



Antennae Revolution

About:

This project takes speculative design as its core, exploring how wearable devices with mechanical insect antennae can solve future social problems. We designed two devices inspired by insect antennae, focusing on future environmental crises and social barriers respectively. On the one hand, in the face of future air pollution problems, the antennae we made imitate the antennae of gypsy moths, showing different curling states in the face of changes in air quality, and at the same time have the function of purifying the air, providing individuals with portable environmental protection means. On the other hand, in response to the prevalent social barriers in the future society, we also designed a wearable device that imitates ant antennae, expressing emotions and social intentions through lights and mechanical movements, providing humans with a non-verbal way of communication and establishing a new way of interpersonal connection. These two devices combine the natural functions of insects with mechanical design, and through interactive design, they trigger deep thinking about the future of science and technology and the way of human survival.

▶ https://youtu.be/P-H0qTgHiBA?si=xQ2OIfmzEU8Vej_m

- Speculative Design
- Bionic Design
- Wearable Device

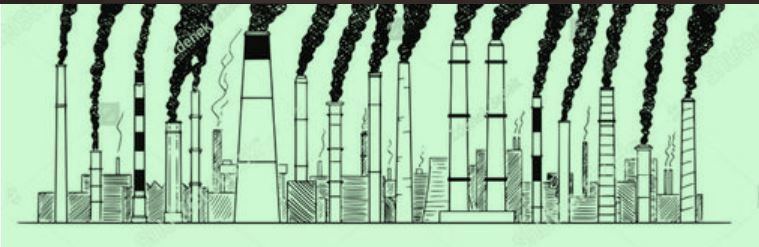
Miriam Guo

12/2023

Group project

RESEARCH -Moth Tentacle Bionic Device

Backgrounds



With global warming, the rising atmospheric CO2 concentration will directly or indirectly affect the forest ecosystem.

Injuries at different carbon dioxide concentrations to the human body

- 01

10,000 ppm (1.0%)

Typically no effects, possible drowsiness.
- 02

15,000 ppm (1.5%)

Mild respiratory stimulation for some people.
- 03

30,000 ppm (3.0%)

Increased heart rate and blood pressure.
- 04

40,000 ppm (4.0%)

Immediately Dangerous to Life or Health.
- 05

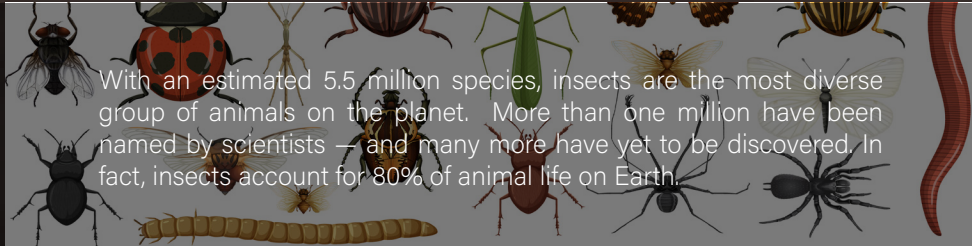
50,000 ppm (5.0%)

Strong respiratory stimulation, dizziness, shortness of breath.
- 06

80,000 ppm (8.0%)

Dimmed sight, sweating, tremor, unconsciousness, and possible death

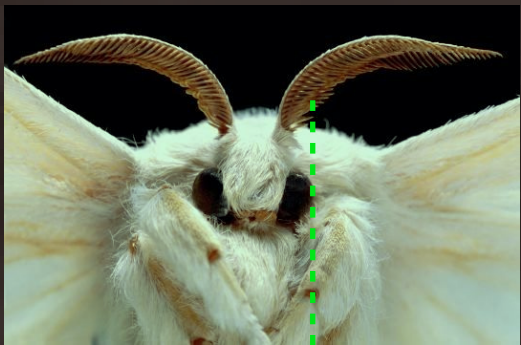
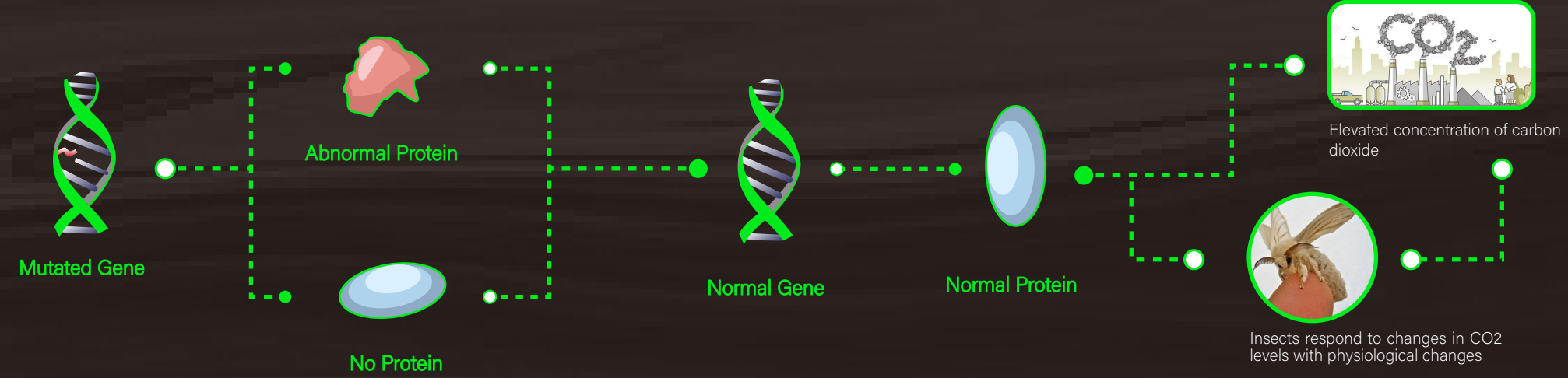
Selecting Bionic Objects



