A Co-located Meeting Support System by Scoring Group Activity using Mobile Devices

Hiroyuki Adachi
Ritsumeikan University
Shiga, Japan
adachi@i.ci.ritsumei.ac.jp

Seiko Myojin
Ritsumeikan University
Shiga, Japan
seiko@i.ci.ritsumei.ac.jp

Nobutaka Shimada
Ritsumeikan University
Shiga, Japan
shimada@ci.ritsumei.ac.jp

ABSTRACT

In this paper, we present a co-located meeting support system using mobile devices such as tablets and smartphones, which can use anywhere and easily set up. We have developed a system using tablets, and we re-designed its visualization and scoring methods for brainstorming. The system provides visual feedbacks of how long a person speaks to the other person and how long the person watches him/her. The system also provides two scores based on a balance degree of individual utterance and that of pair conversation as a group activity. The system is currently under experimentation.

CCS Concepts

•Human-centered computing → Computer supported cooperative work; Tablet computers;

Keywords

CSCW, Meeting support, Visualization, Interaction

1. INTRODUCTION

In these days, there are a lot of opportunities to have a conversation such as meeting, brainstorming, and so on. However, we cannot always have a good communication. In an ideal communication, everyone reaches an acceptable conclusion, and understands each other. On the other hand, in a real communication, it sometimes ends up as one-way conversation because of too much speaking, and participants cannot understand what a less-speaking person is thinking. Considering the situations where a balanced participation is desirable, such as brainstorming and decision-making meeting, the amount of utterance should be well controlled.

In order to enhance conversation, various ways for supporting communication have been researched. Ohshima et al. [2] developed TableTalkPlus that visualizes the dynamics of communication like a change of atmosphere generated through the participants' relationship on a projector. Terken et al. [3] developed a system that represents cumulative speaking time and listening time as circles projected in front of the participants. It gives a positive feedback about speaking and listening.

We have been developing a meeting support system using tablets for balancing of participation [1]. It measures who speaks to whom and when, and provides a score for each participant based on his/her speaking time and listening time. It provides not only a positive feedback but also a negative feedback about speaking, for example, a score decreases when a person speaks too much. In addition, our system only requires a tablet or a smartphone with front and back cameras, while most of previous works need special things such as a microphone and a projector, therefore the system has the advantage of being easy to use.

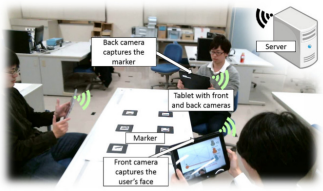

Figure 1: A three-person conversation using our system.

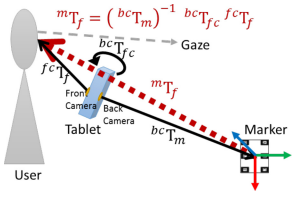

Figure 2: Geometric relation of user-tablet-marker.

2. SYSTEM OVERVIEW

Figure 1 shows an example situation of three-person conversation using our system. Each participant has a tablet and talks around a table which has a marker on it. The tablet has front and back cameras; a front camera captures the user's face for sensing utterance and face direction, the back camera captures the marker for sensing the tablet's position and orientation. The tablet is connected to a communication server via wireless, and sends the measurement of individual utterance. The server integrates the information obtained from individuals as profiles of conversation and sends them back to each tablet. The participants will be able to control their timing of utterance while having a conversation with half an eye on the visual feedbacks such as the scores and the amount of speaking/listening.

3. MEASUREMENT

The system measures an individual utterance and a group conversation as a whole. There are three pieces of information of individual utterance: *who speaks, when speaks, and from where to where.* Each tablet obtains them using its front and back cameras, and sends them to the server. *Who*

AH '16 February 25-27, 2016, Geneva, Switzerland

ACM ISBN 978-1-4503-3680-2/16/02…$15.00
DOI: http://dx.doi.org/10.1145/2875194.2875230

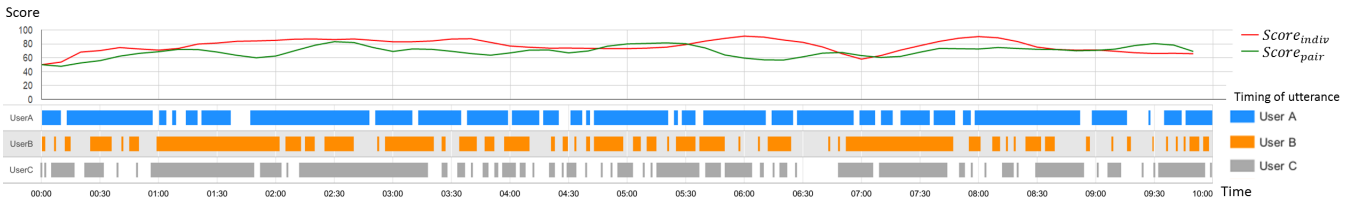

Figure 4: An example of conversation transition. The lines represent the transition of the scores of individual utterance and pair conversation, and the bars represent the timing and duration of each user's utterance.

