
Communication by Changes in Taste

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Abstract

In this paper, we discuss the possibilities and enjoyment of communication by changes in taste, as well as the concept of expanding the sense of taste. When the tongue is electrically stimulated, it senses a characteristic taste. We developed various apparatuses to change the taste of food and drinks based on this effect [1]. An apparatus for drinks, comprising two electrically conducting straws, is used to change the taste of the drink by the formation of an electrical circuit inside the mouth only when drinking by holding both straws in the mouth. In the case of two persons each having one straw in their mouths, shaking hands causes electricity to flow, resulting in the change in taste. With a chopsticks/fork type of apparatus, the taste changes by the electric current that flows through the human body when one person helps the other to eat. In the case of both types of apparatuses, it is possible to control the voltage by a PWM(pulse width modulation) and the pattern by a relay, and a variety of tastes can be produced by a personal computer.

Keywords

Electric taste, altering the taste of food and drink,
physical communication

ACM Classification Keywords

H.5.2 [User Interfaces]: Theory and methods.

General Terms

Design, Performance

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Introduction

Eating and drinking are modes of entertainment for human beings, while they are simply vital for other creatures. Humans get pleasure out of gustatory information obtained from food. Humans use a variety of seasonings and additives even though they are nutritionally poor. For example, carbonated soft drinks are made from carbon dioxide and soft drinks. Why do we enjoy drinking carbon dioxide, even though it is not nutritive? (The change in the taste of food and drink using pseudo sensation has been studied intensively in recent years. Narumi et al. proposed that the alteration in taste can be accomplished by using changes in vision, smell, etc. [2][3].)

Furthermore, humans enjoy communication while eating and drinking. Miller et al. found that when college students were sharing their food or feeding other people, there was more intimacy than when they were not [4]. In recent studies, researchers have proposed many types of distance communication. Chung et al. proposed Lover's cup and argued that people feel more comfortable and intimate with those with whom they eat and drink together [5]. In the area of haptics, inTouch [6] takes part in haptic communication and develops devices, which are cylindrical rollers that rotate synchronously between two distant people. However, face to face communication and skin contact with others are the primary way of communication. Baba et al. argue that skin contact is a new and very important type of interface in our lives. They proposed the use of Freqtrix drums [7] that employ the EDA (Electrodermal activity) technique, which is known as skin conductance and galvanic skin response [8]. For lovers, Tongue music

translates the distance between two tongues during a kiss into a musical composition [9].

The act of sharing food or feeding other people is known to be enjoyable. However, if these actions change the taste and behave like seasonings or additives, the pleasure is intensified. In this paper, we propose a system that changes taste using an electric stimulus and discuss the possibilities of communication by changes in taste. Using this system, shaking hands causes electricity to flow, resulting in the change in taste. In addition, the use of the chopsticks/fork type of apparatus changes the taste because an electric current flows through the human body when it is used by one person to help the other to eat.

Approach

Human beings feel an electric stimulus as a sour or metallic taste. It is called "electric taste," and it is used in gustatory testing [10]. We use this perception as a method to alter the taste of food and drink and developed an apparatus to change the taste of food and drink based on this effect [1]. An apparatus for drinks, comprising two electrically conducting straws, is used to change the taste of the drink by the formation of an electrical circuit inside the mouth only when drinking by holding both straws in the mouth (Figure 1, left). For foods (juicy enough to carry an electric current), we developed the chopsticks/fork type of apparatus (Figure 1, right). Change in taste depends on the change in current and voltage; therefore, we can adjust the amount of changing taste.

In the case of both types of apparatuses, it is possible to control the voltage by a PWM and the pattern by a

relay, and, as a result, a variety of tastes can be produced by a personal computer.

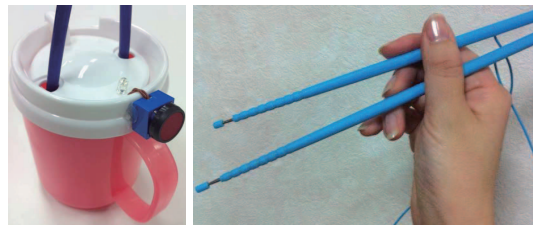


Figure 1. Apparatuses to change the taste of food and drink

Our system functions well even if several people are a part of the circuit. Hence, we use physical contact (touch, hug, and handshake) as the means to switch the circuit on and off. If we complete an electrical circuit by physical contact, the food and drink taste will change. We use this system as a communication tool for drinking together and body contact between persons to stay close.

For a single user

Alter the taste of drink using electric stimulus

The circuit of this system is completed when the user drinks (Figure 2).

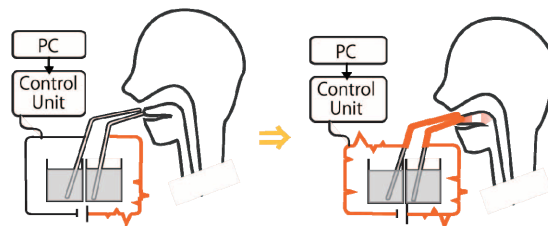


Figure 2. Circuit of an apparatus for drinks

Electric contact is established between the straw and the mouth while drinking. In this case, the tongue picks up the electrical stimulus and perceives the electric taste.

Alter the taste of food using electric stimulus

To use food as the electrical conductor, we have to insert positive and negative electrodes. For this reason, we produced a system to electrify foods, using fork and chopsticks (Figure 3).