With an estimated 5.5 million species, insects are the most diverse group of animals on the planet. More than one million have been named by scientists — and many more have yet to be discovered. In fact, insects account for 80% of animal life on Earth.

Socialising has changed with technology:

There is widespread concern about the effects of global warming on insects. For example, the larvae of the gypsy moth, *Populus pseudosimonii*, consumed **significantly less body weight** than *Populus pseudosimonii* grown in high CO2 concentrations than those grown in atmospheric CO2 concentrations.



Backgrounds

After research and investigation, the antenna morphology of this moth will change with the concentration of carbon dioxide.

the antenna changes with carbon dioxide:



Antenna straightening at low contamination.

The antenna is slightly curved at high contamination.

The comb antenna increases the contact area with air.



CO2 levels inhibited the expression of olfactory genes in *Lymantria*, and the highest levels of these genes were found in the antennae.

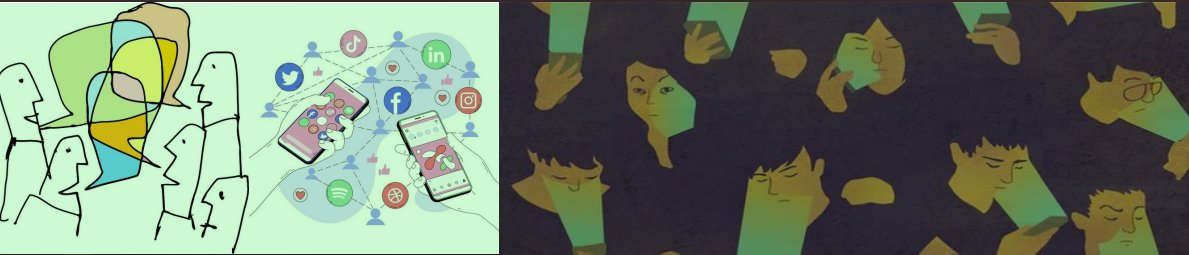
Summary

Global warming is one of the major problems faced by the people in which carbon dioxide is the main component of greenhouse gases. And the effects of global warming on insects have attracted much attention worldwide. *Lymantria* is one of the affected insects and it was obtained that high CO2 concentrations inhibit the expression of olfactory-related genes in *Lymantria*, and all of the relevant genes are expressed at the highest level in the antennae. So this project takes insects as my inspiration, The plan is to mimic the tentacles of insects to create a design that will help mankind overcome the future of surviving with high levels of carbon dioxide.

RESEARCH -Ant Tentacle Bionic Device

Backgrounds

Although the Industrial Revolution greatly facilitated social development through scientific and technological progress, it also caused a profound crisis in social development.



Socialising has changed with technology:

Ants have 10-20 chemical "languages" that allow them to recognise similar ants, tell other ants where food is available, or sound the alarm in case of danger. Most of the ants' communication with other ants is through their antennae.



Selecting Bionic Objects

Functions of ant antennae:

