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# Lover's Cups: Drinking Interfaces as New Communication Channels

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**Abstract**

This paper shows how computer interfaces can enhance common activities and use them as communication method between people. In this paper, the act of drinking is used as an input of remote communication with the support of computer interfaces. We present Lover's Cups which enable people to share the time of drinking with someone they care about in different places. Using a wireless connection, an otherwise ordinary pair of cups becomes a communication device, amplifying the social aspect of drinking behavior.

**Keywords**

Drinking Interfaces, Implicit Interaction, Communication, Ambient Media.

**ACM Classification Keywords**

[H5.2 User Interfaces] Interaction Styles.

**Introduction**

In human relationship, not only explicit communication with voices or texts but also recognizing common activities are important; people notice that their friends are walking by, drinking coffee, or sighing, and respond to these common activities to build more intimate relationship. Can such behaviors be part of a computer

mediated interaction? In this paper, we focused on the act of drinking from a cup.

The behavior of drinking has social meanings and functions. By drinking with other people, people can lower their barriers, relax themselves, feel that they are sharing their time, and thus enhance the communication and social interaction. The words “tea time” or “coffee break” show how drinking is related with open social activities. People serve tea, coffee, wine, or other beverages with snacks to guests during parties, meetings, or many other kinds of gatherings to lower the barriers between people. Also, people often have something to drink while taking a rest or making a conversation with other people—even when they are not thirsty at all.

People feel more comfortable and intimate with people with whom they are eating and drinking together. While drinking, people become more relaxed and comfortable with other people, and it makes them more easily communicate with each other and build up social relationships. In Miller, Rozin, and Fiske’s study, they found that when college students were sharing their food or feeding other people, there was more intimacy than when they weren’t [1].

There have been many studies of enhancing the communication channels and social interactions in the human computer interactions research field. inTouch addressed how to share the physical force and feedback in different places [2]. LumiTouch presented how individuals inform the presence of each other by ambient ways [3]. Context-aware design approaches encourage understanding human intention by simple

sensors and promote human-to-human communication [4].

### Approach

In this paper, we explore drinking as a new kind of communication channel by presenting Lover’s Cups (shown in Figure 1), the communication tools for remote drinking-together interactions for a couple in physically different places.

Drinking with communication enhances traditional communication interfaces such as audio, video, or text communication tools. The Lover’s Cups are not intended to replace the other forms of communication such as voice or text communication, but to add more emotional channels to the traditional communication and improve the quality of interconnections.



**Figure 1:** The Lover’s Cup in the right picture shows the liquid level of the other cup in the left picture while the other user is drinking. The top area of the cup is illuminated while the other user’s lips are touching the other cup.

Lover's Cups explore the idea of sharing feelings of drinking between two people in different places by using cups as communication interfaces of drinking. Two cups are connected with each other, and respond when the other cup is used. A person can see in his/her own cup how much liquid is in the other's cup and when s/he is drinking by which side. Overlapped on their own real liquid, these kinds of displays can help people to feel as if they are drinking together and even sharing the same cups and the same liquid.

### **Scenarios**

Following scenarios show how Lover's Cups can promote emotional interaction, health care, family care, and social activities.

#### *For Lovers*

The Lover's Cups connect a couple through drinking behaviors while they are working. A pair of Lover's Cups is owned by a couple working in different offices. Each of them has brought his/her Lover's Cup to work. Due to the connectivity of this pair of cups, the wife sees her cup glowing which represents her husband is drinking. She picks up her Lover's Cup and takes a sip. At the same time, her husband's cup starts glowing in celebration of the moment of drinking together.

#### *With Other Communication Channels*

The Lover's Cups can enhance the traditional communications. Julie and her best friend Ann live in different states. When Julie got tired or stressed, she had a conversation with Ann through the internet messenger program. However, the text-only communication limited their sympathy and emotional interactions. Today, Julie and Ann use their Lover's Cups. Julie suggests to Ann to have a coffee break by

shaking her cup. While talking through the messenger, they have a feeling of that they are drinking coffee together, and it makes them feel more relaxed and connected.

