DH2323 Project Report: Variable Body Sizes

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Abstract

Our Homo Colossus team are now setting up a science + art + communications project that will result in a number of installations both at the 2021-2022 World Expo in Dubai as well as at Tekniska Museet, Färgfabriken and in the city of Stockholm (2020-2022). Our project is run by Principal Investigator (project leader) Daniel Pargman (KTH/Media Technology and Interaction Design) and by Mario Romero (KTH/Computational Science and Technology).

This project is a sub-project of our plan and we are aimed at making people realise how different they will be if some of their body parts waste too many resources. The future plan for this project is to combine it with Virtual Reality (VR) technology and display the Homo Colossus figures not only on PC screen but also in the space around people.

1 Project Specification

Aiming Grade: A

1.1 Background

This project derives from the running project Homo Colossus which KTH will exhibit at the 2021 World Expo in Dubai. We expect it to become a part of the project at the World Expo after the course ends. Homo Colossus is a spin-off from a three-year (2020-2022) communication, research and art project that is funded by the research grant agency Formas [5], *"From Homo Sapiens to Homo Colossus: Visualising our energy footprint"*. More specifically, we have a KTH page [6] which states the main idea: the bigger a person is, the more he needs to eat. And if people included not just calories from the food they eat, but all the energy they "consume" in their daily lives (such as the fuel that powers the vehicles, the hot water that heats homes and the electricity that illuminates cities and powers the Internet) - people would then be incredibly big! In our project, we represent people's different energy habits by distorting their different body parts. For example, people who eat a lot of meat per week will have a big belly, and people who travel a lot (by airplane or car) will have long legs.

Humanoid characters are widely applied in many modern applications, such as a humanoid robot. Also, humanoid characters are very common in computer games. Three.js [7] is a cross-browser JavaScript library and application programming interface (API) used to create and display animated 3D computer graphics in a web browser. Three.js uses WebGL. We are going to use this JavaScript library to create our system on a website.

1.2 Problem

The main problem is to create an interactive system which asks the users' some questions about their daily life, takes their input and calculate their unique size of Homo Colossus. And then the system displays the 3D model of their Homo Colossus and gives some advice on how to change their lifestyles and become more sustainable. What shape will human be if taking all their energy consumption into account?

1.3 Implementation

The project is preliminarily developed in WebStorm with JavaScript and HTML. For construct the website, we will use Express.js, which is a minimal

and flexible Node.js web application framework to set up our web application framework. [4] Besides, we will deploy and publish our website using Heorku, which is a cloud application platform that enables developers to build, run, and operate applications entirely in the cloud. [2]

For character modelling, we are going to use MakeHuman and we will export the output of MakeHuman to Blender, in order to add animations. We will use Three.js which is a lightweight, 3D library with a default WebGL renderer to display those 3d models on our website. [7]

1.4 Expected system

The final system is expected to include a main panel for the main 3D humanoid model with a user interface asking questions about the users' lifestyle like "how many kilos of meat do you eat per week". The users only need to select answers of the questions showed in the left panel and submit, their Homo Colossus figure will then show in the right main panel. The sketch of our website is shown in Figure 2.

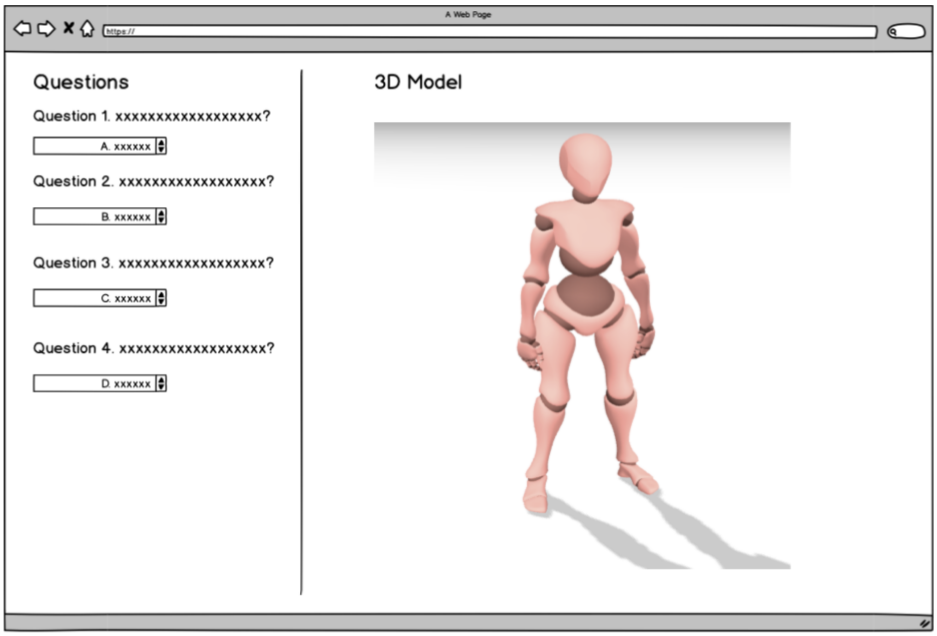

Figure 1: The sketch of our website for Variable Size Body Parts

1.5 Potential challenges

1.5.1 Question Design

The first challenge of this project is to design several questions and then calculate the size of the Homo Colossus's different body parts from the users' answers.