Chemical Communication

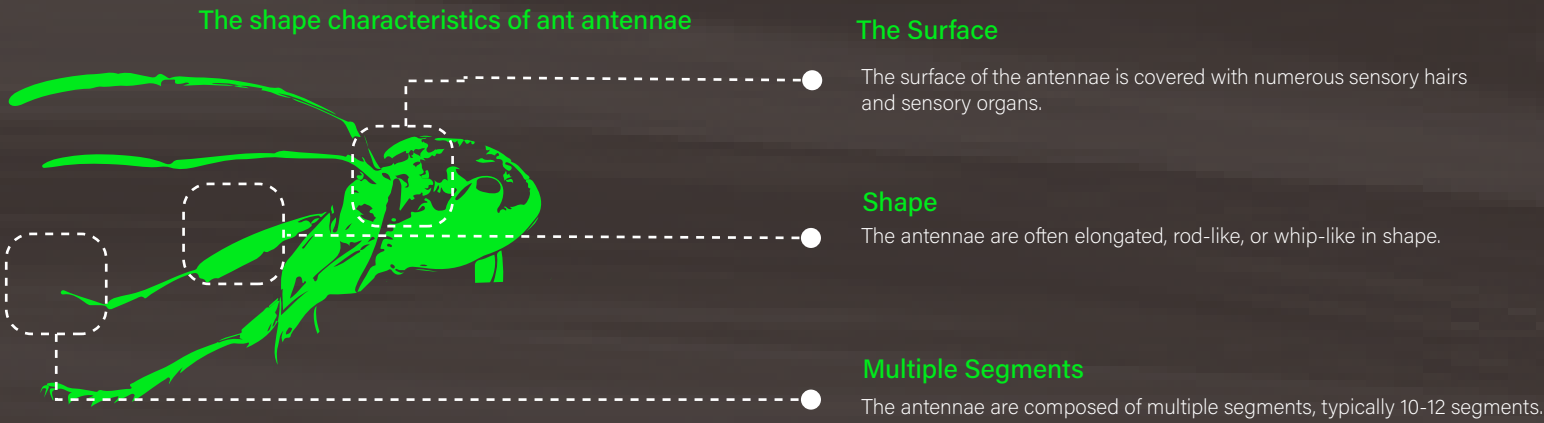
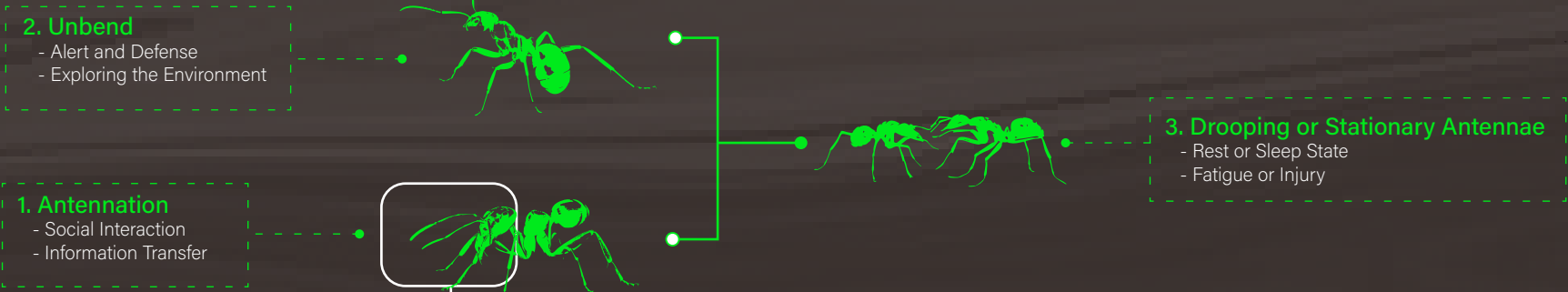
Pathfinding

Social Interactions

Warning and Defence

Ants use their antennae to sense information about the world around them, which is crucial for their survival and the life of the ant colony. The antennae are in constant motion, touching, tasting, and smelling everything within reach. Each antenna bends in the middle, similar to the elbow of a human arm.

The meaning of the antennal movements of ants



Summary

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PRODUCT CONCEPT DEVELOPMENT

Brainstorming

Melting glaciers lead to prehistoric virus outbreaks that human immune systems can't cope with.

Global Warming and Glacier Melting

Rapid development of artificial intelligence

Humanity is highly polarised and class solidarity is hard to broke down.

It causes people to have serious breathing

Substantial greenhouse gas emissions

Mass extinction of organisms, humans face ecosystem collapse, food scarcity

overdevelopment of environment

with water scarcity, how do people manage to store water at all time.

Extreme scenarios that the future may face in the future

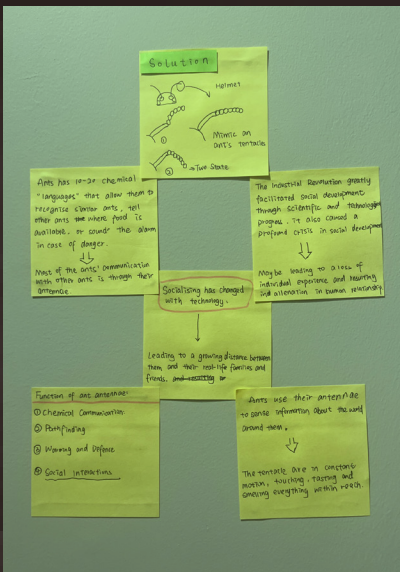
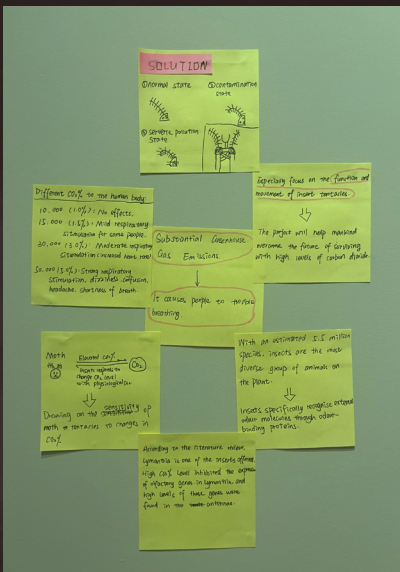
Global warming and population growth

Society is under great pressure, especially for young people

Rapid changes in socialisation leads to decline in people's ability to empathise and difficulties in socialising.

