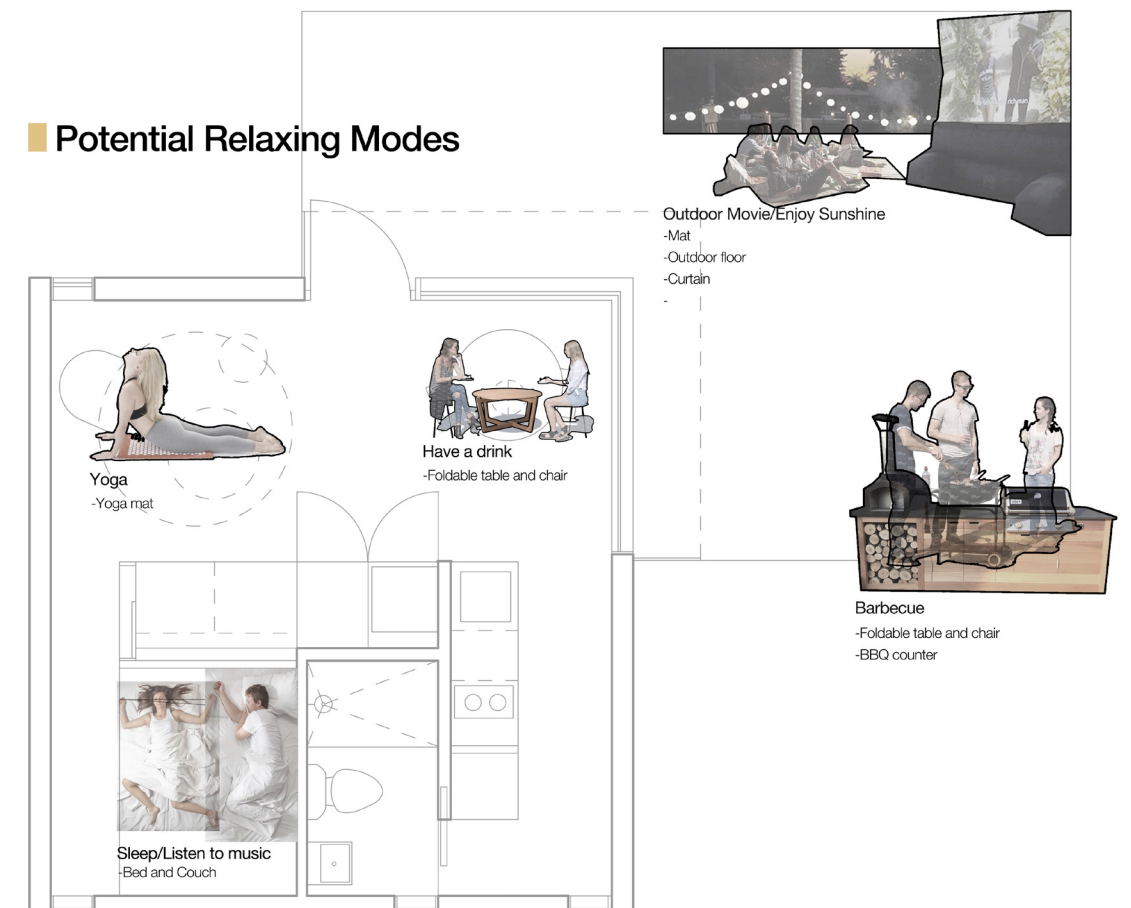


(Figure 2.1. Floor plan and interesting surfaces)



(Figure 2.2. Persona)

Potential Relaxing Modes



(Figure 2.3. Potential relaxing modes)

2.2 – PROXEMICS, TEMPORALITY AND SOCIAL INTERACTIONS

Ethnographic exploration based on persona and provided site was proposed to tailor calm-technologic solution for site’s specific identity and target group in task 2.2.

As per client’s target group, personas’ daily routine is presumed and remapped in floor plan (Figure 2.4.) to identify how potential user could interact with surfaces at different locations. Then, after analyzing relationship between activities and space, detailed information could be explored such as which surfaces involve, what kind of movement is it, and what kind of data could be collected during these activities as well as movements. As a consequence, timeline was created associated with routine, activities, movement, data category, and sensors, to organize complex information visually and clearly. (Figure

2.3 - PATTERNS AND RHYTHMS

As per task 2.2, multiple data input sensors provide opportunities for inhabitant condition recognition, hence how could an artificial intelligence system track users’ daily routine and create a profile by analyzing patterns and rhythms should be discussed in task 2.3.

A primary pattern recognition input is inhabitants’ personal movement. The system could pick personal movement data through multiple pressure sensors and depth camera. By analyzing long-term record data, the system could transfer rhythms of original data into activities identification. For example, slower movement reveals calm activities while urgent movement shows chores that are not enjoyable for inhabitant. Because different individuals have specific rhythm, the artificial intelligence system should also distinguish different humans’ data characteristics

CONCLUSION

To summarize, 6 interesting activities are the best choice for creating or enhancing calm experience as specified by previous space analysis, namely wake-up, shower, breakfast, working, yoga and relaxing outdoor. Input sensors such as infrared sensor, pressure sensor could provide automatic human-surface interaction awareness for the tiny home obviously, in addition, camera and microphone could collect data from human’s

2.5. Figure 2.6.)

Complexity of data collecting shows that 6 activities could be considered for calm-interaction. For morning routine, wake-up, shower and breakfast could be valuable for enhancing calm experience, which could delight user’s mood from start of one day. In comparison, working could be an opportunity for utilitarian action transforming into calming experience, or creating calming experience after utilitarian action. Also, evening relax activities reveal that multiple surfaces could be used for ludic interaction which enhance calm-interaction such as yoga and relaxing outdoor. Furthermore, outdoor decking should be considered for both mindfulness personally and social interaction interpersonally.

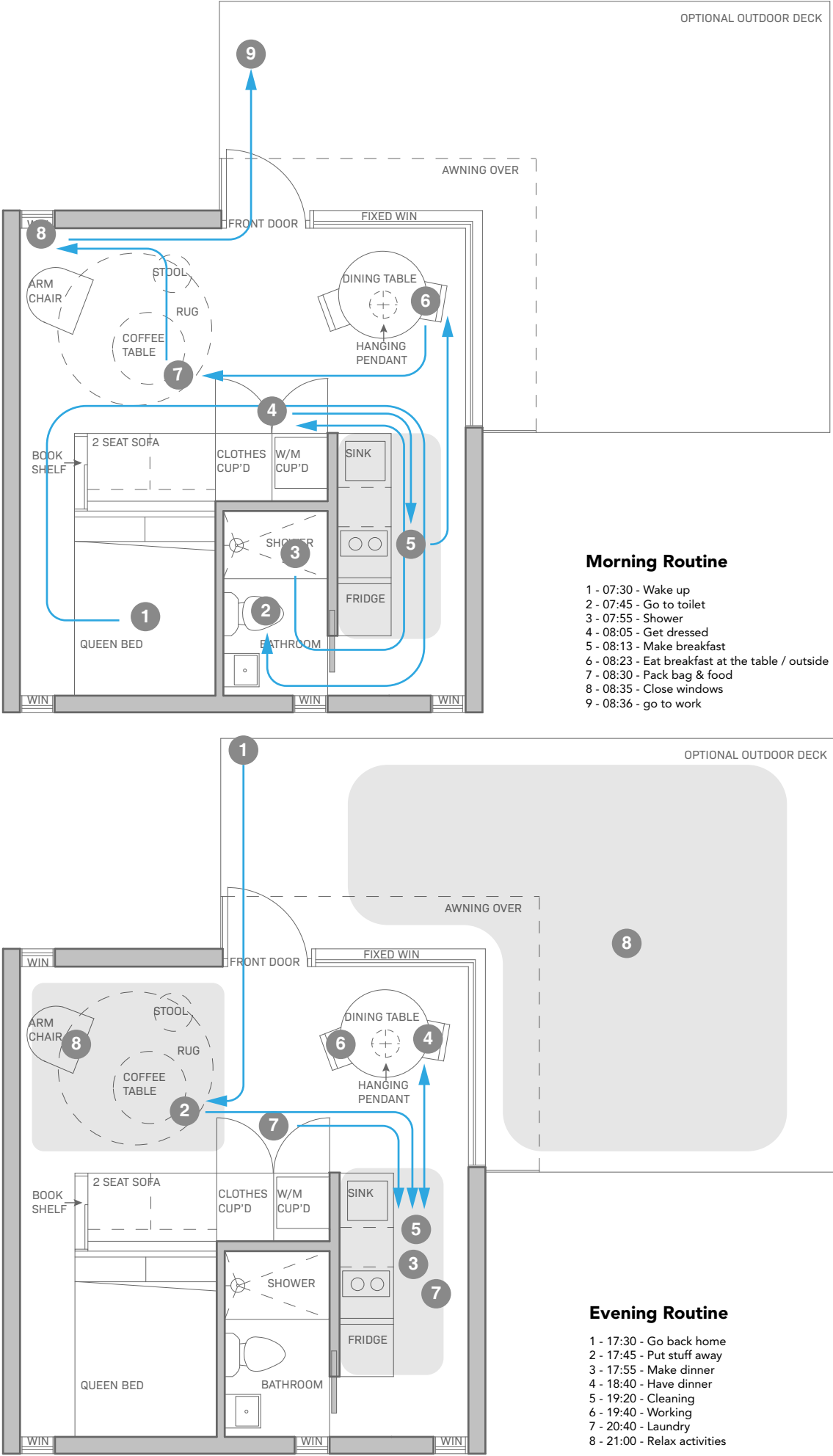
and creates a profile for every inhabitant.

