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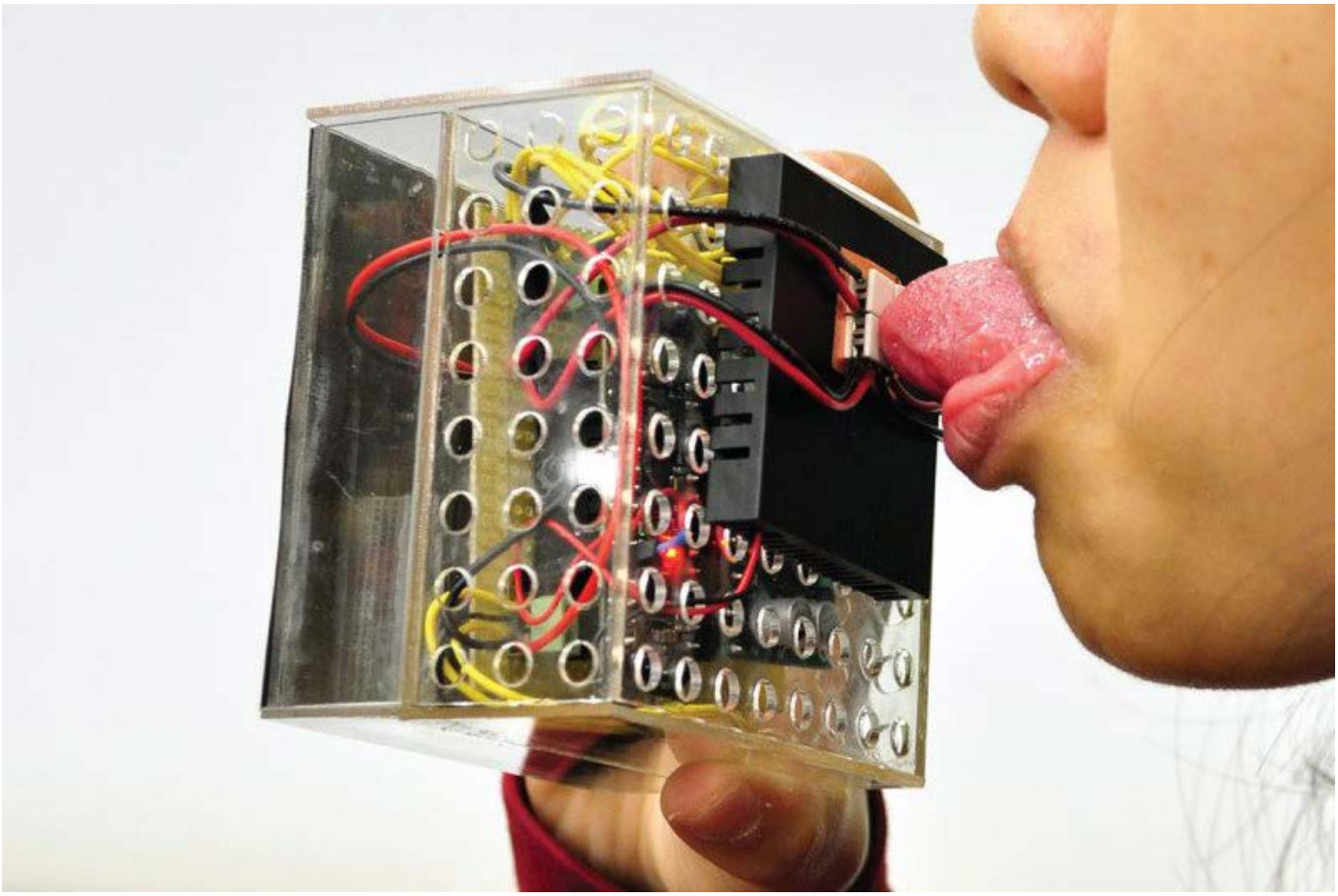
Face electrodes let you taste and chew in virtual reality



Unreal: this tastes delicious
Nimesha Ranasinghe, National University of Singapore

By **Victoria Turk**

You're having dinner in a virtual reality game. The banquet scene in front of you looks so real that your mouth is watering. Normally, you would be disappointed, but not this time. You approach the food, stick out your tongue – and taste the flavours on display. You move your jaw to chew – and feel the food's texture between your teeth.