people have low fertility and may be a risk of human extinction

Moth Tentacle Bionic Device



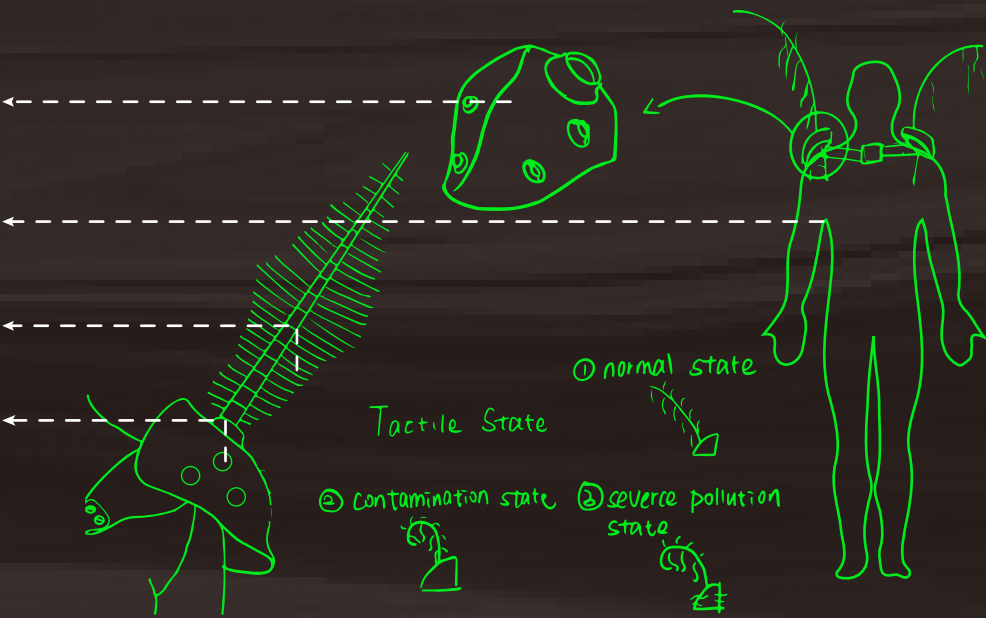
-Moth Tentacle Bionic Device

Mimics the tentacles of a moth. Works in installations that serve to amplify the curvature of the tentacles.

The product is a wearable shoulder armour device

The device has a total of three states depending on the concentration of carbon dioxide.

If the air contains a high concentration of dioxide, the spray port will release an air purifier to protect the wearer.



A set of shoulder armour designed to be worn in imitation of moth tentacles, based on research on moth tentacles. It can detect the concentration of carbon dioxide in the air and alert the wearer to the safety level of the surrounding environment by bending the tentacles and spraying them.

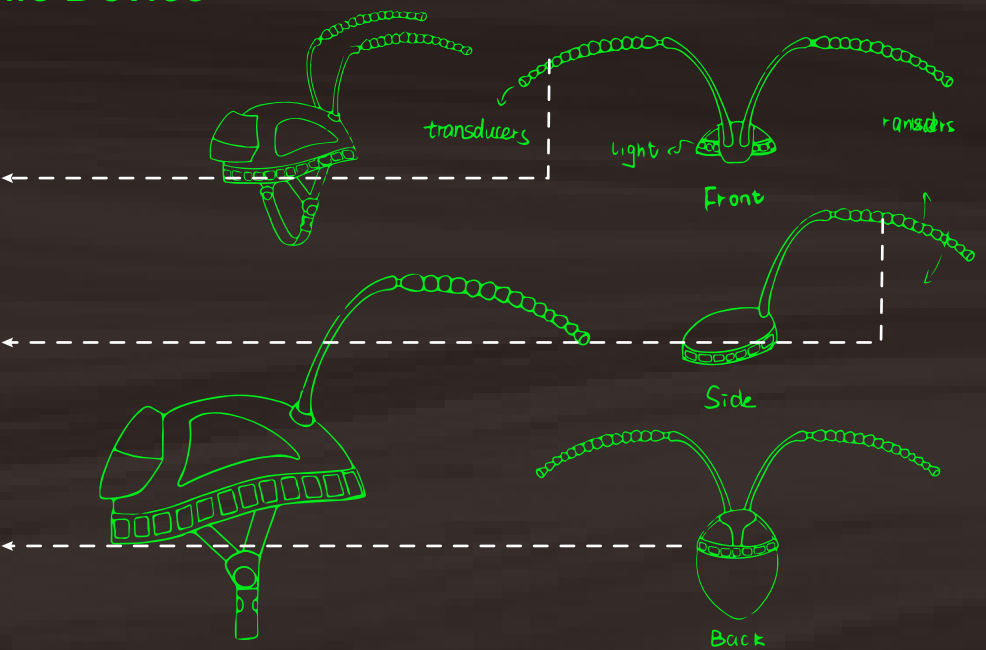


-Ant Tentacle Bionic Device

The design of the object imitates the structure of ant tentacles, featuring a two-section wire-activated mechanism.

The tentacles are available in two states, bent and straight, indicating negative and positive moods respectively.

The lights and tentacle states represent six distinct emotions.