Secondary pattern recognition input is inhabitants’ location. Through infrared sensor and depth camera, the system could pick additional information associating movement data and reveal where inhabitants’ activities happen. The more movement data and location recognition data based on timeline are analyzed, the more accurate could the system through machine learning, which provide “The Peak” a smart home system.

Additional pattern recognition could be considered in further solution exploration such as microphone, humidity detector, airflow detector and temperature detector. Multiple sensor provide feasibility for calm-interface, and this finding leaded solution directed experiments in next step.

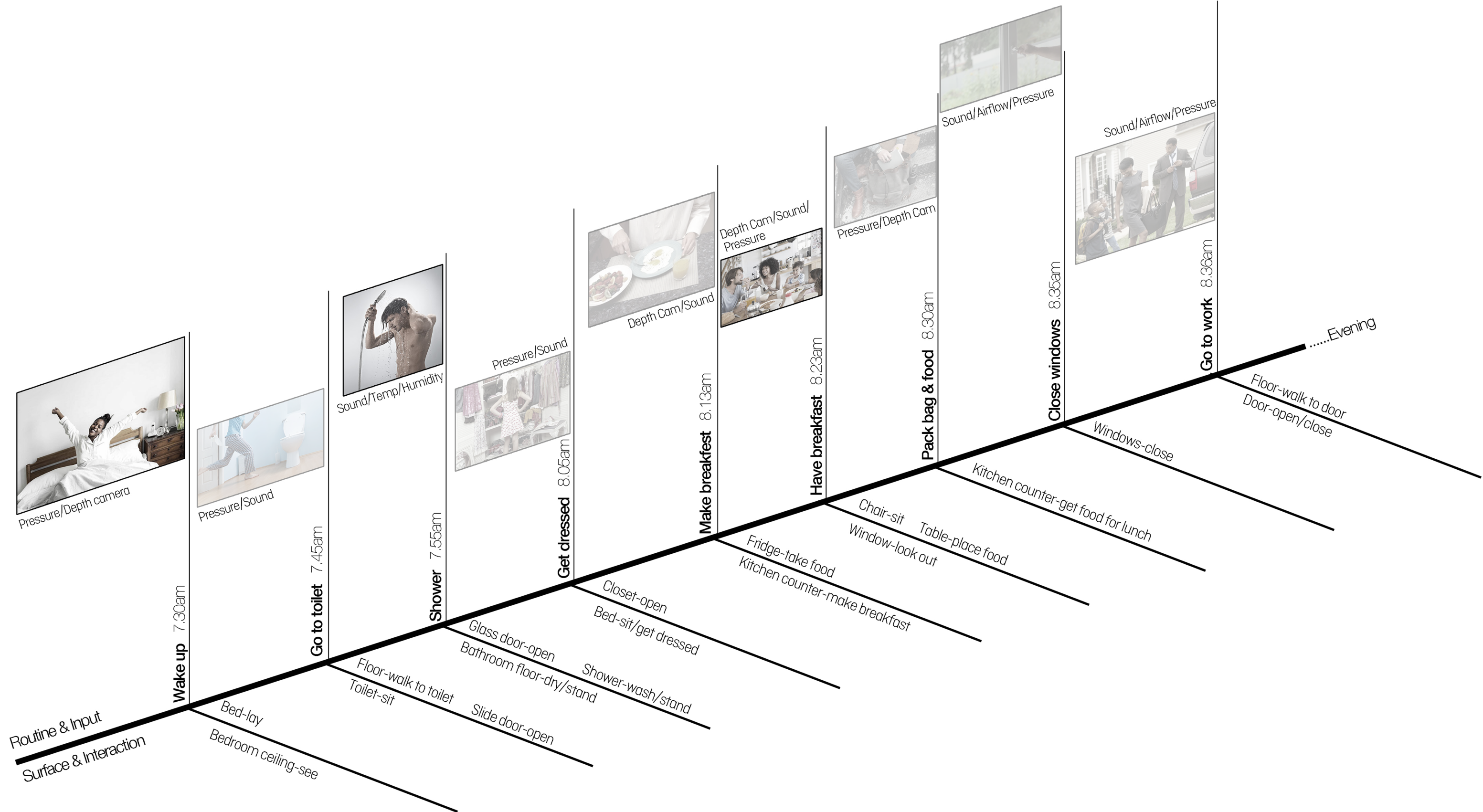
sound and movement, which could be used for further calming reflection from domestic surfaces.

In next step, simplification of natural elements and ludic interaction would be considered for improving user’s well being while living in “The Peak”, because nature has a major impact on people’s calmness through research and personal experience (White 2013).