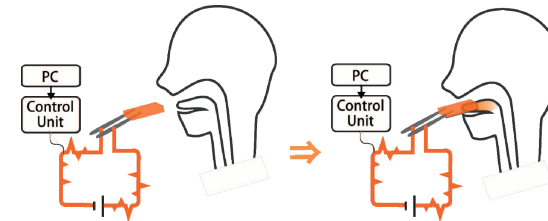


Figure 3. Circuit of the chopsticks/fork type of apparatus

Because the resistance value of metals is higher than that of the tongue, the user cannot perceive the electric taste if negative and positive electrodes connect to the same plate. When we use food in place of metal, however, we can feel the electric taste if negative and positive electrodes connect to the same plate. The resistance value of food is lower than that of the tongue; therefore, the electric current is carried between the tongue and the food.

For two users

Alter the taste of drink communication

In the case of one person, s/he drinks beverages through both straws to perceive the electric taste. However, in the case of two people (couple, parent and

child, etc.), each holding one straw in the mouth, shaking hands causes electricity to flow, resulting in the change in taste (Figure 4).



Figure 4. Using straw type of apparatus by two users

Alter the taste of foods communication

With the chopsticks/fork type of apparatus, the taste is altered by the electric current that flows through the human body when one person helps the other to eat (Figure 5).

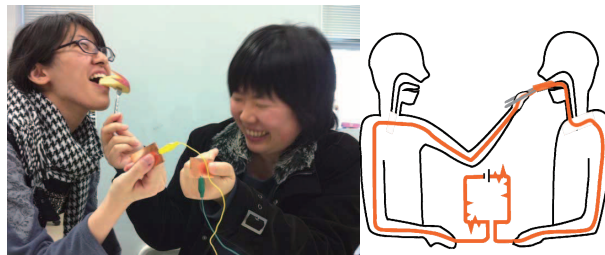


Figure 5. Using fork type of apparatus by two users

When one user touches a positive electrode and the other touches a negative electrode, and either of them feeds the other using a metal fork, spoon, or chopsticks,

then an electric contact is established through between the bodies and the utensils while eating. The person's tongue who is fed picks up the electrical stimulus, and feels the electric taste.

Systems (Implementations)

Analog mode

The hardware of our "drink" system consists of two cups and straws and a conducting wire. To setup the system, the user pours drinks (electrolyte-containing) into cups A and B. Next, s/he inserts a negative electrode into a straw and puts it in cup A. In a similar manner, the user inserts a positive electrode into the other straw and puts it in cup B. The user switches this circuit on and off using the side of a button.

The hardware of our "food" system consists of a conducting wire and chopsticks or a fork. If we use chopsticks, one connects to the negative electrode and the other connects to the positive electrode. The user has to break the connection between the right and left tine. If we use a fork, the right tine of the fork connects to the negative electrode and the left tine of the fork connects to the positive electrode.

Digital mode

The digital mode of the prototype system consists of the control circuit of the output voltage (using a relay circuit) and a microcontroller (Figure 6). We can adjust the pattern and the output voltage using a PWM output. The relay circuit can be attached in the system via a drink.

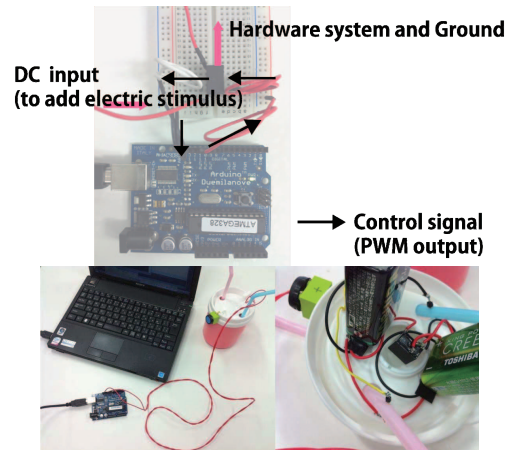


Figure 6. Controlling System

Demonstrations

We demonstrated our system at Make: Tokyo Meeting 06 [11] (Tokyo, Nov 20 to Nov 21, 2010) and the 18th Workshop on Interactive Systems and Software [12] (Fukushima, Dec 1 to Dec 3, 2010). Over 800 people drank a beverage, which altered the taste by an electric stimulus. Most of them perceived the electric taste when we used DC18V for adding an electric stimulus (Figure 7). In addition, the majority could perceive the electric taste and remarked that the taste of the beverage changed to sour, metallic, like soda, and so on. However, some of them could not identify the electric taste. We think there are two reasons for that. First, our system did not function because of a break in the circuit. Second, the reason may be a taste disorder. Presently, we have no way of telling what caused this problem, because we did not perform any gustatory tests.



Figure 7. Demonstrations at MTM06 and WISS2010

We also explained how to use it for communication. Some of them (friends, couples, parents, and children) tried it and enjoyed the altered taste of the beverage (Figure 8).



Figure 8. Demonstration of the communication

Concluding remarks

Catfish are described as “swimming tongues,” because their taste buds are a part of their external body and the oropharyngeal cavity, and have an extraordinary number of taste buds as well as high sensitivity [13]. In contrast, the taste buds of humans are in the mouth, and their sensitivity is lower than that of a catfish. However, humans can augment their sensitivity and sense variation.

Using our system and various sensors, it is possible to expand the sense of taste by allowing the tongue to sense phenomena to which it is not usually sensitive. By using our apparatuses, it may be possible to make humans able to sense the taste of air by combining it with a gas sensor, or able to discriminate subtle differences of taste.

By inputting the physical information using sensors and outputting them as electric stimulus, people may succeed in sharing their emotions. For example, by replacing one's heartbeat by some pattern of electric taste using the United-Pulse [14], we can perceive it as a change in taste when we eat and drink together. We believe that communication at the table using our system will make people feel closer.

Acknowledgement

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