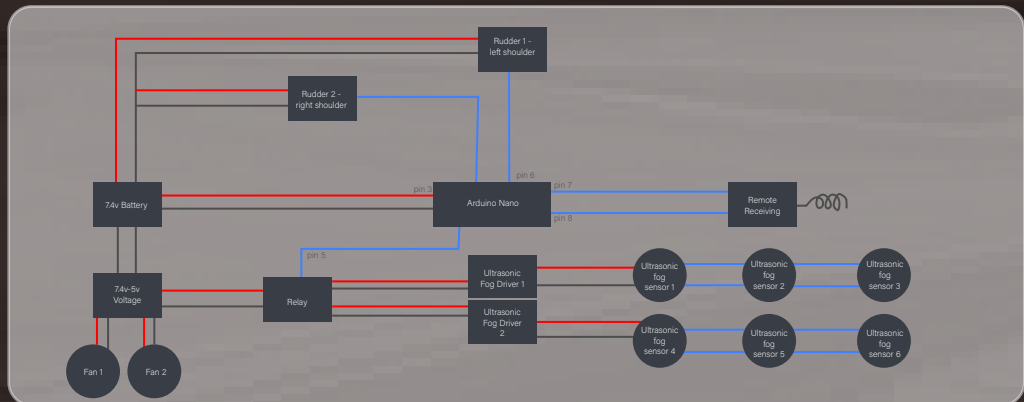


A helmet wearable device has been designed based on the social properties of ant tentacles. It can display the user's new products through the status meter of the antennae and the colour of the lights. Additionally, it can facilitate the exchange of emotional experiences by touching the antennae.



Manufacturing

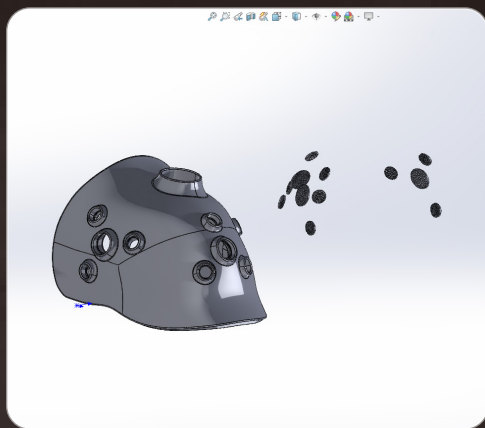
Circuit Diagram Design



```
130 All Off();
131 Alarm: if (Vv == 1)
132 Yellow_On();
133 else if (Vv == 1)
134 Blue_On();
135 else if (Vv == 1)
136 Red_On();
137 else
138 {
139   angle_Y = remote_Y_angle();
140   Aha = map(angle_Y, 70, 200, 255);
141   if (angle_Y > 10 && angle_Y < 100)
142   {
143     Right_angle = map(angle_Y, 10, 100, 54, 90);
144     Left_angle = map(angle_Y, 10, 100, 144, 90);
145   }
146   else if (angle_Y < 10)
147   {
148     Right_angle = 54;
149     Left_angle = 144;
150   }
151   else if (angle_Y > 100)
152   {
153     Right_angle = 90;
154     Left_angle = 90;
155   }
156   else
157   {
158     myServo.Left_Write(Left_angle);
159   }
160 }
```