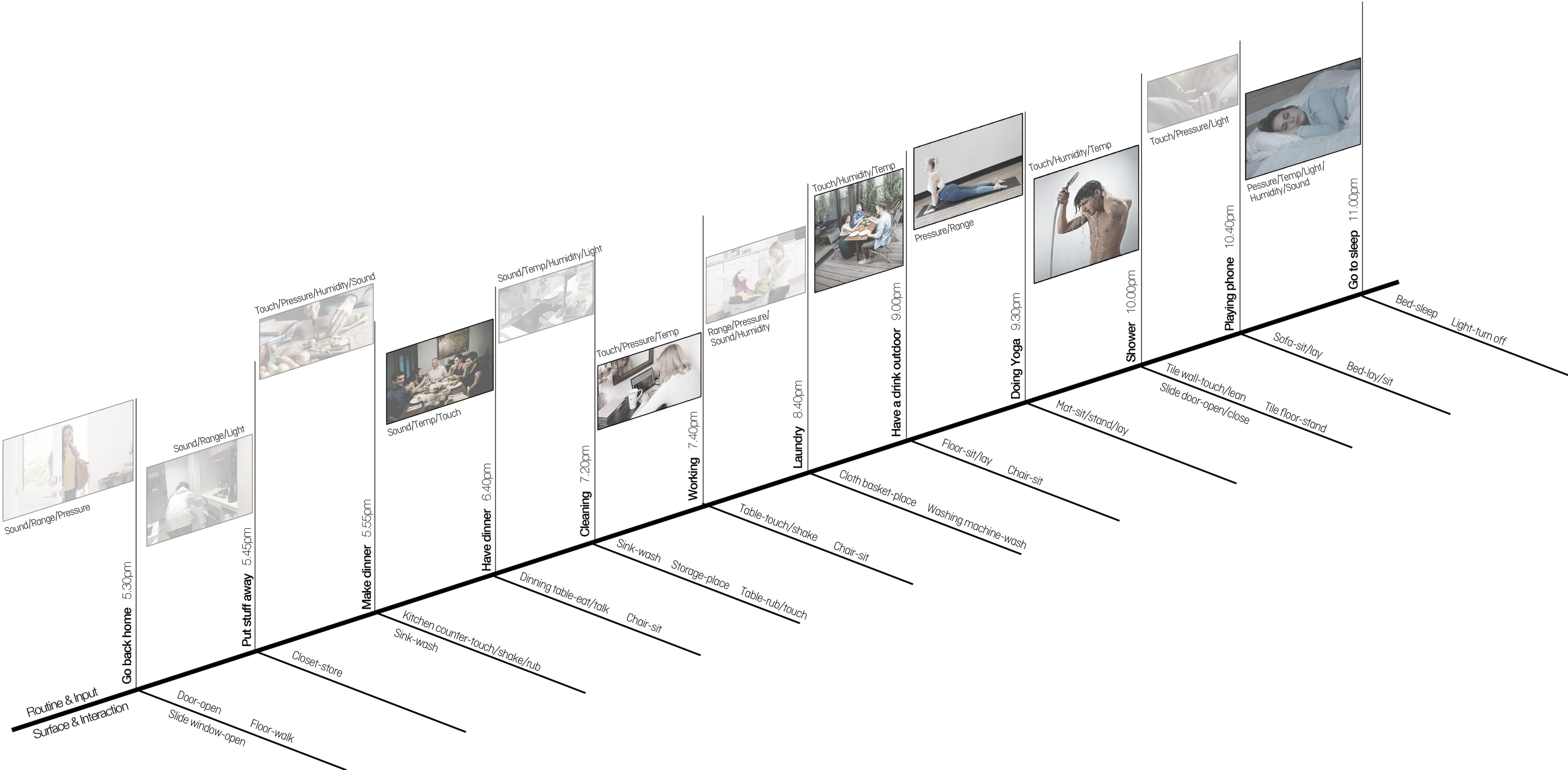


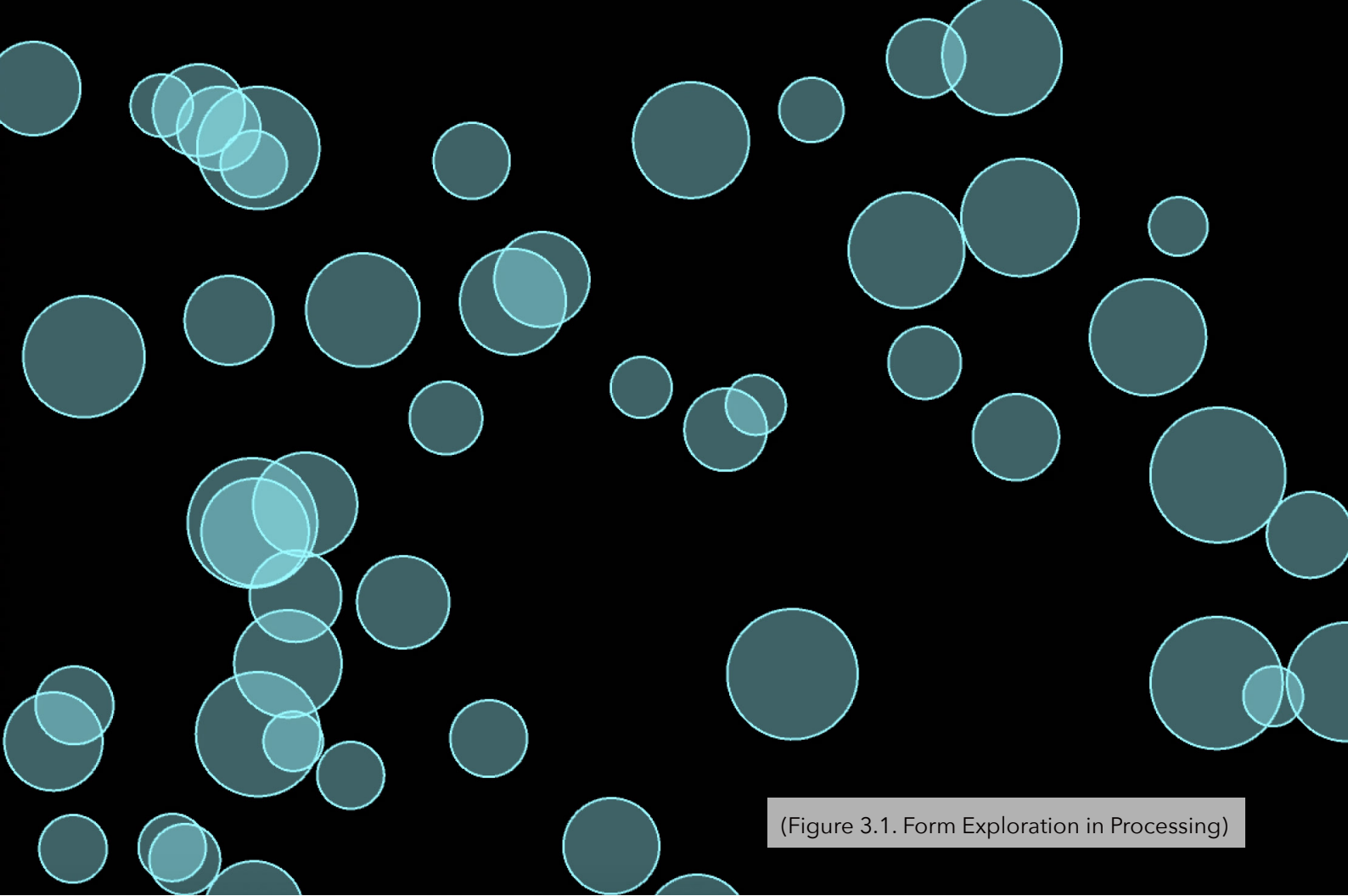
(Figure 2.4. Personas' daily routine)

(Figure 2.5. Timeline - morning)