#### *For Nurse, Family, and Patient*

The Lover's Cups can be also extended to health care applications. Patients always need extra care from their families. The Lover's Cups are able to connect the patients to someone who cares about their water drinking behavior. While a patient is drinking water, the paired Lover's Cup reflects to someone related to him/her. If the patient did not drink enough water, through the physical illumination of cups, patients might be motivated to drink water or being taken care.

#### *For a Social Event*

Lover's Cups can be distributed in a social party where everyone uses Lover's Cups to drink. When one's Lover's Cup meets with another cup by toasting, two of them will become a pair of Lover's Cups until one of them toasts with other cups. For example, in the Lover's Cup social event, Jackie is holding a Lover's Cup and meeting with Helen who holds another Lover's Cup. They toast for good luck and their cups remember each other by the action of toasting. When Helen takes a sip, Jackie's cup glows to motivate him to take a sip at the same time. When Jackie shakes his cup, Helen can feel that her cup is vibrating. Using the cups, they have a new way of interacting with each other while drinking. After a while, four of Helen's friends arrive. Helen and her friends hold their cups and toast together. At this moment, their cups become a group of Lover's Cups. Whenever one is in use for drinking, the other cups will also glow and celebrate this moment of drinking.

## Interactive Techniques

Cups are common and daily objects that people are familiar with. For using cups as a medium for people to communicate and feel with each other, we suggest interactive ways as following.

### *Attentive Illumination*

Lights can be designed as both attentive and ambient interfaces representing different meanings. The Lover's Cups are like normal cups sitting quietly on the table if no one picks them up or there is no liquid inside. When a person holds one of the Lover's Cups, it triggers soft glowing processes for the paired cup. If a person is sipping on one cup, the LED illumination of the paired cup is at its maximum. LEDs are embedded into the Lover's Cups for displaying the level of the liquid inside and also the color of the liquid.

### *Virtual Kiss*

When the paired Lover's Cups are held by two people, the cups start glowing slowly to let this couple become visually aware of each other by the illuminated cups. When both of them take a sip at the same time, this pair of Lover's Cups is glowing at its maximum illumination to celebrate the shared intimacy and the feelings of drinking with someone s/he cares about.

### *Connectivity*

The paired Lover's Cups are connected by wireless technology. By sensing drinking behaviors and multimodal actuation, it creates the emotional illusion of connecting with other people. Depending on the situations, the cups use different types of networking module for transmitting and receiving sensing data. In the same room or short distance, within 30 meters, the Radio-Frequency (RF) modules are effective peer-to-

peer transceivers. For long-distance or cross-country, the RF transceivers need to be hooked up to computers as access points for the Lover's Cups in order to send and receive data through the Internet. We also consider embedding GPRS mobile phone modules into the Lover's Cups for sending sensing data for worldwide uses.

### *Shaking Hands*

People may shake their glasses to send active signals. By inter-communicating the networked cups, we designed a hand-shaking action. As shown in Figure 2 (left), if a person shakes one of the Lover's Cups, the other cup will vibrate to generate the remote hand-shaking feeling to the other person.



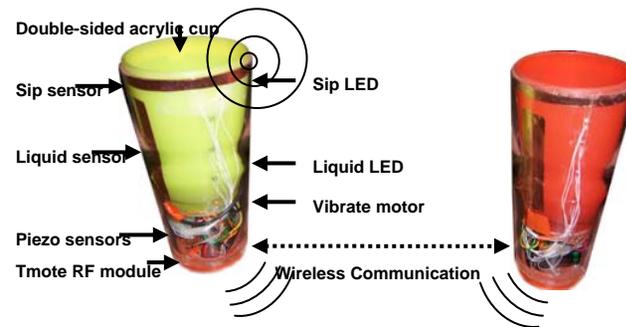
**Figure 2.** Lover's Cups interact with people's hand behavior.

### *Toasting as Commitment*

When using Lover's Cups for social events, toasting two cups together makes them into a pair of Lover's Cups, as shown in Figure 2 (right). Given the social implications of a toast, we designed the toasting actions as a commitment to drinking together.