The Programming Process

Exterior Part Design

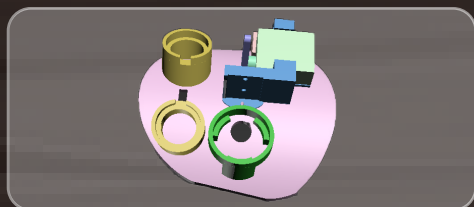


3D Modelling Diagram

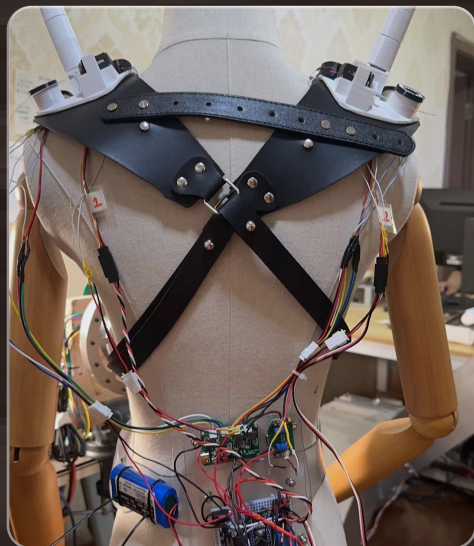


3D Printing Process

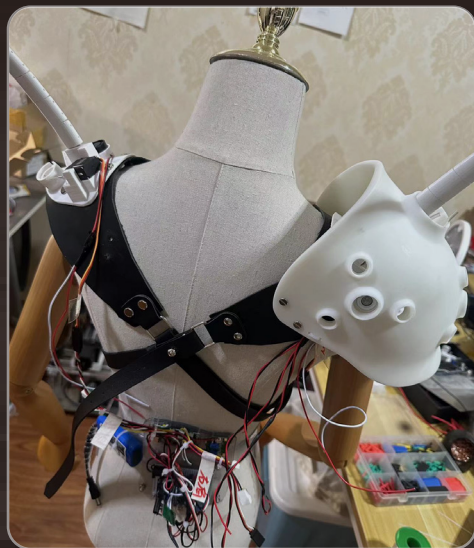
Internal Mechanical Structure Design



Internal Structure Modelling



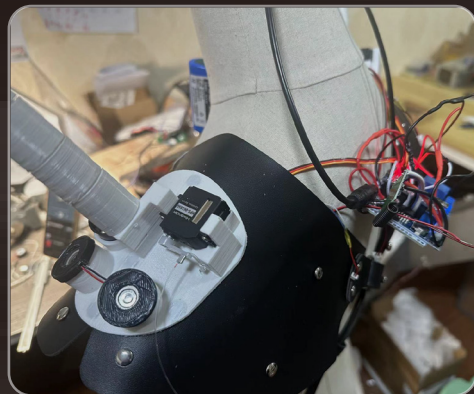
Initial Assembly Back View



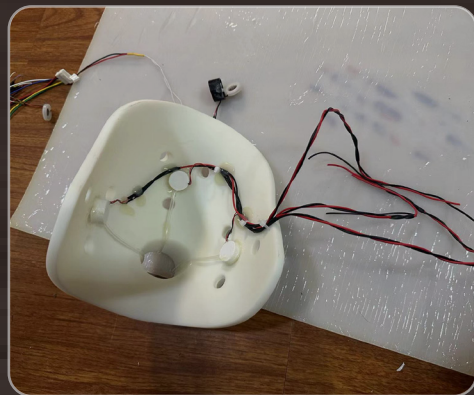
Assembling the Shell Part



Initial Assembly Front View



Internal Structure Diagram



Connection Diagram Inside the Shell



Assembling the bulb section



Linking different components

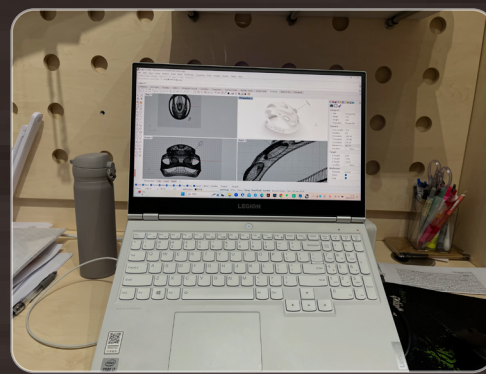


Assembly of circuits

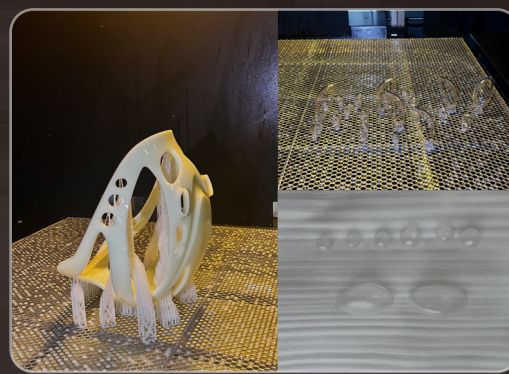


Test Function

Shell Part Design



Building 3D Models with Rhino



3D Printed Models

PRODUCT INTRODUCTION

-Moth Tentacle Bionic Device

A wearable device has been developed, inspired by the sensitivity of poisonous moth tentacles to carbon dioxide. The device detects the concentration of carbon dioxide in the air and alerts the wearer to the safety of their environment. This is particularly relevant given the potential for serious greenhouse gas emissions in the future.

Details



Antennal Primordial State (straight)



Antennae Curved State



Spray Condition (Air Purification)