1.5.2 3D Figure design

Another challenge is to design Homo Colossus characters. This is because we are not Art students and we do not have specialised knowledge related to Arts.

1.6 Evaluation

The project is focus on data collection and 3D figure display. This means that the two important components of the project are human-computer interaction and 3D animation. Thus, the technical evaluation will focus on Interactive experience and feedback scores. At the same time, we are also very concerned about whether 3D animation we designed matches the corresponding character's feature.

1.7 Contingency plan

In case that we run out of time and can't catch the calendar to have a thorough discussion meeting with the Homo Colossus team, we will create an online survey for a basic online user testing. After getting the feedback, we will improve our website iteratively. But mainly, we will focus on implementing the functions described in Section 1.4 and optimising the performance of our implements.

2 Reflective Evaluation

2.1 What we do

a. Design a website (including user interface and user-friendly functions) which conveys the main idea (what do we look like through the lens of our energy footprints?) of our Homo Colossus project.

b. Explore MakeHuman and use it to quickly model humanoid 3d figure shown in FIgure 2.

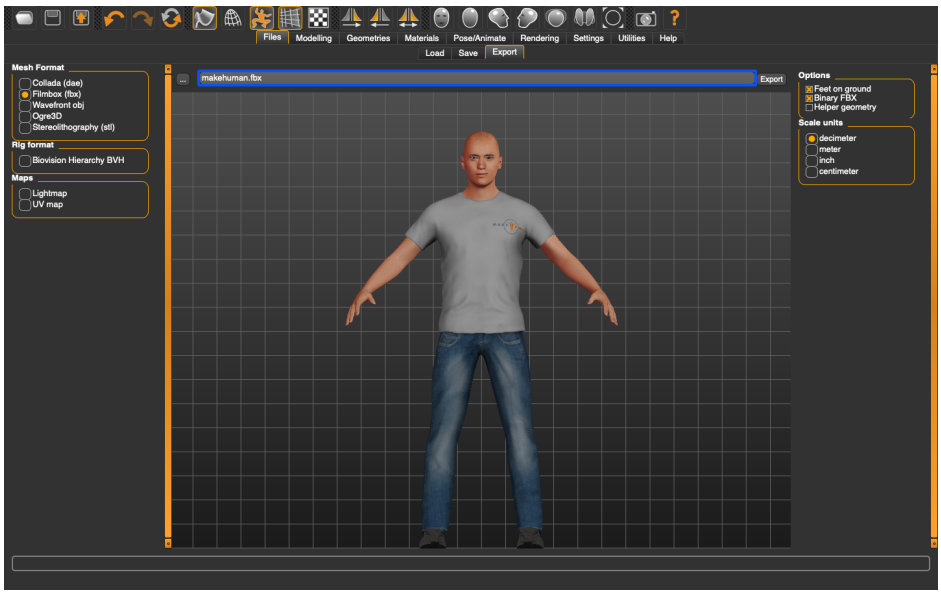

Figure 2: Model humanoid 3f figure with MakeHuman

c. Explore Blender to load models from MakeHuman and add animations shown in Figure 3.

Figure 3: Add animations to MakeHuman 3d figure with Blender

d. Explore Three.js to load 3d models to website and display animations.

e. Construct our website with Express framework using JavaScript and HTML.

f. Deploy our website using Heroku so that users from all over the world could visit.

g. Conduct user tests to improve our website.

2.2 How we solve challenges

a. As to the first challenge stated in Section 1.5.1, to make questions simple to understand and answer, we are design questions which maps to four parts of human bodies which are head, arms, belly and legs.

b. As to the second challenge stated in Section 1.5.2, we have other members in our whole Homo Colossus team who will specialise in designing characters (but they are not in our course nor in us course team). This makes us do not need to design many 3d figures in this project. Thus, we only model one character in our project to show that we have learnt knowledge of modelling characters. The rest of our characters are from the web open source [1] and we will replace them in the future.

2.3 What we learn

After the project, we've learnt the following things.

a. We learn how to use MakeHuman and Blender to model a humanoid 3d figure and add simple animations.

b. We learn how to use Three.js to load 3d models and display animations on the website.

c. We learn how to construct a website using Express.

d. Express is based on Node.js and websites constructed with it can only be visited locally. This is not enough. We learn how to deploy a website using Heroku.

3 Outcome and Presentation

3.1 Website display

Our website link is: http://variable-body-sizes.herokuapp.com/.

