Computer-Augmented Tableware to Enhance the Eating Experiences

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1 INTRODUCTION

Eating is fun. Historically, human beings have paid much attention to the process of eating and the mealtime environment, attempting to enhance the palatability of food, discover new seasonings, and create aesthetic tableware. We aim to make mealtimes more pleasant through the use of technology. We think that a gamification approach using computer technology to make everyday activities fun can be applied to helping children improve their eating habits. In the past, such research has typically focused on food environments, such as dining tables and dishes [2],[3]. Against this background, we focus on the eating/drinking activity itself, and propose a new approach named " EducaTableware (Educate/Tableware) ". EducaTableware is computer-augmented tableware that emits sounds when a user eats or drinks (Figure 1). EducaTableware aims to enhance human-food interaction using computer technology, encourage children to eat through gamification, and help in dietary education during mealtimes at home.

Figure 1: Overview of " EducaTableware "

2 PRELIMINARY SURVEY

To better understand the problems on dietary education at home, we sent paper-based questionnaires to 300 parents of children aged 3-6. 112 parents answered, giving a collection rate of 38%.

As a result, we found that in response to the question " Does your child have eating problems? " 93.8% of respondents replied " Yes ", and over 75% of parents surveyed wanted to improve the child's eating habits and over 60% felt that imparting dietary education at home is difficult. This situation motivates us to contribute to the dietary education of children, particularly those who fell into the " dislikes [1] "and " unfocused [2] " categories. The major answer of eating's concern was " dislikes " which was selected by 69.5% of the parents. " Unfocused " was selected by 33.4%. Further, among " dislikes ", most children exhibited a stubborn attitude; that is, they disliked certain foods without ever having tasted them. The next section describes a design method based on this summary. Our devices are intended to reduce the burden on parents who do not have enough time and knowledge to impart dietary education.

[1]"The child dislikes certain foods.
[2]"The child cannot concentrate on his/her eating.

3 DESIGN CONCEPTS

In this section, we describe the design concepts to achieve the goals of " EducaTableware ".

3.1 Interaction Design

We considered the actions associated with the eating process: spearing food with a fork, moving the food to the mouth, and biting into (eating) the food. In this paper, we focused on the biting action since we thought it was most suited for dietary education of children: augmenting the spearing or moving actions may encourage a child to merely play with food without eating it.

3.2 Feedback Design

To encourage children to eat through gamification, we decided to generate feedback when a user eats (bites into) a food. There are several possible types of feedback, such as visual (e.g., picture/animation), auditory (e.g., sound/music), and tactile (e.g., vibration). Visual feedback has high expressiveness but may reduce a child's focus on eating; in fact, eating in front of visual displays such as a laptop or a TV is a well-known social problem [1]. Tactile feedback has limited expressiveness and is unlikely to please children. We thus selected auditory feedback, which is expressive without being distracting. We pre-recorded two types of sounds: (1) onomatopoeic sounds related to eating (e.g., Paku) that are familiar to most people in Japan and (2) the sounds/voices of popular cartoon characters. We can change the sounds easily depending on a child's preferences. We prepared about 10 sounds per device in view of the limited memory size. The system selects a sound to play on the basis of several parameters (e.g., food type) and a random factor to solve the " dislikes " problem in the Preliminary Survey, i.e., to motivate children to eat new foods. Moreover, we believed that the system might solve the " unfocused " problem by attracting children's attention to the meal. In addition, we believe that auditory feedback is a natural accompaniment to dinnertime conversation.

3.3 System Design

To allow the system to be used conveniently at dinnertime, we integrated it into familiar tableware. We

embedded all the electronic components (e.g., a microcomputer, a speaker, and a battery) into a device for standalone use in the daily environment. We believe that people can easily use our augmented tableware, since they can treat it as normal tableware.

4 IMPLEMENTATION

We have developed two kinds of device: “ EaTheremin ” is a fork-type device, which focuses on the eating act, and the cup-type prototype “ TeaTheremin ”, which focuses on the drinking act. Both prototypes use the same sensing mechanism to detect the moment when a user eats or drinks something(Figure 2). Each device has a pair of electrodes: “ EaTheremin ” uses the fork tines and grip as electrodes and the “ TeaTheremin ” uses the cup bottom and grip(Figure 3)/(Figure 4). These devices detect weak electric current through the human body, foods, and two electrodes. The current varies based on the resistance values of foods, beverage, and human body. The sounds change in response to these resistance values.

Figure 2: Sensing method

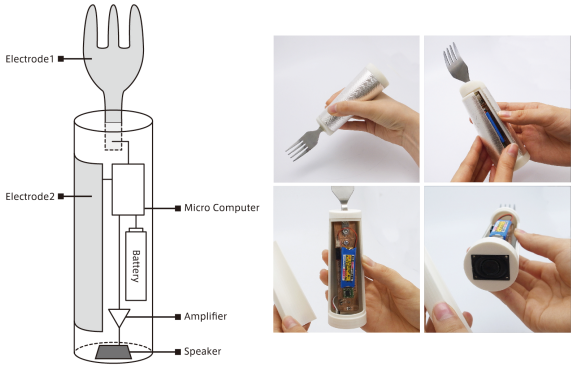

Figure 3: System Architecture of “ EaTheremin ”

5 USER STUDY

Here, we describe the results of a one-week user study conducted with three families to evaluate the performance of our system and explore further uses and enhancements. In summary, although the novelty factor may be partly responsible, our device was well liked by children and parents through the days. Through the evaluation result, interview, and recorded videos, we confirmed that our device had a positive effect on children who were categorized under “ dislikes ” and “ unfocused ”. We conclude that

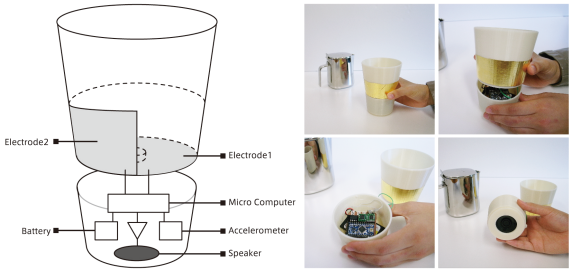

Figure 4: System Architecture of “ TeaTheremin ”

children’s eating habits can be improved if effective education tools are provided.

6 CONCLUSION

We proposed the EducaTableware approach that generates sounds when a user eats or drinks in order to encourage good eating habits. We implemented two devices: “ EaTheremin ”, which generates sounds when a user is eating, and “ TeaTheremin ”, which generates sounds when a user is drinking. We successfully conducted an evaluation with children and their families with “ EaTheremin ” devices. It was found that users could eat their disliked foods more easily than usual, while having fun. Our most important motivation is to make the family smile at dinner and encourage children to eat healthily and happily. We believe that providing novel stimuli along with food, we can encourage children to develop greater interest in food.

7 ACKNOWLEDGMENT

The author SUPER appreciates the help and advice of Dr. Koji Tsukada at JST.

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