Chewing Jockey :
Augmented Food Texture by using sound based on the cross-modal effect

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1. Introduction

How can we redesign eating experience? How can we provide someone who uses artificial teeth to get real teeth sensation? How can we control chewing speed and count, to attain healthier eating habits?

Taste is composed of many elements. There are not only basic tastes like sweetness, sourness, umami, bitterness and saltiness but also pungency, astringency, smell, texture, temperature, color, shape, environment, experience and physical condition. In this demonstration, we focus on texture of food. From the viewpoint of cognitive science, Charles Spence found that if participants eat potato chips while listening to chewing sound or white noise that has been processed with high-pass filter, it was perceived as crisper [1] because of cross-modality effect. We expanded that knowledge to other foods such as toast, cucumber, fresh salad, and so on. We use sound effects to augment texture, creating a cross-modal illusion.

2. System

Our system is composed of a bone-conductive speaker and microphone, a photo-reflector to measure the motion of jaw, and a computer to design the sound effect.

We have developed three elements. First is a bite-detection sensor, utilizing a photo-reflector, to measure the movement of the lower jaw. And also we use this data to control the volume of sound. Previously, there is KOMEKAMI switch [2] to detect the bite times or wink. This method is not suitable for our system because it detects the bite timing just after bitten, so we put same sensor under jaw, then we can measure the jaw motion and predict the timing of biting. Second is a sound filter for each type of food that will be used to control texture. We can augment or diminish the hardness of cucumber or the crispiness of potato chips. Third is a system that records the sound of chewing and the jaw motion, and delivers it to the user using bone-conduction speaker.

This demonstration, we will control food texture by our system like DJ and VJ do. This is one kind of self-feedback system to enhance the chewing actions.

3. Experience

There are two applications.

One is a chewing game experience. Participants will be given gummi sweets to chew on. As they begin to chew, they will hear screaming sounds. The food is just ordinary candy but because of the sound effects, the candy feels like living creatures. This is a kind of weird experience that is similar to horror movies.

The other is augmented food texture. We control the sound of chewing and give feedback to user to create the sensation of “Super crispy potato chips” or “Stale potato chips”. People can feel illusion of augmented food texture simply by sound effects from this demonstration.

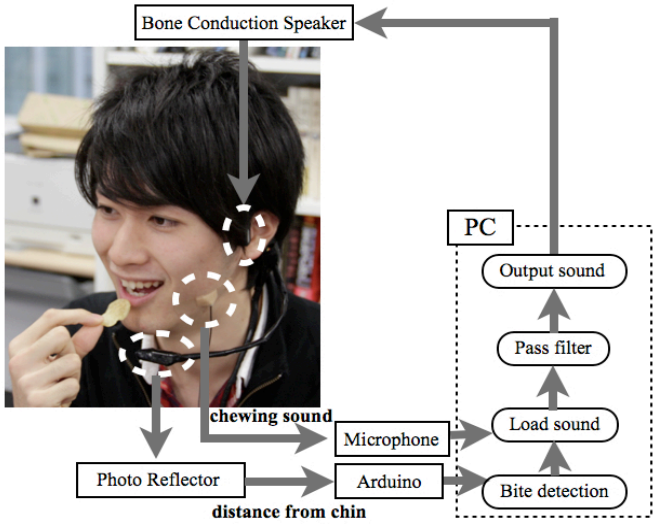

Figure 1. System block. This is a kind of feedback system. Human inputs the chewing sound and motion, computer outputs the suitable sound to feel augmented food texture.

4. Conclusion & Future

We have made the “Chewing Jockey” system. This system augments food texture by introducing sound, based on the cross-modality effect. We aim to improve eating experience, to encourage healthy eating habits, and to make the eating process entertaining.

For future, it is a challenge to improve the eating QoL for dentures users. As they cannot bite strongly, they get a reduced sensation of food. Chewing Jockey helps to restore that sensation. Another application is to moderate the chewing speed. Chewing too fast is not good for digestion and also leads to over-eating.

Reference

[1] Zampini, M., & Spence, C. (2004). The role of auditory cues in modulating the perceived crispness and staleness of potato chips. *Journal of Sensory Science*, 19, 347-363

[2] Taniguchi, K., Nishikawa, A., Kawanishi, S., & Miyazaki, F. , KOMEKAMI Switch: A Novel Wearable Input Device Using Movement of Temple. *Journal of Robotics and Mechatronics*, *20*(2).2008

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