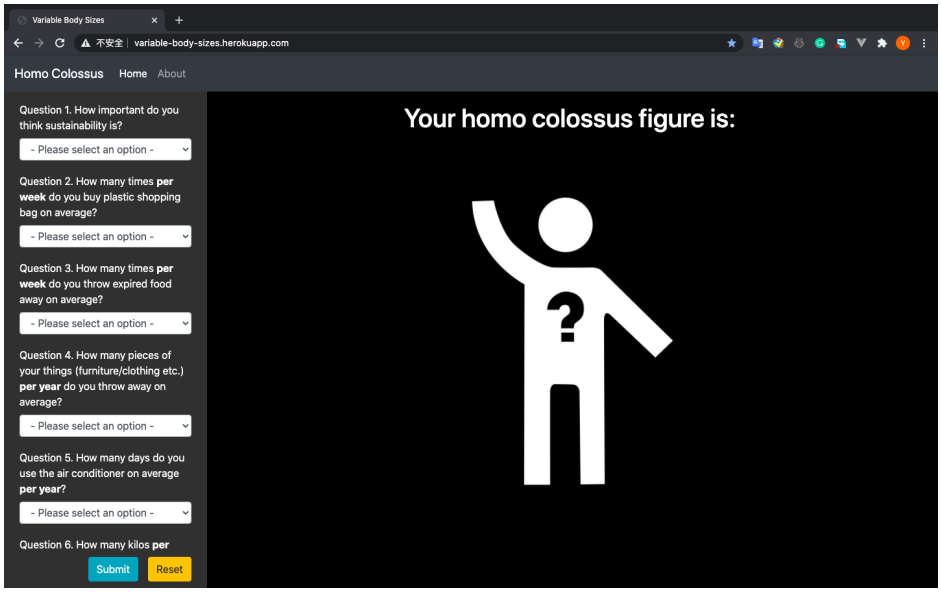

Figure 4: The homepage of our "Variable Body Sizes" website

As can be seen from Figure 4, our website contains a navigation bar, a left-side question panel and a right-side main panel displaying results.

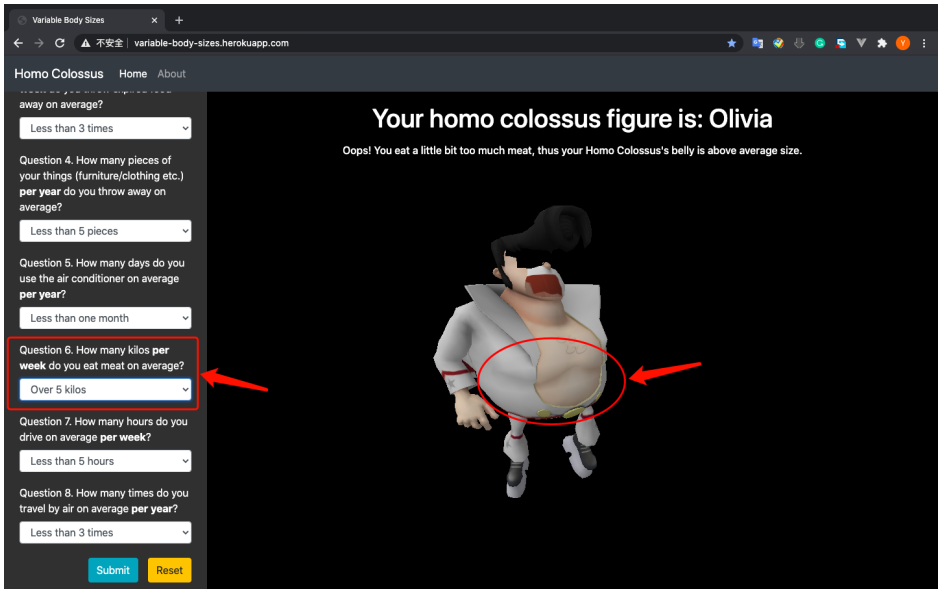

Figure 5: The example result of submit answers to the questions

After answering all questions listed on the left and click the submit button, the customized Homo Colossus figure will show on the right, along with

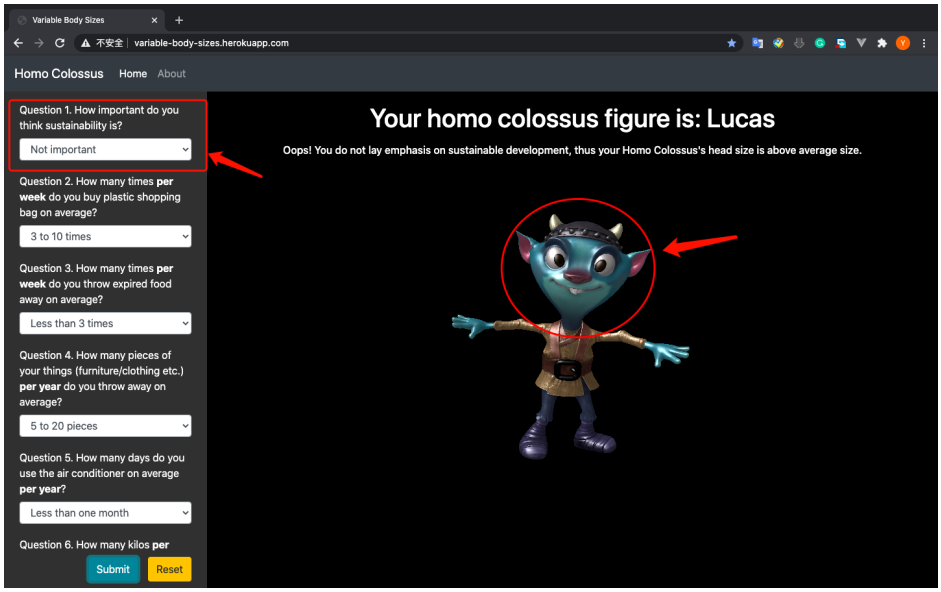

Figure 6: Another example result of submit answers to the questions

descriptions and suggestions about the 3d figure. For example (shown in Figure 5), if one eats a lot of meat (over 5 kilos) per week, then his Homo Colossus figure will have a big belly and we will suggest him to try eat less meat. For another example (shown in Figure 6), if one does not lay emphasis on sustainable development, his Homo Colossus figure will have a big head. If one clicks reset button, all of the select boxes will be set to the default option and our system will remove the last result figure.