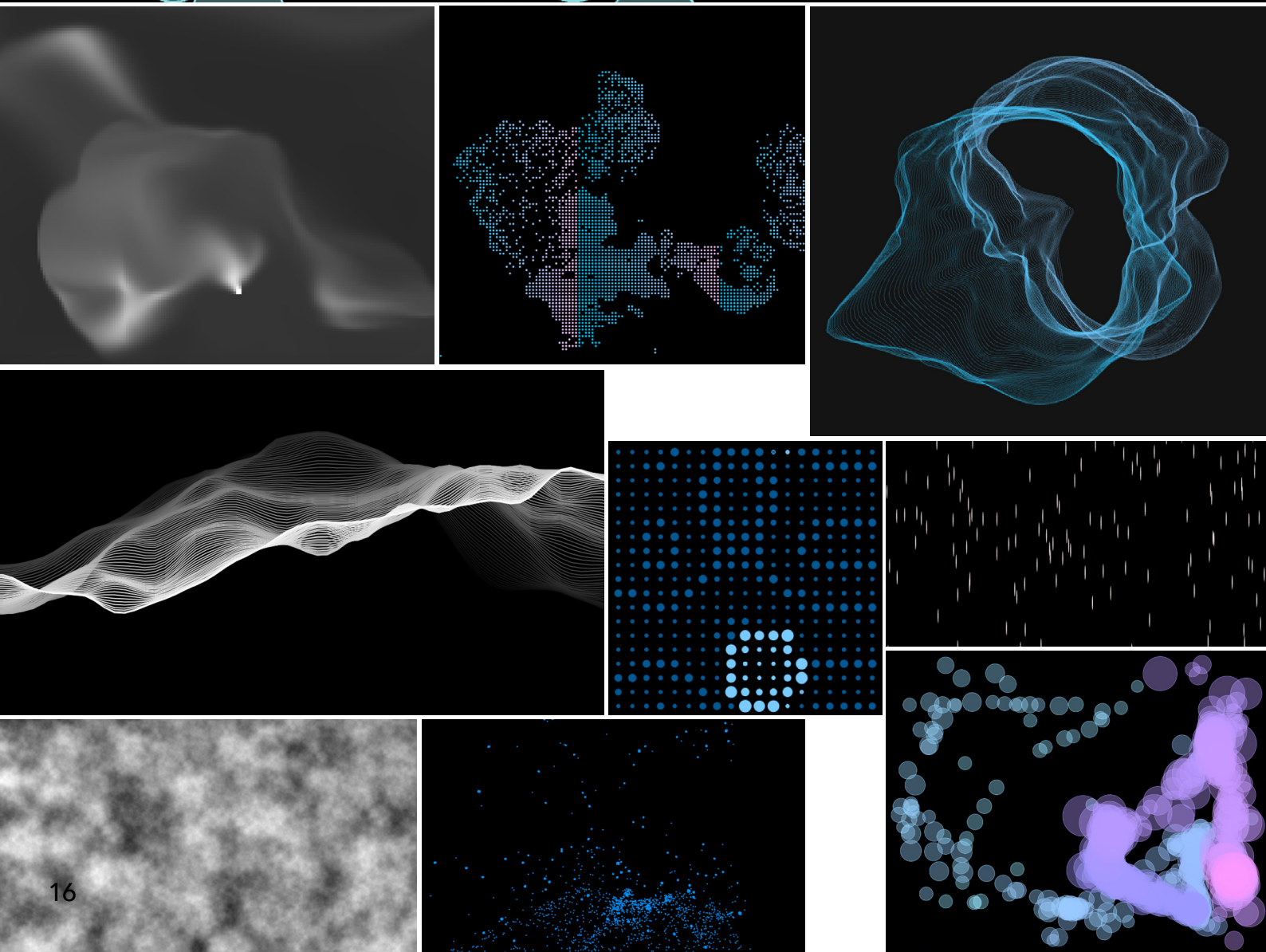


(Figure 2.6. Timeline - evening)





(Figure 3.1. Form Exploration in Processing)



PART 2 - SOLUTION EXPLORATION

INTRODUCTION

The objective of this section is to explore how could calm technology embedded in Grimshaw Apartment, "The Peak" tiny house, through simplifying natural elements. As per academic research from White (2013), natural elements are recommendable to associate interaction between inhabitants and surfaces within domestic environment. Considering human's daily activities could be complex, the main challenge in this part is feasibility of data transformation and unifying thread of an artificial intelligence system.

The main approach to be used as an output effect is Processing - graphic interaction software based on java program language. (Figure 3.1.) According to interior structure given by Grimshaw, (Figure 3.2.) the upper surface provides a space where a projector could be embedded with rotatable structure, so that several surfaces in the living room could transform into calm-interface visualizing inhabitants' personal movement. Different data input devices are tested during this exploration, namely Arduino, Kinect and Wii balance board.

The first feasibility experiment is connecting Arduino as a serial data input with Processing as graphic interaction output (Hamza, 2018). Firstly potentiometers were used as data input to test both one variable input and multiple variables input. The finding is that one variable input from Arduino to Processing succeeded, but it was failed to connect them with multiple data as multiple variables. The reason is that Processing could only import one serial library, and multiple sensor data could only export into one serial library from Arduino, hence the graphic interaction seems like an interactive visualization with one noise variable. In the late Arduino experiment it was failed to split one serial library into multiple arrays.

The second feasibility experiment is connecting Kinect with Processing according to Daniel Shiffman's tutorial (2015). Data input from Kinect is point cloud with RGB and depth value, while the array structure of pixel data is slightly different with canvas pixel data of processing. During the experiment it was found that connection between Kinect and Processing was unstable because of version limit. Another disadvantage of Kinect is that point cloud has a large amount of data input,

the original code in Kinect is already complex, and hence Kinect runs slow when human's body movement data was collected.