Experiments with "virtual food" use electronics to emulate the taste and feel of the real thing, even when there's nothing in your mouth. This tech could add new sensory inputs to virtual reality or augment real-world dining experiences, especially for people with restricted diets or health issues that affect their ability to eat.

Several projects have succeeded in tricking us into tasting things that aren't there. Nimesha Ranasinghe at the National University of Singapore has already experimented with a "digital lollipop" to emulate different tastes, and a spoon embedded with electrodes that amplify the salty, sour, or bitter flavour of the real food eaten off it. However, his experiments with electrical stimulation had less success simulating sweetness compared to the other tastes. But digitising this taste could be particularly useful in, for example, helping people cut back on sugary food or drinks.

So Ranasinghe and his colleague Ellen Yi-Luen Do started experimenting with thermal stimulation instead. Their new project, presented at the 2016 ACM User Interface Software and Technology Symposium (UIST) in Tokyo, uses changes in temperature to mimic the sensation of sweetness on the tongue. The user places the tip of their tongue on a square of thermoelectric elements that are rapidly heated or cooled, hijacking thermally sensitive neurons that normally contribute to the sensory code for taste.

In an initial trial, it worked for about half of participants. Some also reported a sensation of spiciness when the device was warmer (around 35 °C) and a minty taste when it was cooler (18 °C). Ranasinghe and Do envisage such a system embedded in a glass or mug to make low-sugar drinks taste sweeter.

Your taste receptors may be open to electrical manipulation, but food isn't just about taste – texture is every bit as important. This week, a team from the University of Tokyo presented a device that uses electricity to simulate the experience of chewing foods of different textures. Arinobu Niijima and Takefumi Ogawa's Electric Food Texture System also uses electrodes, but not on the tongue, instead they place them on the masseter muscle – a muscle in the jaw used for chewing – to give sensations of hardness or chewiness as a user bites down. "There is no food in the mouth, but users feel as if they are chewing some food due to haptic feedback by electrical muscle stimulation," says Niijima.

To give the "food" a harder texture, they stimulated the muscle at a higher frequency, whereas a longer electric pulse simulated a more elastic texture. Niijima says their system was most effective at mimicking the texture of gummy candy.

Like the flavour work, this technology could also help modify the texture of real food. At UIST, participants wore the electrodes while eating cookies. Ranasinghe, who tried the device, says it changed the cookie's texture to something harder and chewier – like gummi bears.

Both projects are still in the experimental stage but share the goal of helping people with special dietary requirements or health problems. "There are many people who cannot eat food satisfactorily because of weak jaws, allergies, and diet," says Niijima. "We wish to help them to satisfy their appetite and enjoy their daily life."

He says the team will develop the idea by targeting additional muscles in the jaw to create more complex textures, and combining the electrical stimulation with other sensory inputs, such as chewing sounds.

Ranasinghe says that a Singapore hospital is planning a long-term study with the electrode-enhanced spoons to try to reduce sodium intake in its elderly patients. Many older people lose their sense of taste and prefer stronger flavours, but adding too much salt can contribute to health problems such as high blood pressure. The spoon acts like electronic seasoning instead.

Put together, all of these technologies could one day be incorporated into a virtual reality headset to create a multisensory dining experience.

"I think the main advantage is to increase the immersion inside the virtual environment," says Ranasinghe.

He gives an example: an astronaut could put on a headset, soak in a relaxing view from back home, and have a nice cup of virtual coffee.

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