Besides, we also add some user-friendly functions shown in Figure 7 and Figure 8. In Figure 6, if one forget to answer question x but he clicks the submit button, our system will remind him to answer question x and will not display the result. Only if all the select boxes are set to a certain option, our system will then show the result. In Figure 7, since loading 3d models may take some time which means the users may wait for a while to see their results, we add the loading progress notification.

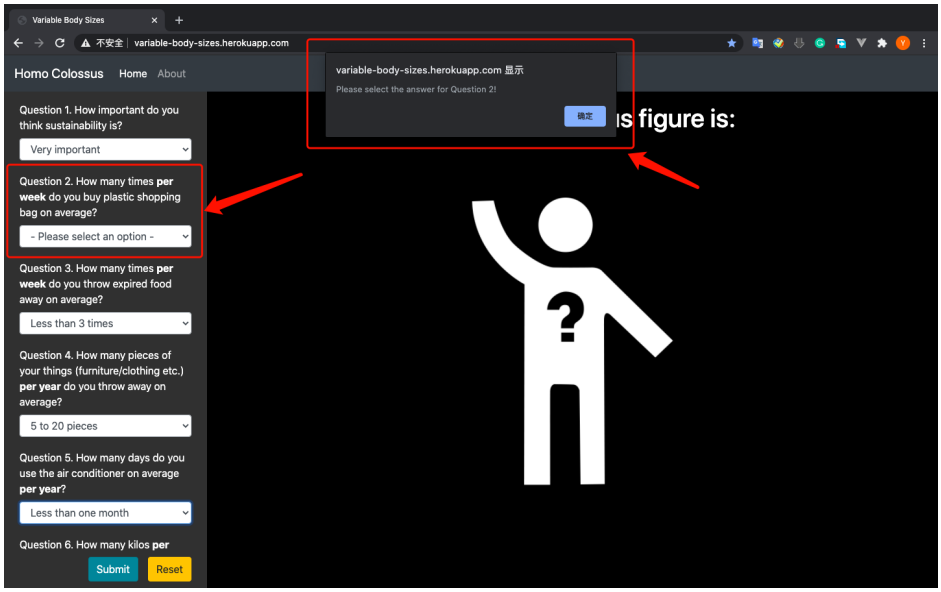

Figure 7: User friendly function: notification of reminding users to answer Question 2