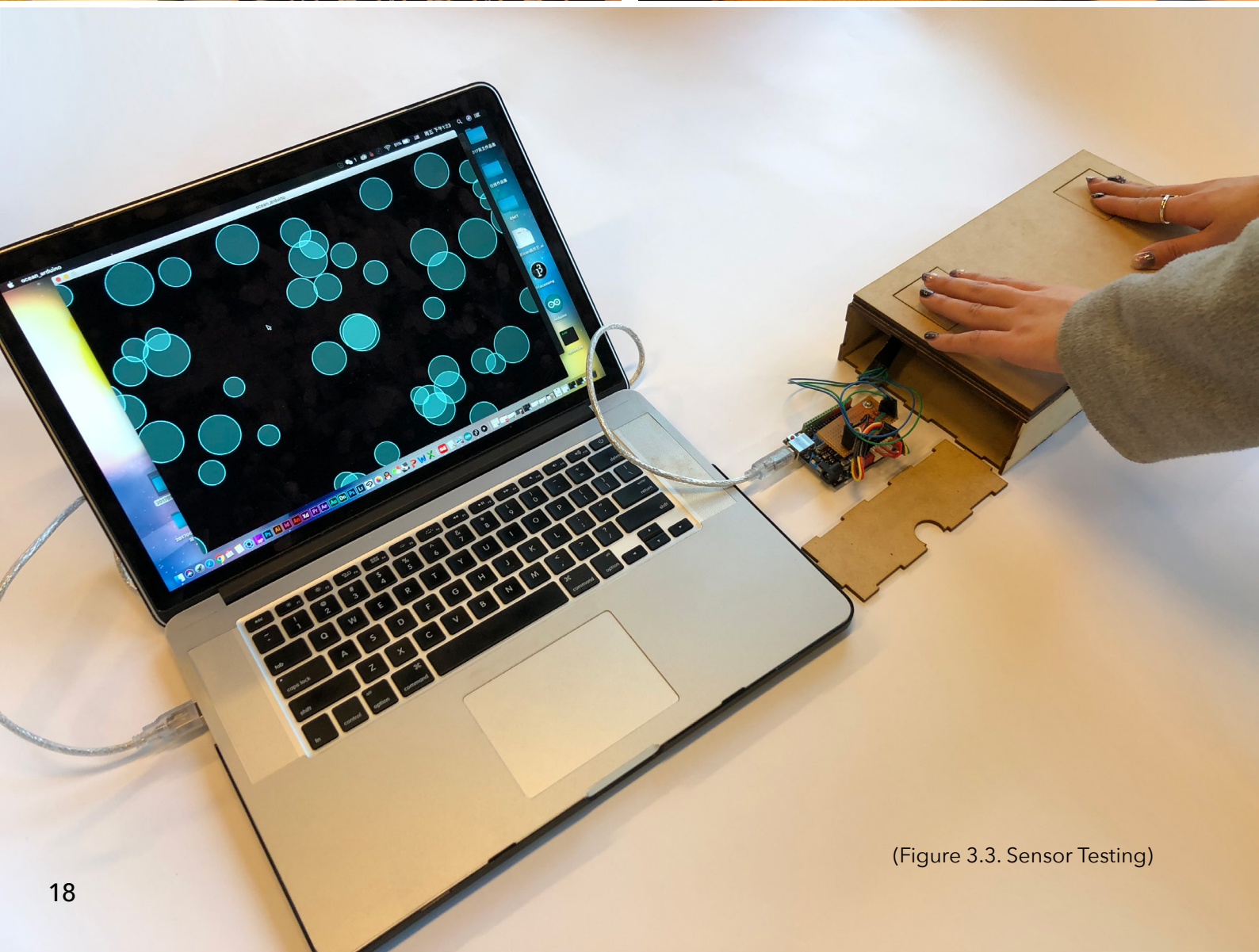
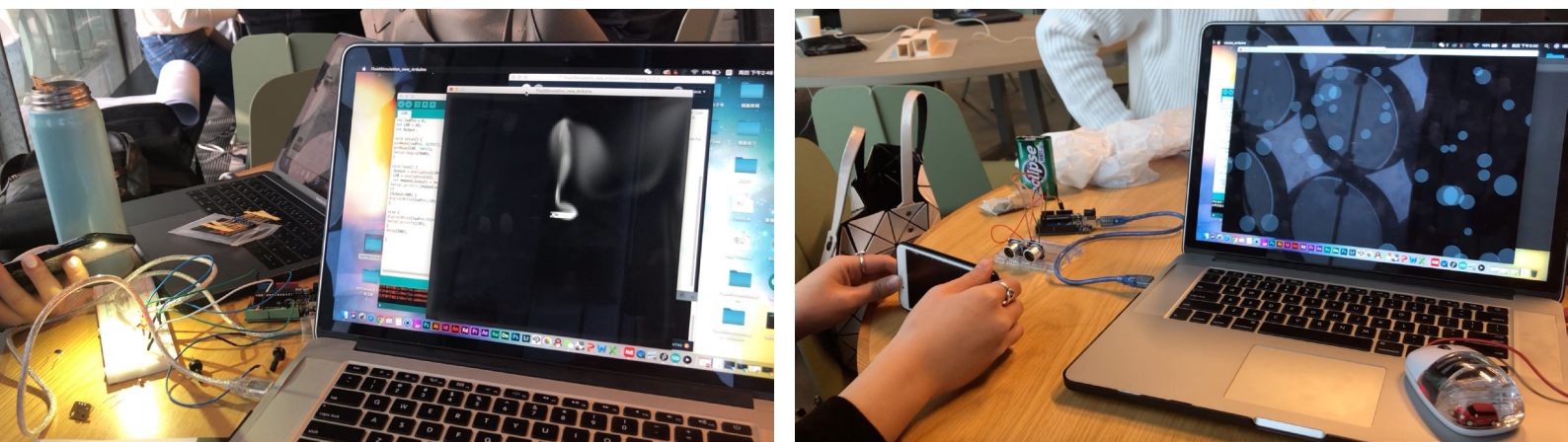
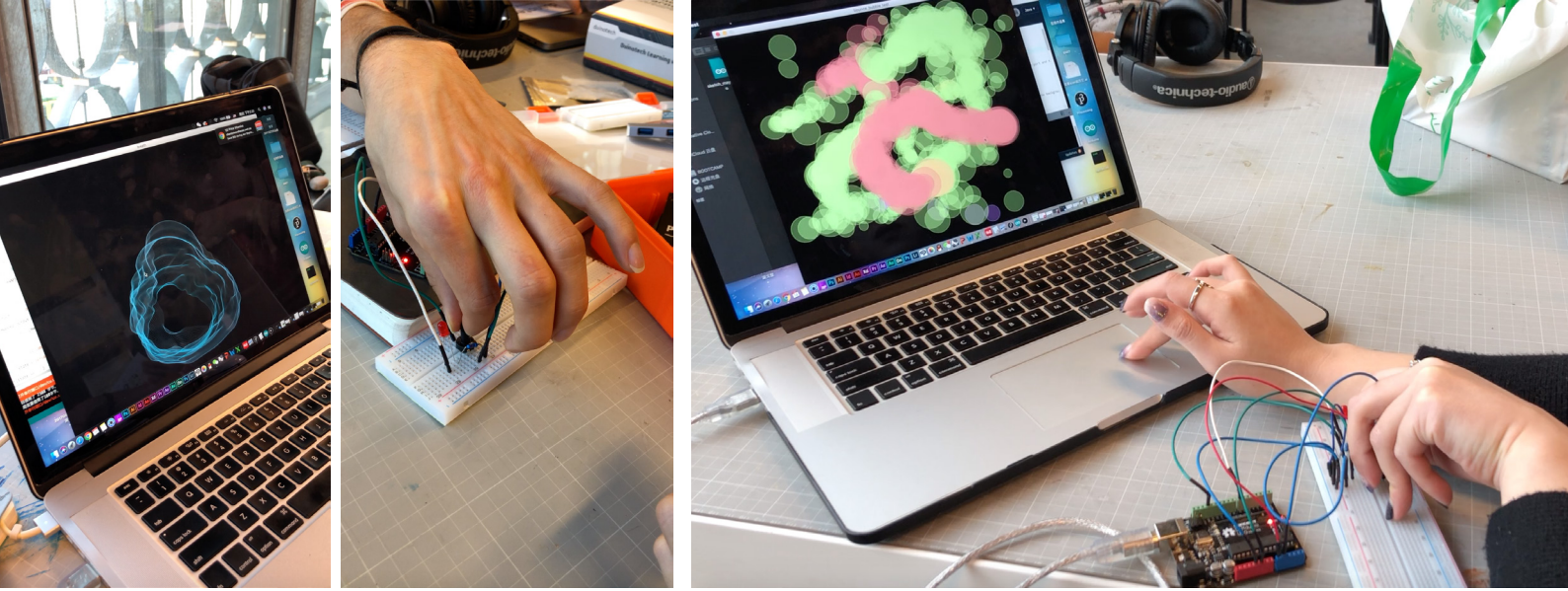
The final feasibility experiment is connecting Wii balance board and Processing (Schlegel, 2011). In this stage it was found that Wii balance board could collect body movement sensitively in Osculator, but when Processing and Osculator connected, Processing could only read data from Osculator with Osculator's java function. Therefore, Processing could not use its graphic interactive function with Osculator's data input.

Finally, the prototype outcome is an installation connecting Arduino pressure sensors and processing to visualize body movement and balance during yoga activity within "The Peak". Here is already some feedback that this installation is playful enough, calming and inspiring ludic exploration during daily life.

Because of tight deadline, this version of prototype is just an inspiration for short-term calm-interface within Grimshaw's Apartment. In long-term version, it is still valuable for further research about import multiple sensor data from Arduino in Processing considering a smart home system based on artificial intelligence and machine learning.

(Figure 3.2. "The Peak" Model)





(Figure 3.3. Sensor Testing)