Wearing Details



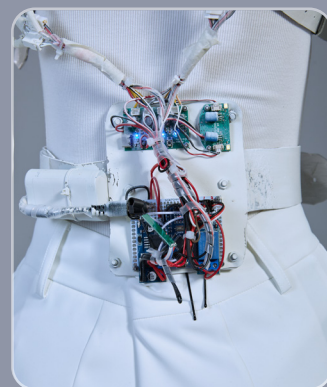
Spray Hole Detail



Antennal Primordial State



Spray Detail

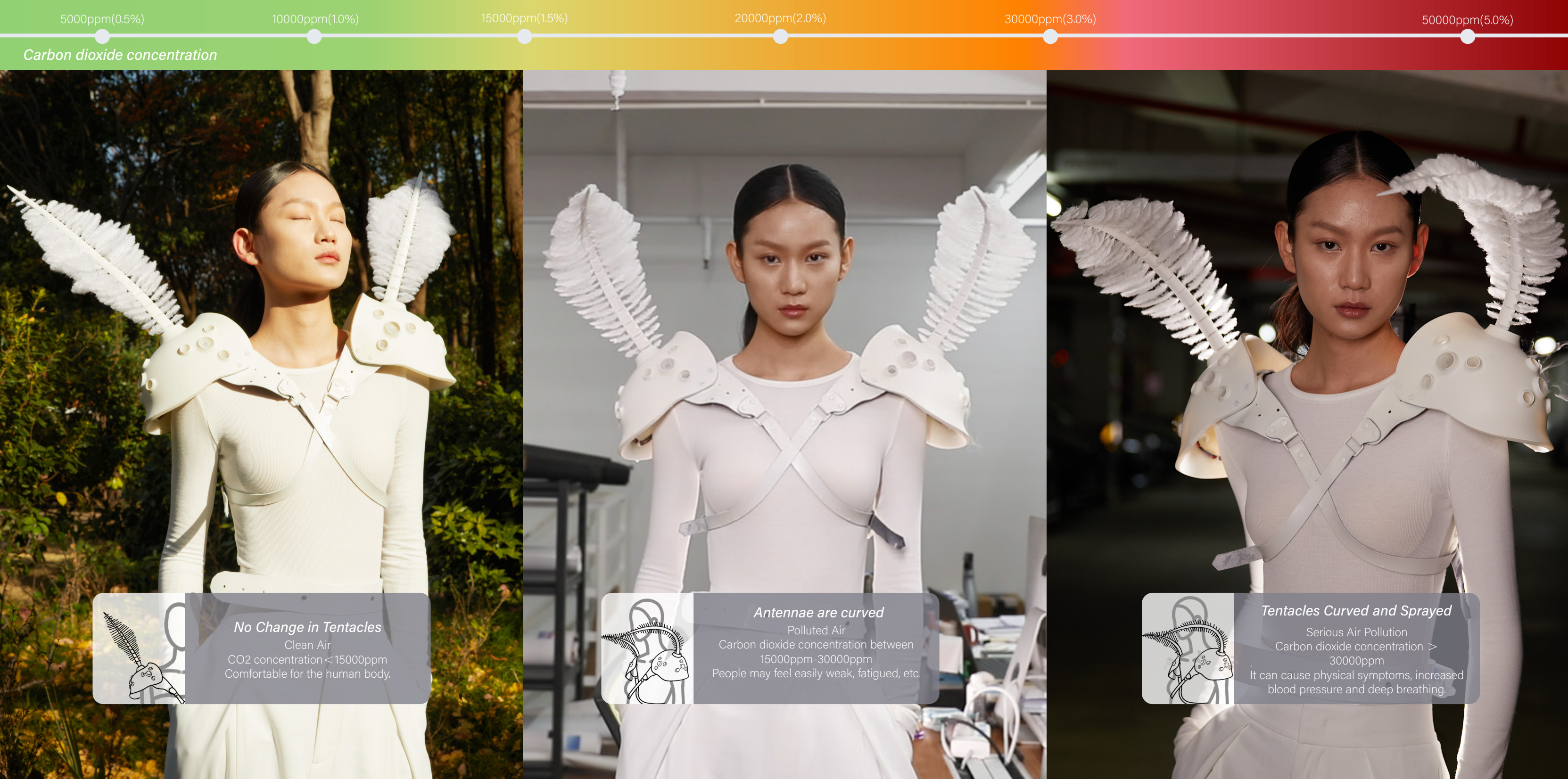


Back Motor Section



飛蛾觸角肩甲
Moth Antenna
Shoulder Armor





PRODUCT INTRODUCTION

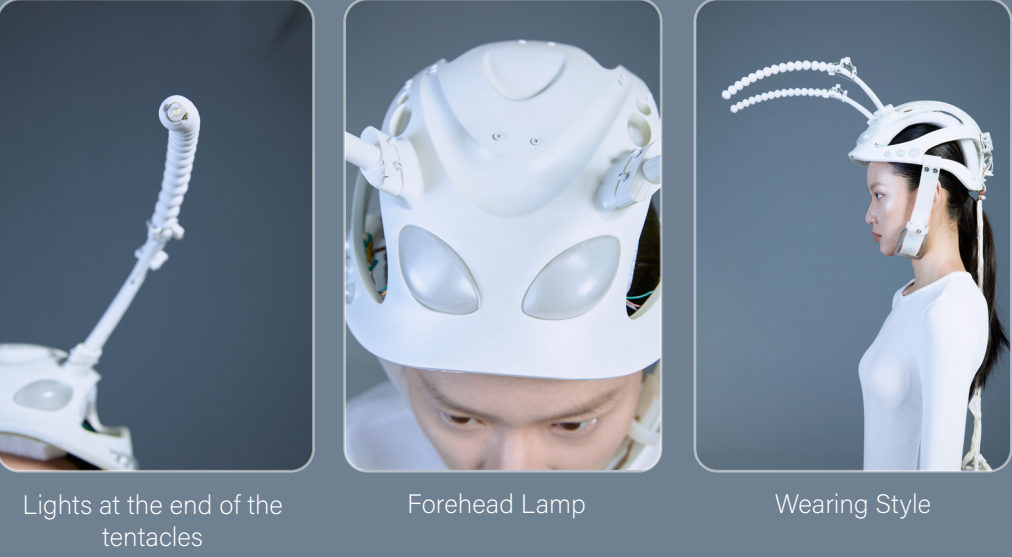
-Ant Tentacle Bionic Device

The project is about the rapid technological advances that have changed how humans socialize. In the future, people's ability to empathize will be greatly reduced. The design is inspired by the rapid transfer of information between ants through their tentacles. This project aims to assist people in socializing and enhancing their empathy. The helmet's tentacles can express six different moods depending on their state and the change of light colour.