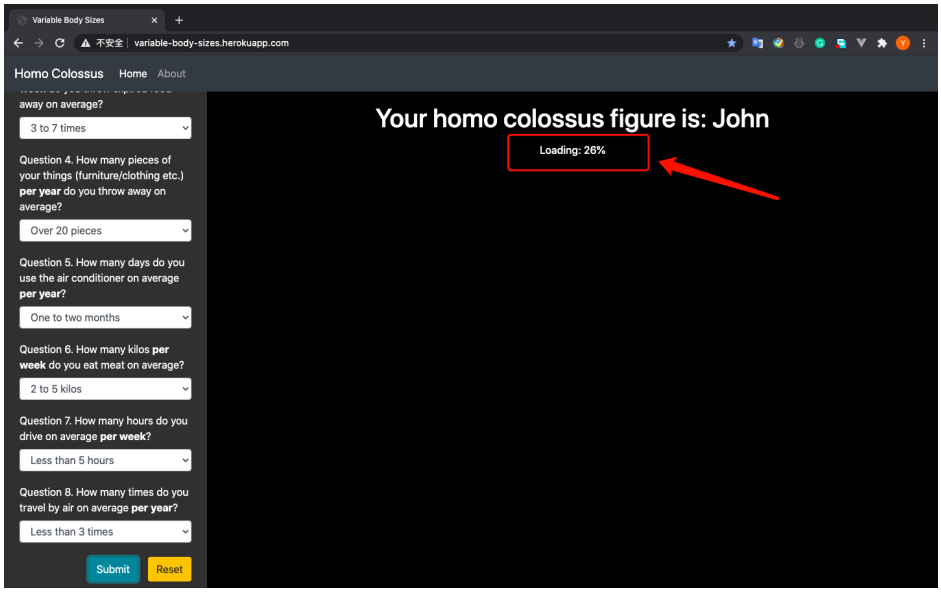

Figure 8: User friendly function: loading progress notification

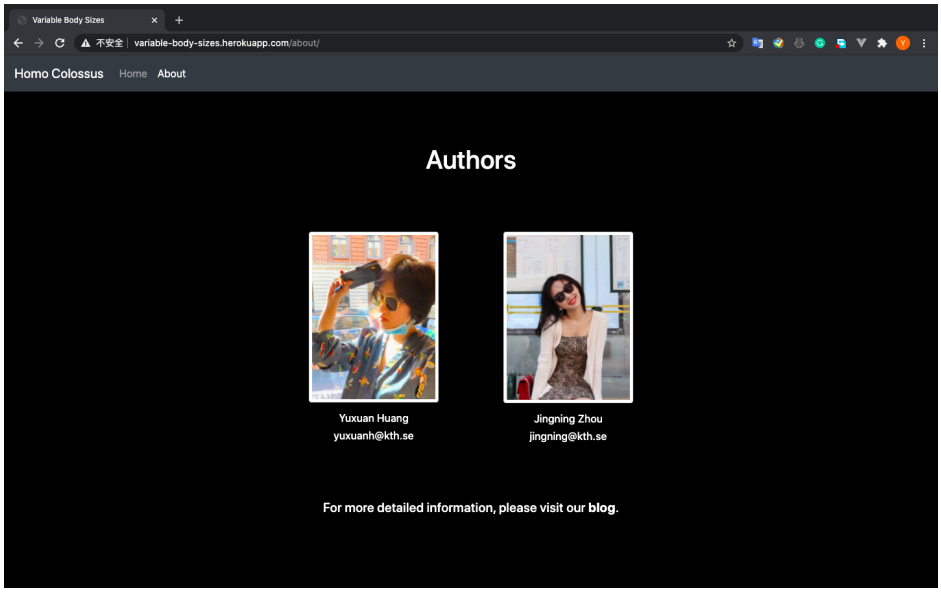

Figure 9: The about page of our website

Last comes with our about page shown in Figure 9.

3.2 Blog

Here is our blog website: https://jingningkth.wixsite.com/website. It is one part of our project display. We record our project progress in 5 blogs. In addition, our blog has quite a wealth of content, including some project inspiration, introduction and some user feedback.

3.3 Video Display

https://youtu.be/MQxGKUoEZUk.

4 Perceptual study

4.1 User Test

In our project, we map 6 different figures to 6 different life habits. The 6 different figures are Oscar, Peter, Alma, Olivia, Lucas, and John. As is shown in Figure 10, Oscar maps to a person who has an excellent sustainable habit and his energy consumption is below average. Peter maps to a person who has an average energy consumption behaviour. Alma maps to a person

who consumes a lot energy by legs. For example, he may travels a lot by air or by car. Olivia maps to a man who eats a lot (thus he has a big belly). Lucas maps to a person who does not have a sustainable mind. And John maps to a man who consumes a lot of energy by arms. For example, he may throw out a lot of reuseable things, which leads to his big arms.

Figure 10: Six different 3D characters

To investigate how good we map our 3D characters to people's daily lives, we conducted a survey. Our survey consisted of six questions, which are all related to our 3D characters.

The 1st question is *"Do you think your result of word description is in line with your daily habits?"*. We designed this question to investigate into the correspondence between the users' text results and their real daily habits. The 2nd question is *"Do you think your character features can reflect your daily habits?"*. We designed this question to look into the correspondence between the features of users' 3D characters and their real daily habits. The 3rd question is *"Do you think your character is in line with your test result of word description?"*. We designed this question to confirm the correspondence between the text descriptions and the 3D characters. The results of these three questions are shown in Figure 11, Figure 12 and Figure 13.

From the results of Question 1 and Question 2, we can see our 3D characters are not as correlated to the users' daily habits as we thought. However, the result of Questions 3 shows the text results and 3D characters are highly consistent. The reason for this situation can be inferred from the result of