TASK 3 - DESIGNING INTERACTIONS IN THE GRIMSHAW APARTMENT

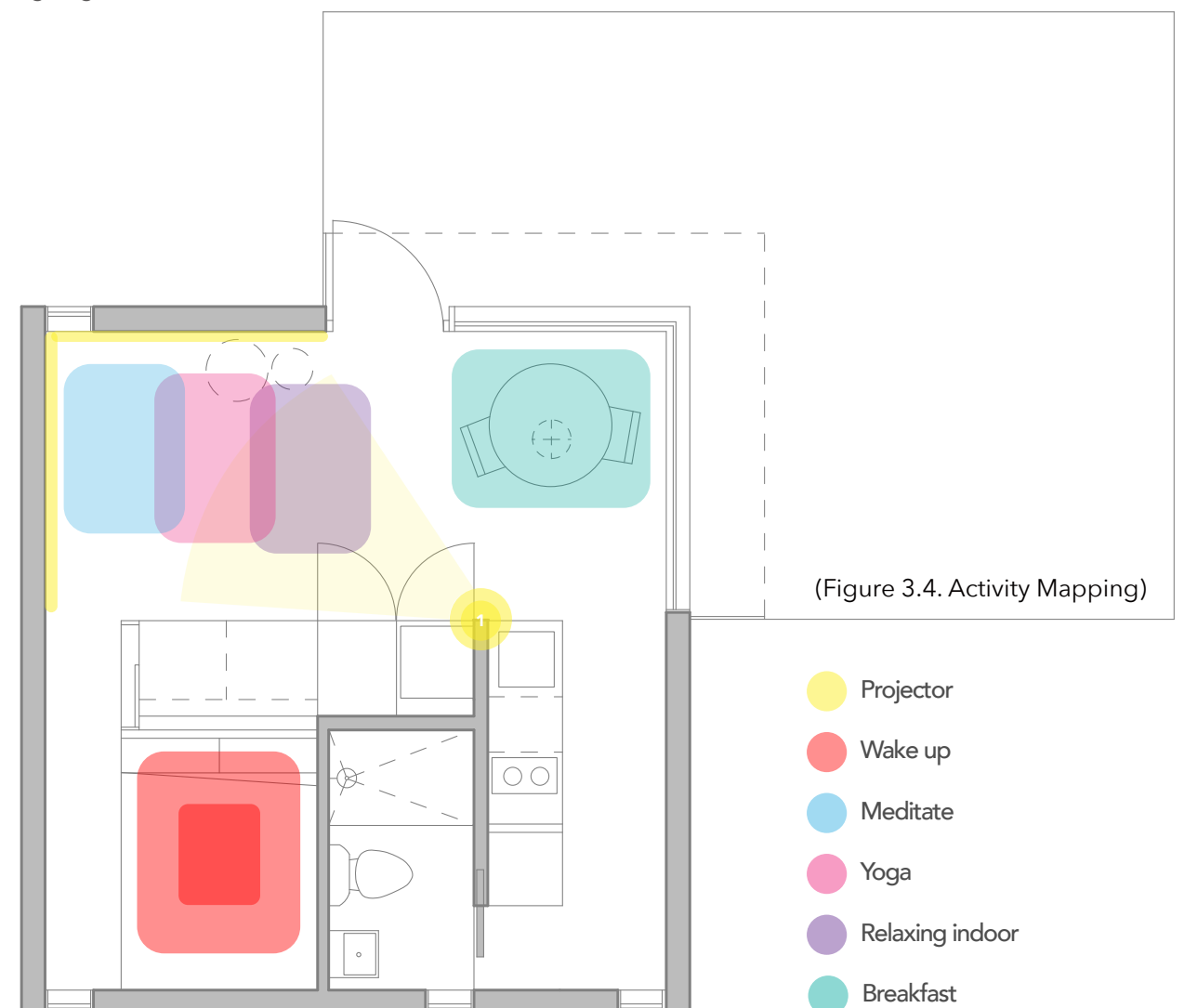
3.1 - MAPPING ACTIONS AND SURFACES

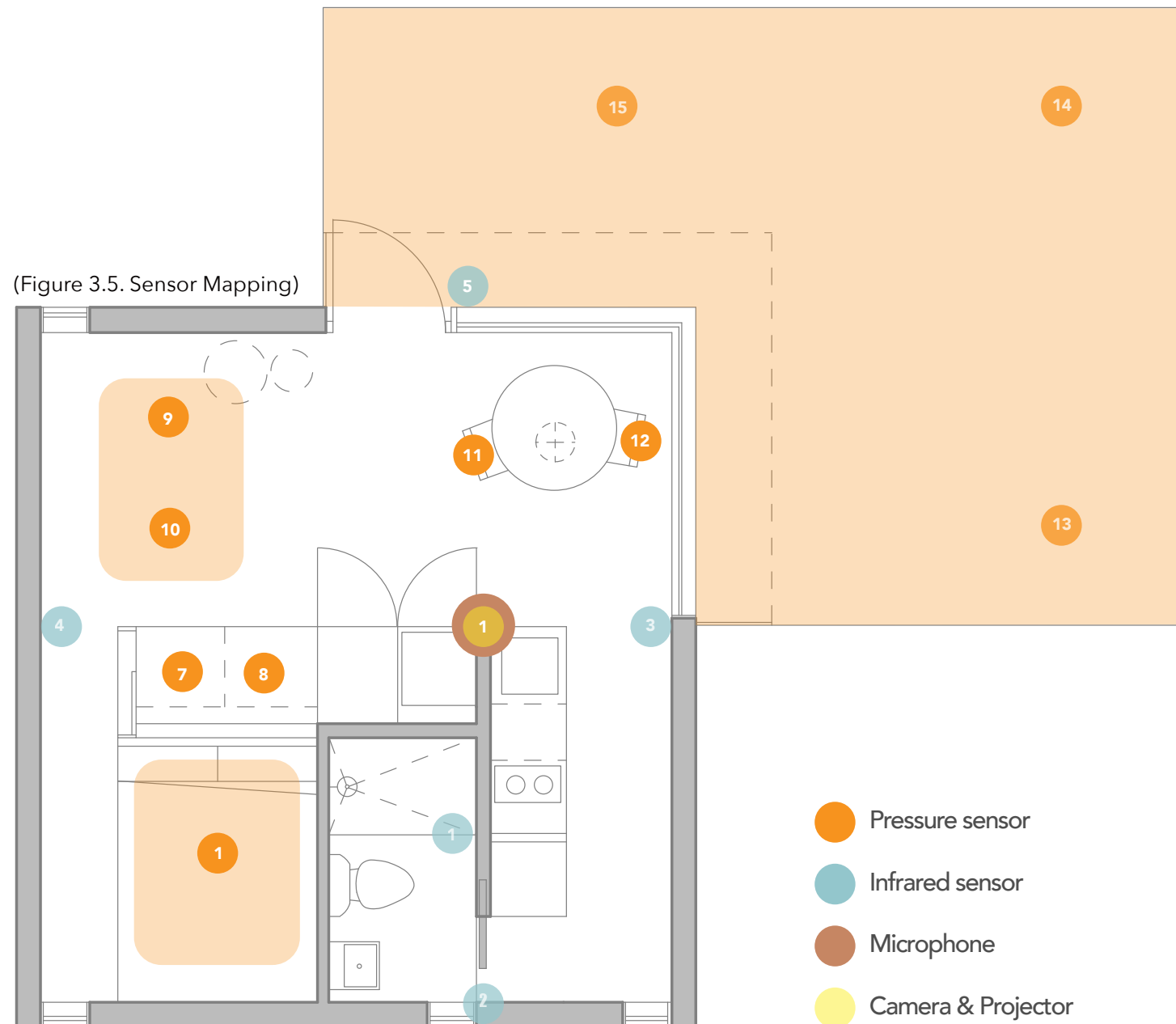
Technical support using Processing here is to simplification natural elements using such as rain, ocean, wind and smoke using particle systems, lines and shapes based on java algorithm. (Shiffman, 2012)

As per conclusion of task 2, 6 activities could be potential calm-interaction design opportunities, namely wake-up, shower, breakfast, working, yoga and relaxing outdoor. After a group discussion about affordable house for young inhabitant according to client's brief, our concept ideation should be narrow down to save cost. Therefore, wake-up and breakfast are the chosen activities in the morning, while yoga, relaxing indoor and meditation are the decided activities in the evening (Figure 3.4.).

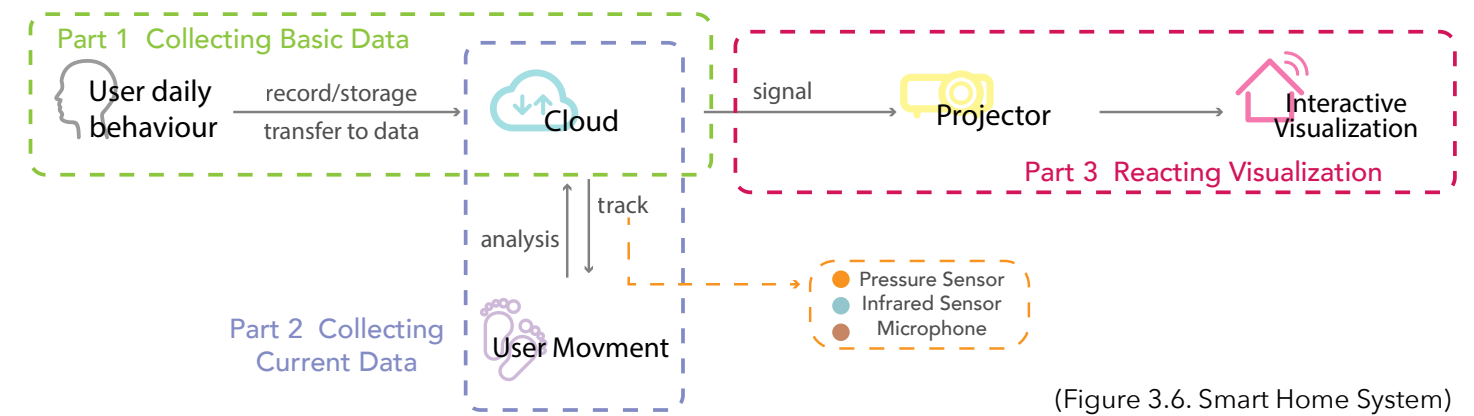
As the following floor plan shows, the focus of this interaction design is activities in the evening, because all of them could be inhabitants' choices after daily chores and take place all in living room. The 3 activities' zone overlay with each other, and hence same data input sensors and interaction output device could be used for all of them within the movement area to save fabrication cost.