## Implementation

The hardware of Lover's Cup consists of a double-sided acrylic cup, sip and liquid sensors, LED displays, actuators and wireless communication, as shown in Figure 3. We used integrated sensor boards, Tmote Skys, which already include the microprocessor, IEEE 802.15.4 radio module, and other integrated peripherals such as ADCs and UART bus. Capacitive sensors and Piezo sensors were used to extend the sensing capability, and LEDs and vibrators made visual and tactile outputs.



**Figure 3.** Lover's Cup consists of a double-sided cup with non-contact liquid sensing mechanism, LED displays, actuators and RF communication module.

### *Liquid and Sip Sensors*

The Lover's Cup consists of a double-sided cup with a non-contact liquid sensing mechanism using microcontrollers. The sensing part included the sensors to measure the level of liquid and the sensors to sense the touch of the user's skin on the rim of the cup. Capacitive sensing techniques were used to detect the liquid level and drinking action without contacting the liquid, so sensors could be invisible.

To measure the level of liquid inside, a pair of capacitive sensors was used. The long and thin sensors were embedded on the inner side surface of the double-sided cup, vertically abreast. As liquid was filled in the cup the capacitance between two sensors would be varied. Thus, we could measure the volume of the liquid inside the cup by measuring the capacitance between two sensors. One of the two sensors was connected with a signal generator, and kept sending the reference signal from the signal generator to the other part of the sensors. The other sensor received the signal through the liquid and sent the signal to an ADC input pin of the microcontroller through an amplifier. Because the amplitude of the signal was modulated by the volume of the liquid between two sensors, the microcontroller could infer the level of the liquid from the signal.

A similar method was used to sense the touch of user's skin on the rim. Another pair of capacitive sensors was used. However, one sensor transmitting the reference signal was installed on the surface of the cup to be touched by a user's hand when the cup was held by a user. The other sensor to receive the modulated signal was put on the inside of the rim to be nearly touched by user's lips when a user drank. The reference signal passed through the user's body and showed whether user's skin touched the rim of the cup or not by its amplitude.

### *Displays*

The drinking information was also displayed with green color LEDs. LEDs are used to show the status of the other cup. For example, if one is drinking, the top area of the other cup will be illuminated to show someone is drinking and how much left. If user 1 poured coffee in

cup 1, cup 2 displayed the volume of the coffee in cup 1 by the height of illuminated LEDs so that user 2 could recognize that user 1 might be using his/her cup. If user 1 drank and touched his/her lips on the rim of cup 1, the rim of cup 2 glowed and indicated the drinking behavior of the user 1 to user 2. The information transmitted from the counterpart cup was displayed using color-coded LEDs in the side of the cup. Five yellow LEDs were vertically set on the side of the cup and displayed the level of the liquid in the other cup. Finally, a red LED glowed when the other user was actually touching the other cup and drinking.

#### *Shaking Sensors*

The cups could be used in other ways than pouring and drinking. Piezo sensors and micro motors made more active communication possible. If a user shakes a cup on purpose, the Piezo sensors send strong and relatively continuous signals to the microcontroller. The controller sends the shaking information to the paired cup, so that the paired cup can make a vibration to imitate the tangible feelings of shaking. In this way, users can send active signals to the other users.

#### *Wireless Transceiver*

The communication between the two cups used RF to send messages to the other cup or a computer. For a short distance transmission, like in a home or office, the two cups used RF to communicate with each other directly. In a large area or long distance, the communication needed to rely on the Internet; the messages sent out by one cup needed a computer to send it out through internet, so that it could reach another computer and also the other cup through RF.

#### *Toasting*

Another possible interaction is toasting. When users toast their cups together, two cups recognize and communicate with each other cup to make special relationship or to exchange information. This technique is not implemented in our current prototypes, but we are planning to embed it in subsequent versions with Piezo sensors and IR communications.

#### **Conclusion**

We present the Lover's Cups as new interfaces which explore the area of drinking together with sensory communication channels. This interface introduces interactive drinking opportunities for emotional interaction, health care, family care, and social activities. This project implies that communication in our daily life should not be limited by a certain media form such as audio or video, but could also be extended to more sensual, tactile or other subtle actions.

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