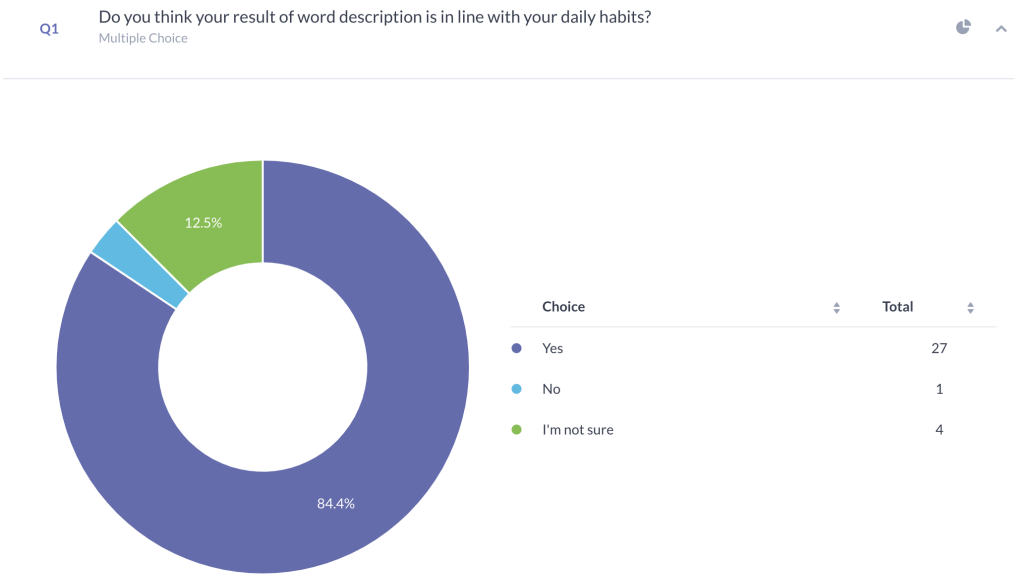

Figure 11: Result of Question 1

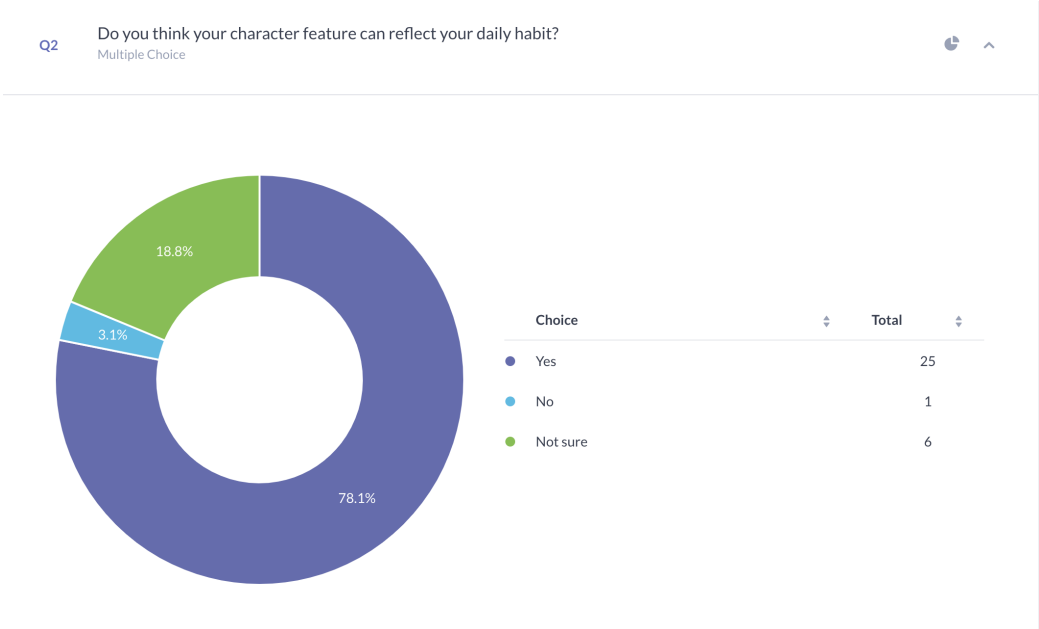

Figure 12: Result of Question 2

Question 4. Question 4 is *"Do you think your result of word description is in line with your daily habits?"*. We design this question to check the

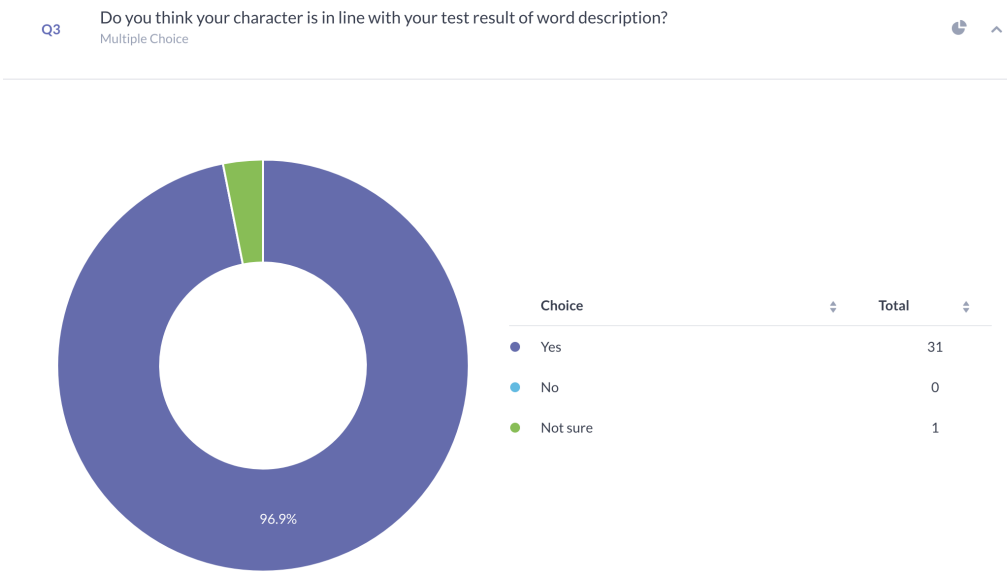

Figure 13: Result of Question 3

correspondence between the features of each characters and the result text descriptions. The result is shown in Figure 14.