During yoga, relaxing indoor and meditation, it was feasible that applying graphic ludic interaction and simulating natural elements according to inhabitants movement, to enhancing their calming experience. Finally, the sensors are mapped below (Figure 3.5.).

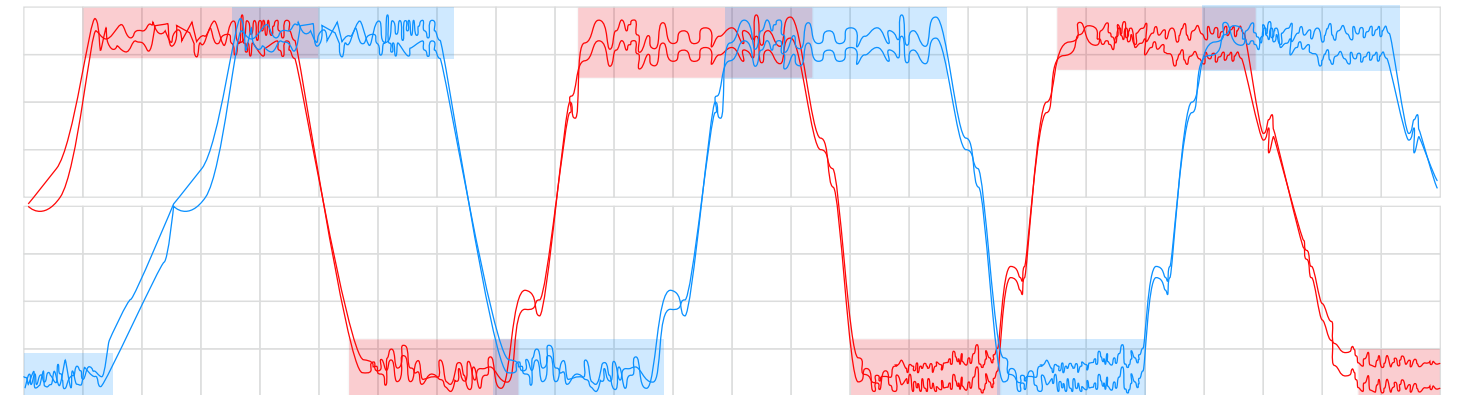




(Figure 3.5. Sensor Mapping)



(Figure 3.6. Smart Home System)



(Figure 3.7. Sample of Movement Recognition based on Data)

3.2 - SMART HOME SYSTEM LEARNING FROM UPDATING DATA

As per sensor mapping in the floor plan (Figure 3.5.), below should unifying thread of the system discussed in "The Peak" in task 3.2.

A general concept of the smart home system in "The Peak" was discussed that the tiny house could have an artificial intelligence built into it. (Figure 3.6.) Here is three part of "The Peak" smart home system. The first part is collecting inhabitants' daily behavior recorded and transferred into data, and then the database is storage into data cloud. The second part is collecting updating data, which means that the cloud tracks personal movement through pressure, infrared and microphone sensors. In addition, those original data from sensors could be analyzed by the smart home system. The third part is reacting visualization, namely the projector could transfer input signal

into interactive visualization.

Through the artificial intelligence system, the system could create a profile for every inhabitant by analyzing personal movement. According to machine learning technology, it could compare difference and seek characteristics of data deviation zone (Figure 3.7.), so that it could recognize which activity inhabitant is doing and how long it takes. The more data it collected, the accurate activities and inhabitants' calm condition it could recognize because of machine learning. In the further concept exploration, if the system recognizes inhabitants' stressful condition, it could automatically start relaxing state and remind user to take a rest and enhance calmness with light and sound interaction.

3.3 - INTERACTIONS AND STATE DIAGRAMS

Compared with general concept in task 3.2, 5 interactions of chosen activities are introduced detailed in this section.

From the start of a day, inhabitant is woken up by a slowly increasing ambient sound of nature, and there is a color changing sunrise visualization fabricated with LED panel embedded in bedroom ceiling. The input data is from pressure embedded in the bed. (Figure 3.8.)

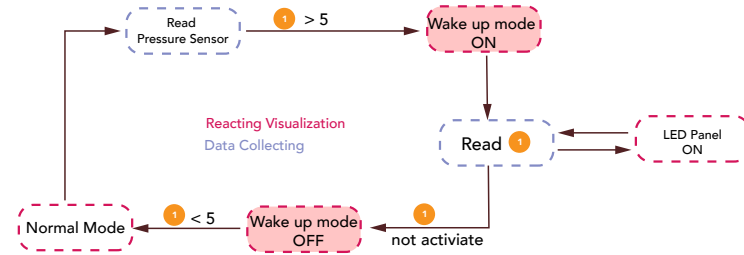
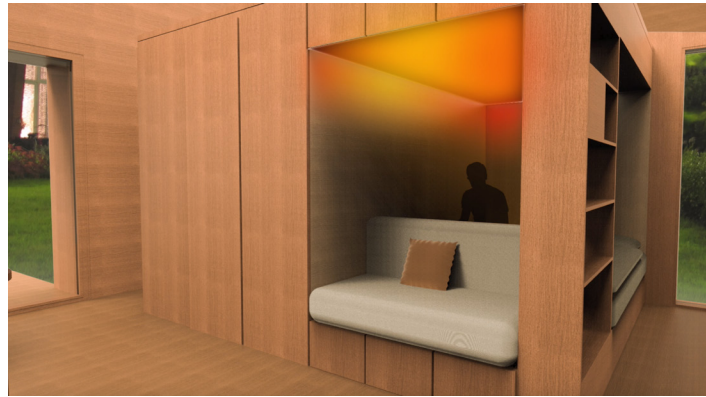
The second activity is breakfast, during which the dining table's LED panel could simulate the weather forecast for the day. It could provide calming and functional experience with out put visualization of the temperature and weather type, while the input data is pressure from chair. (Figure 3.9.)

In terms of activities in the evening, projector could visualize simulation of rain during relaxing indoor. Input data is from camera and pressure sensors. Drop speed visualize personal movement speed, color of particle could visualize warmth of interior temperature. In addition to basic personal data, weather data from open data source could

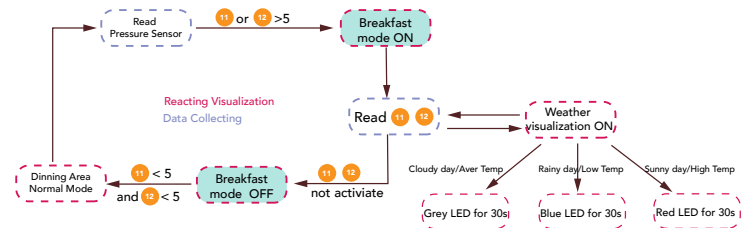
also contribute algorithm visualizing for example outdoor weather and wind force in the future. (Figure 3.10.)

Meditation is an important calming step before yoga, so camera could import inhabitant's movement data and projector visualize simulation of breath and wind according to movement speed. (Figure 3.11.)

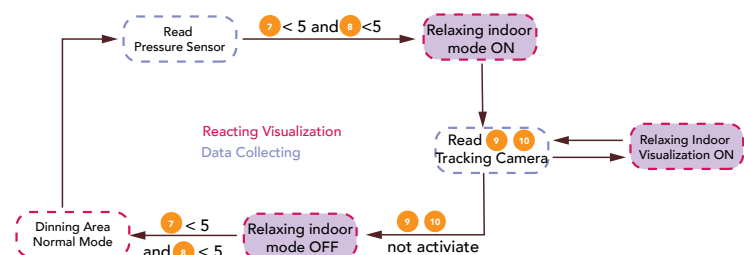
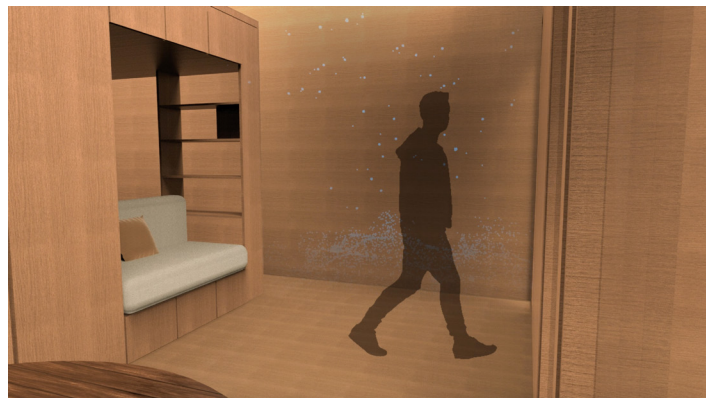
Finally, as a lot of prototype exploration introduced before, pressure sensors could import users' balance data within yoga area. User's balance is visualized into simulation of bubbles in the ocean. (Figure 3.12.)(Figure 3.13.).



