FoodMorph: Changing Food Appearance Towards Less Unhealthy Food Intake

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Figure 1: (1) different textures for burgers in FoodMorph (2) Scenario for using FoodMorph (3) user test

ABSTRACT

Human dietary experiences are influenced by multiple senses. To promote healthy eating and reduce the consumption of unhealthy food, we have developed FoodMorph, a virtual reality system that immerses users in visually simulated food textures that are inedible. By presenting users with these textures, FoodMorph aims to diminish interest in and intake of unhealthy food while also assessing the dining enjoyment associated with common non-food textures. We found that concrete textures on food tend to lead to the lowest enjoyment score, which potentially effects their dietary habits.

1 INTRODUCTION

Based on WHO data, global obesity surged from 1975 to 2016, linked to poor diet and reduced physical activity[1].

[1] https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight

Virtual Reality (VR) technology can effectively change the human eating experience[Narumi 2016]. VR can elicit a greater appetite and desire to consume compared to two-dimensional images[Gorini et al. 2010]. In addition, VR provides an immersive virtual environment[Manasse et al. 2021]. Meanwhile, changes in the appearance of food can alter human taste perception due to cross-modal effects between the senses. [Narumi et al. 2011a,b]

This study focuses on investigating the relationship between food texture and dietary choices. We propose FoodMorph, a virtual reality-based system that modifies the perceived food textures during meals to resemble the textures of inedible items. This intentional alteration is aimed at reducing the users' appetite and altering their dining experience, consequently diminishing their interest in unhealthy food choices and promoting a healthier dietary habit.

2 DESIGN AND IMPLEMENTATION

The FoodMorph app design comprises two aspects: food and virtual textures. To discern food preferences, a pilot interview was conducted (n=24, 11 males and 13 females, age: 22-53). Findings indicated that 58% viewed American fast food and fried food as unhealthy, while 83% indulged in perceived unhealthy food at least monthly. Hamburgers were chosen as the primary food object based on these interviews due to their widespread consumption.

For virtual texture selection, we selected from various 3D modeling and rendering software, extracting eight common daily-life textures: plastic, wood, snow/ice, concrete, paper, fabric, and metal. In addition, as a control, we referenced real food to create virtual food textures.

The environment and food model are modeled in Unity Game Engine[2], and Meta Quest 2[3] are used as VR head-mounted display. Eight virtual burgers were rendered with different textures. The real burgers were placed in the same position as the virtual burgers, so users could grab both of the burgers at the same time to create a more realistic dining experience.


Figure 2: Different textures of burgers, top row from left to right: wood, ice /snow, stone, metal. Bottom row from left to right: cloth, simulation, concrete, plastic

3 INITIAL STUDY

Ten users were invited from previous interview (3 males and 7 females, age: 22-27), All of them are familiar with both the food and the rendered texture, 6 of them have used VR before.

They were required to observe the real burger for ten seconds before taking a bite and giving a rating and enjoyment score. After drinking water and rinsing their mouths, they would put on the HMD to start the experience in the virtual environment. Again they need to observe the virtual burger for ten seconds and choose one among them. The real burger is also placed at the same location and the participant can pick up both the virtual and real burgers to enhance the sense of immersion. Participants will need to taste all textures of the virtual burger and rate each texture until they have finished their hamburger. Staff will guide them throughout the process to share their feelings which are being recorded throughout.
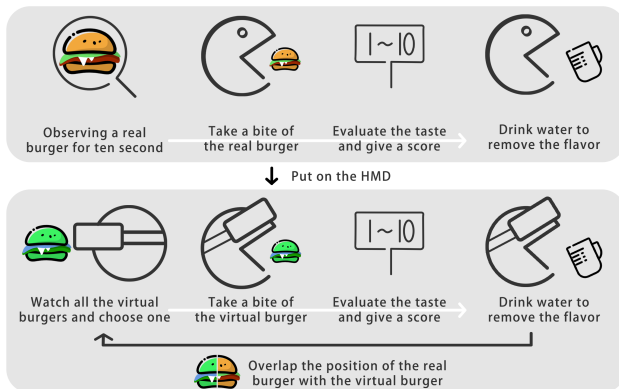

Figure 3: User Testing Process

4 RESULTS AND DISCUSSION

Based on the ratings of the different textured burgers, all the textured burgers in the virtual environment were less enjoyable compared to the real burger. Among the virtual burgers, simulated burgers scored the highest, while those made of concrete scored the lowest. In addition, it was also found from the aggregated feedback that people imagine the texture of the material and unconsciously influence their taste perception that they taste such a flavor. When presented with inedible textures, people's interest in food decreases dramatically.
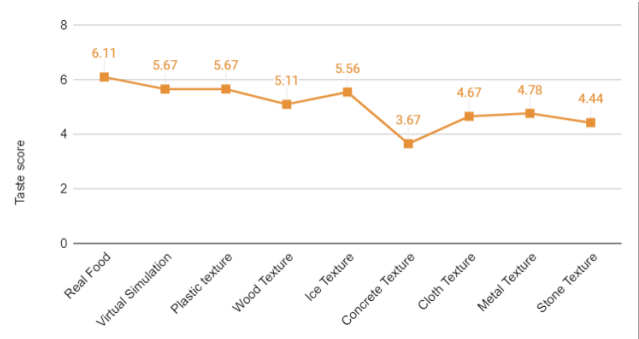
Figure 4: Taste scores for different textures

5 CONCLUSION AND FUTURE WORK

The FoodMorph system has demonstrated that transforming the texture of food into inedible textures in virtual reality can effectively reduce people's appetite for unhealthy food. In addition, it can alter people's taste perception through cross-modal effects, providing a unique dining experience and enjoyment for each participant. In the future, we will explore how to improve people's recognition of inedible textures and explore how we can increase people's interest in healthy food.

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