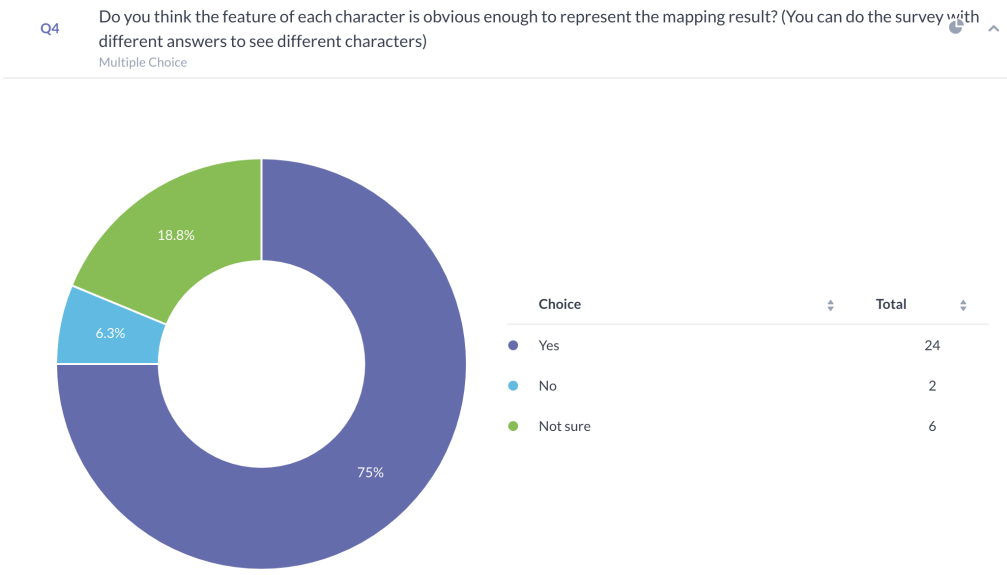

Figure 14: Result of Question 4

It shows that 25 percent of the users think that the features of each character are not obvious enough. That is to say, they think our 3D characters are not typical enough to represent the content of text descriptions. This may because that the features of our 3D characters are not well designed.

In respect with Question 5, which is *"Please score our characters!"*, it is about how users rate our 3D characters in three aspects, which are aesthetics, consistency and fun. The result is shown in Figure 15.

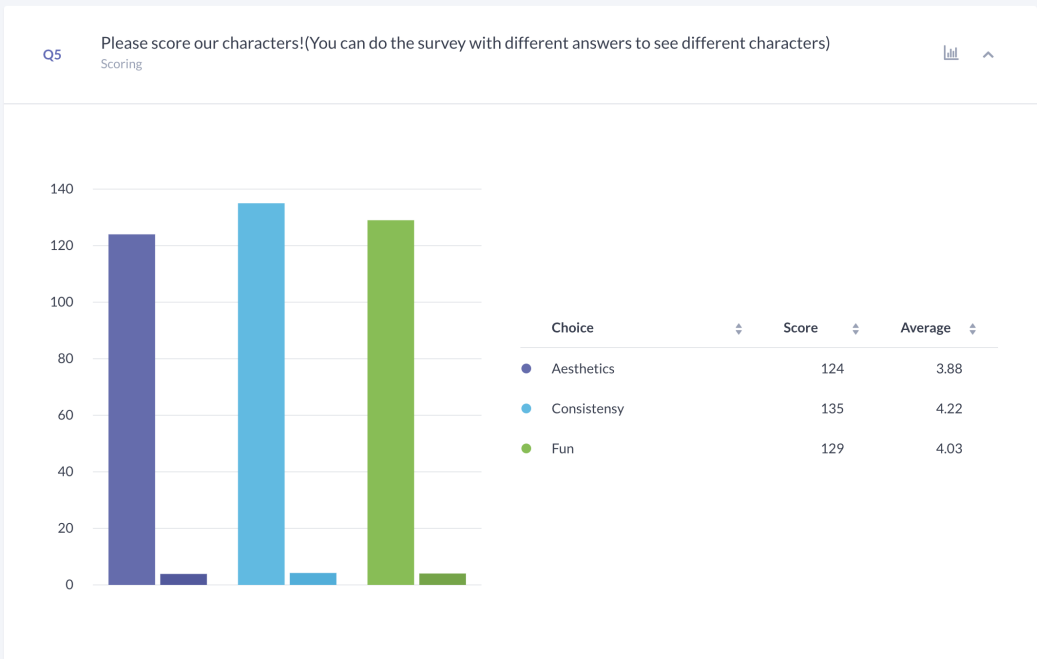

Figure 15: Result of Question 5

The last Question 6, which is *"What improvement do you think we can perform on the characters?"*, is related with users' feedback on some general aspects about our website (including design, character mapping, etc.). Part of the feedback that we received is shown in Figure 16.

4.2 Potential Improvement

In our user tests, we receive lots of feedback about how to improve our 3D characters in order to better fit the mapping to people's daily habits. Summarized from the feedback, we think we can do the following several things to improve. **First**, We could design one character, and based on that character, we can enlarge every parts of his body. That is to say, instead of giving several different 3D figures with different distorted body parts, we