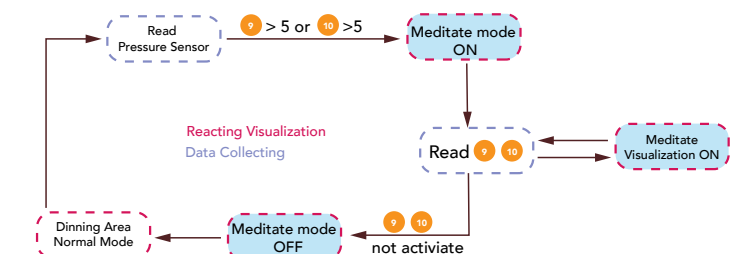
(Figure 3.8. Visualisation and State Diagram - Wake-up)



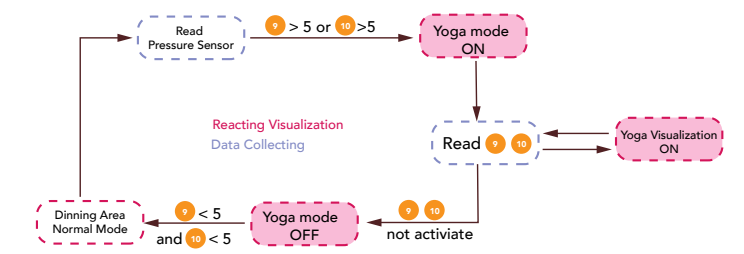
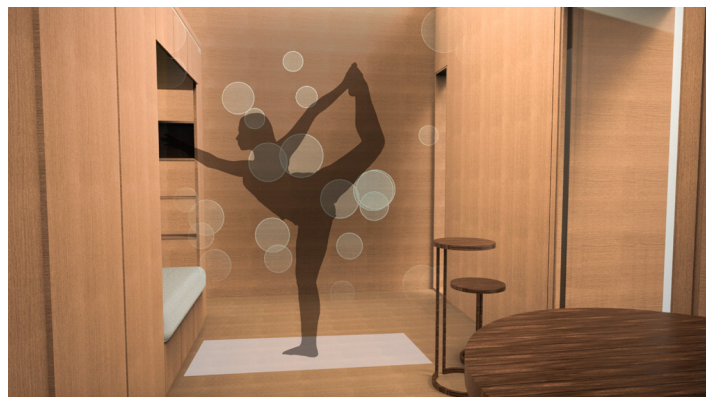
(Figure 3.9. Visualisation and State Diagram - Breakfast)



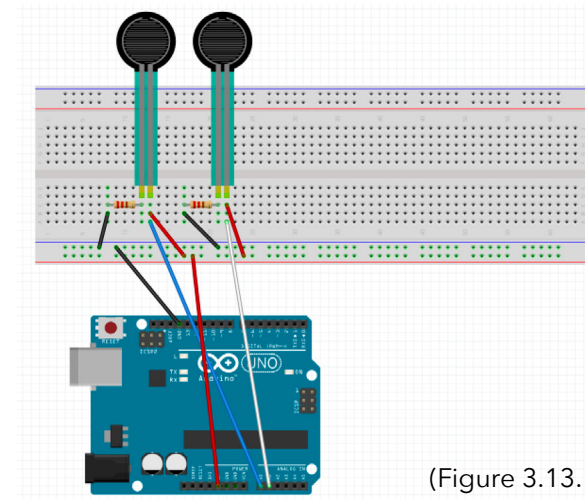
(Figure 3.10. Visualisation and State Diagram - Relaxing indoor)



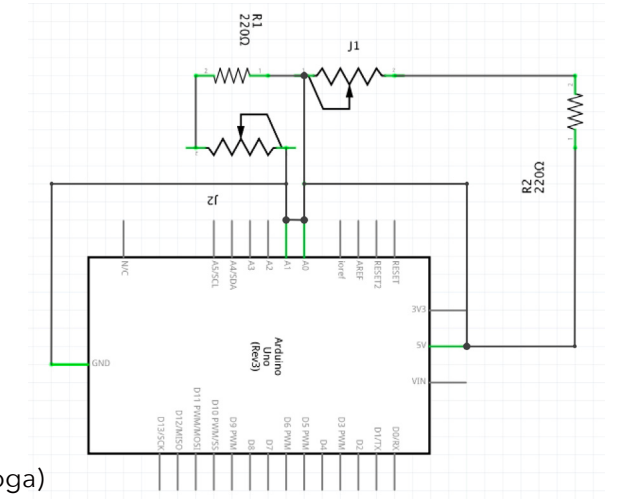
(Figure 3.11. Visualisation and State Diagram - Meditation)



(Figure 3.12. Visualisation and State Diagram - Yoga)



(Figure 3.13. Circuit - Yoga)



CONCLUSION

As a group work, in this project my main contribution is dealing with Processing, even though I just started to learn it from mid-break, and my secondary contribution was video making both for ethnographic research and final concept visualization.

In terms of my acquirement, firstly and basically, I learnt new skills, software and technique about coding. At first I just want to learn Processing for data visualization, and then fortunately I have the chance to design a feasible interactive concept having strong relationship with everyone's daily life. It provided me a strong sense of achievement because I always trust that designers' responsibility is enhancing users' enjoyable experience.

Secondly it is quite inspirable that we started to design an immersive experience based on data collecting, machine learning and artificial

intelligence, through multiple media platform and combining multiple technology. I feel very excited that we did an interactive concept engaging users' multi-sensory participation.

Finally, because I have already did some project about smart home before, I feel that I understood smart home more deeply after this project. A lot of technology companies a coping with smart home system development currently, but most of them are devising concept based on basic user need from Maslow's theory. All my previous impression about smart home is coping with efficiency in the domestic environment, but this project provided me new inspiration that we could also use smart home to enhance users' well being such as calm experience, a high level of Maslow's need theory. From this I think in my further career, this acquirement could lead me to be a designer with sympathy and deeply thinking.

REFERENCE

Amber Case (2016) Calm Technology. Available at: <https://www.youtube.com/watch?v=D5neEzKMClA> (Accessed: 11 June 2019).

Weiser M., Brown J.S. (1997) The Coming Age of Calm Technology. In: Beyond Calculation. Springer, New York, NY

Crabtree, A. et al., 2003. Finding a Place for UbiComp in the Home. UbiComp 2003. p.208-225.

Raijmakers, B. et al., 2006. Design Documentaries: Inspiring Design Research Through Documentary Film. University Park, PA, USA – June 26 - 28, 2006. p. 229-238.

White, M. P., Pahl, S., Ashbullby, K., Herbert, S., & Depledge, M. H.. (2013). Feelings of restoration from recent nature visits. Journal of Environmental Psychology, 35, 40 - 51.

Hamza, A. (2018). Learn how to connect the Arduino to the Processing IDE so they can communicate with one another. [online] Available at: <https://maker.pro/arduino/tutorial/how-to-make-arduino-and-processing-ide-communicate> [Accessed 13 May. 2019]

Shiffman, D. (2015). Getting Started with Kinect and Processing. [online] Available at: <https://shiffman.net/p5/kinect/> [Accessed 20 May. 2019]

Schlegel, A. (2011). Using Osculator with Processing. [online] Available at: <http://www.sojamo.de/libraries/oscP5/> [Accessed 21 May. 2019]

Shiffman, D., 2012. The Nature of Code. 1st ed. California: Creative Commons.