Light Colour Status

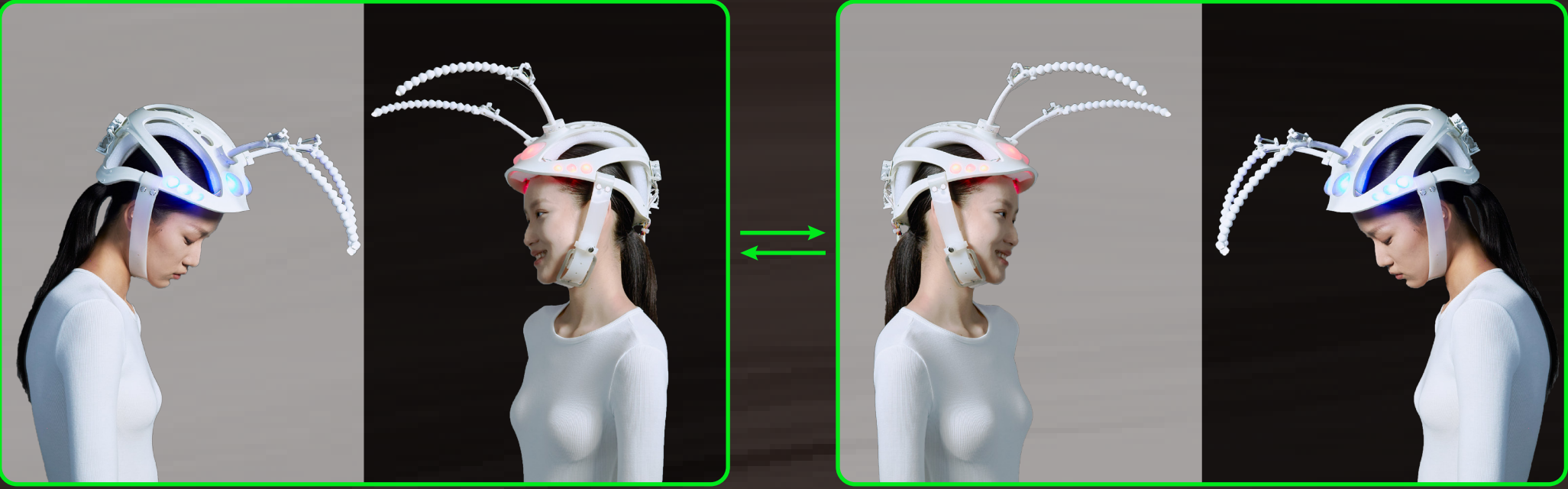


Details

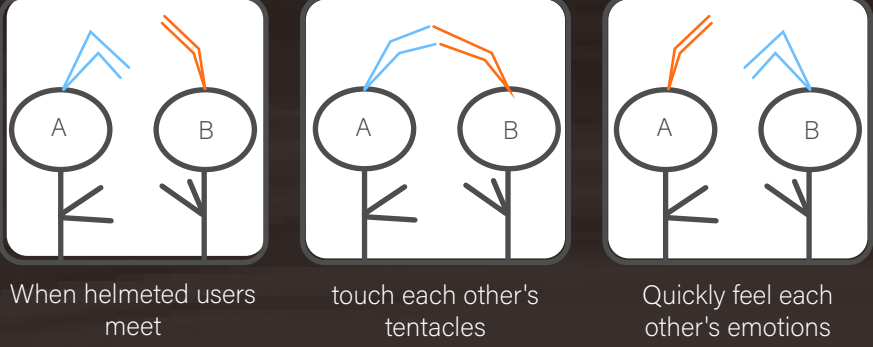




Between two users



Users can quickly convey emotions through the contact of the tentacles while wearing the helmet.

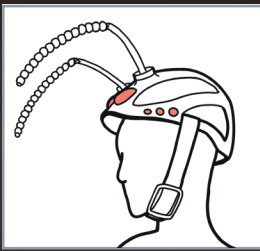


The device can detect the emotions of others through touch using its tentacles. It has the potential to aid in social interactions and improve social efficiency, particularly as technology advances and people's empathetic abilities decline.

In the case of multiple people

The product can be used not only when people are wearing helmets, but also in scenarios where other people are not wearing helmets. The mood of the user can be easily determined by observing the state of the helmet's tentacles and the colour of the lights. This helps people to empathise quickly and increases social efficiency.

Scenario 1

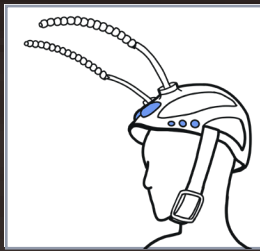


 **Furious**

When the user feels anger is, the helmet has tentacles pointing down and lights turning red.

Those around her can feel the anger more directly, helping the user to moderate her emotions.

Scenario 2

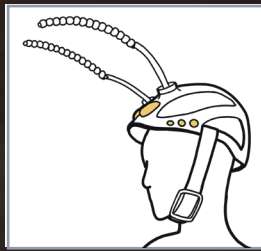


 **Calm**

When the user feels calm, the tentacles on the helmet extend upwards and the lights turn blue.

The calm atmosphere can be felt by neighbours.

Scenario 3



 **Excitement**

When the user feels pleasure, the tentacles on the helmet stretch upwards and the lights turn yellow.

Those in proximity can experience pleasure more directly, which can improve the overall mood.