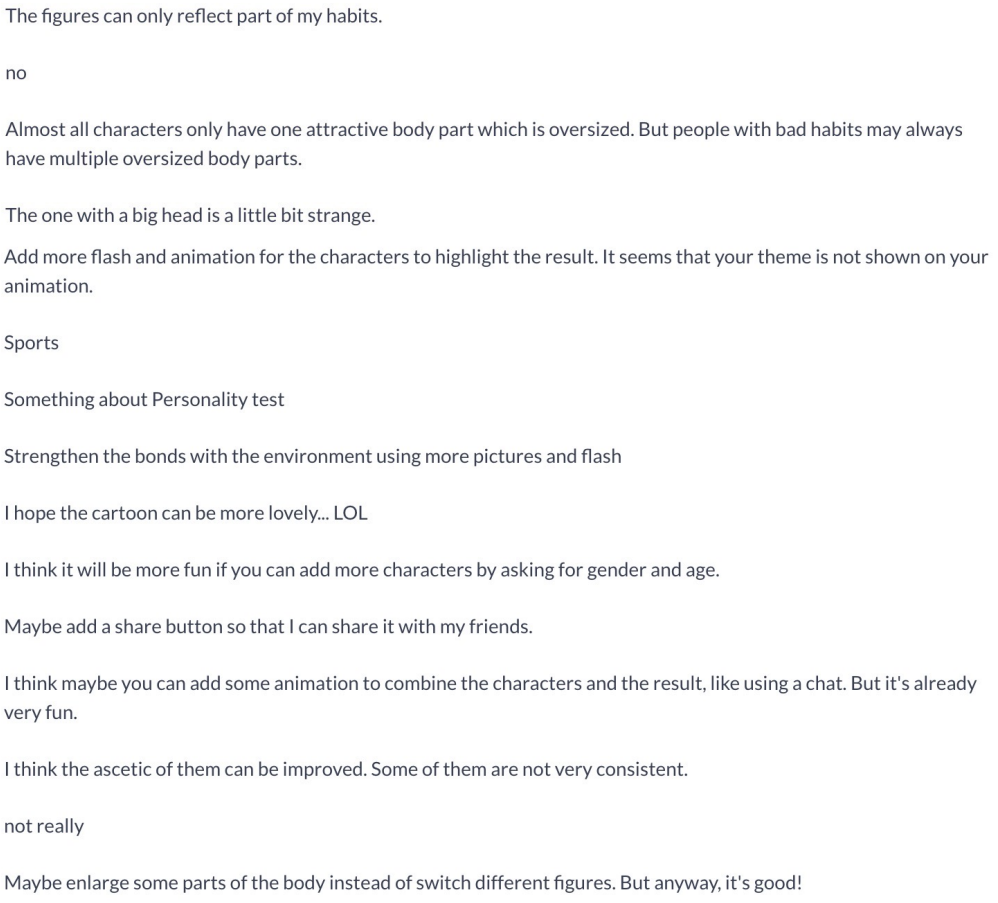

Figure 16: Partial Results of Question 6

should focus on one 3D figure and distort his body part. In this way, we will have more explicit way to feel how energy consumption changes the way we look like. Also, we will be able to represent those people who have several bad habits at the same time. For example, a person may eats a lot and travels a lot, which means he will both have a big belly and big legs. **Second**, change the animations and replace them with more suitable ones to combine the characters and the result since the animations we are using now are not very relevant with people's habits. **Third**, to more truly represent people's habits, we'd better also ask their gender and age, and take those two variables into account when displaying their corresponding 3d characters.

Apart from the feedback that we receive from the survey, we think we can also improve our project in the way that we display. In our project, we use 3D model of reshaped human body to represent the Homo Colossus. The whole process are online and this may not be an optimal way to convey our ideas.

This is because it lacks some sense of fun and may not be so impressive. A potential perceptual study can be exploring and coding with Virtual Reality (VR). [3] For those who come to the Expo, we could let them wear special glasses and see those Homo Colossus right around them! This will add much more fun and impressiveness and actually, we do have this plan. Our team will continue to work on the idea this year.

In the meanwhile, using VR will bring many technical problems. For example, since the 3D figures will not only shown on the screen but also in real space, we need to create more detailed 3D figures. This is because the 3d model shown in the space around will be larger than it shown on the PC screen. Thus, more details of the 3d model are needed to bring our users a sense of reality. Besides, in order to adapt our project to VR facilities, we need to make changes and how to combine VR into our current project may be a challenge.

5 Self Assessment and Collaboration

5.1 Self Assessment

5.1.1 Yuxuan Huang

First, I was responsible for designing, coding and deploying the website. I explored Three.js and applied it to our website constructed with Express to display 3d models. Second, I led the work with modelling characters with MakeHuman and using Blender to add animation. Third, I wrote most of the project specification and the project report. Forth, I took part in creating the video display.

5.1.2 Jingning Zhou

First, I took part in modelling characters with MakeHuman and using Blender to add animation. Second, I created our Blog website and posted 5 blogs to record progress. Third, I was responsible for user testing, including designing questionnaire and collecting feedback. Fourth, I wrote part of the project report. Fifth, I designed and directed the display video.

5.2 Collaboration

Our Homo Colossus project is funded by Formas. [5] Besides, we work with Principal Investigator (project leader) Daniel Pargman (KTH/Media Technology and Interaction Design) and Mario Romero (KTH/Computational

Science and Technology). And we also collaborate with Åsa Andersson Broms (artist and lecturer at Kungl. Konsthögskolan/The Royal Institute of Arts), Per Hasselberg (artist and director of operations at Konstfrämjandet/The People's Movements for Art Promotion) and Belinda Retourné (communications officer, Changency).

References

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