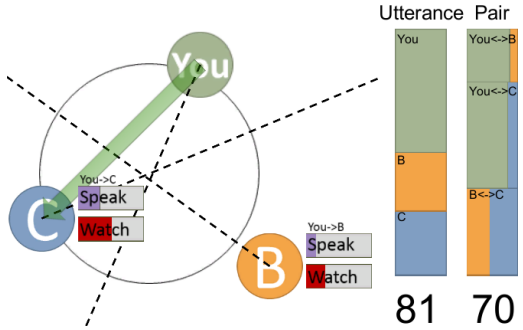

Figure 3: The visual feedbacks on users' devices.

speaks is specified by the connection ID of a tablet. *When speaks* is decided from a user's mouth open level. *From where to where* is estimated from the geometric relation of user-tablet-marker and captured images of both cameras (see Figure 2). The server estimates how long a user speaks to the other and how long the user watches him/her.

4. SCORING GROUP ACTIVITY

In this section, we present two scores in brainstorming. We design two indices for evaluating group activity with the following considerations;

- *Maximize the amount of individual utterance.* We consider actively participation leads idea generation.
- *Balance the amount of pair conversation.* We consider having a conversation with variety of people increases the variety of ideas.

We define the index of balance of individual utterance as (1), applying Gini coefficient as a measure of equally.

$$I_{indiv}^{(t)} = \frac{n}{2(n-1)} \sum_{i}^{n} \left| Utterance_i^{(t)} - \frac{1}{n} \right|. \quad (1)$$

Here, $Utterance_i^{(t)}$ is a relative amount of utterance of user i at time t, and n is the number of users. $I_{indiv}^{(t)}$ becomes 0 where the amounts of individual utterances are balanced, and becomes 1 where they are unbalanced. We also define the index of balance of pair conversation as (2).

$$I_{pair}^{(t)} = \frac{{}_nC_2}{2({}_nC_2 - 1)} \sum_{i,j} \left| Conversation_{ij}^{(t)} - \frac{1}{{}_nC_2} \right|. \quad (2)$$

The indices are updated on every frame based on the measurements obtained within 30 seconds. We calculate the weighted average of each index in time window T, and convert it to the score with a scale of 0 to 100% through (3).

$$Score^{(t)} = 100 \left(1 - \frac{1I^{(t-T+1)} + 2I^{(t-T+2)} \cdots + TI^{(t)}}{1 + 2 + \cdots + T} \right) \quad (3)$$

5. VISUALIZATION

Figure 3 shows the visual feedbacks on users' devices. The left area shows a visualization of conversation. It represents a situation where user A speaks to user C. A circle represents a user's position, and a dotted line represents a user's face direction. A purple bar beside a circle represent a cumulative time of speaking from a user to another, and a red bar represents a cumulative time of watching. The right area shows the group activity. The bar charts represent the relative amount of individual utterances and pair conversations, and the below numbers show those scores.

6. SCORE AND ACTUAL CONVERSATION

We had a 10 minutes of three-person conversation as a performance test of the system. The system measured the participants' speaking/listening behavior, and calculated the scores of individual utterance and pair conversation. Figure 4 shows the transition of the scores and the timelines of utterances. It reasonably matched the actual conversation.

7. CONCLUSION

We proposed a tablet system for supporting co-located brainstorming by providing a visual feedback with the scores of group activity. We consider the tablet system is easy to use and is useful for increasing the amount and variety of ideas. Since we only proposed a scoring method for brainstorming and had a self performance test, further studies are needed to confirm the effectiveness of the system.

8. ACKNOWLEDGMENTS

This work was supported by JSPS KAKENHI Grant Number 15H02764 and by the foundation for the Fusion of Science and Technology. The authors would like to thank the OMRON Corporation let us use the OKAO® Vision Library in their courtesy.

9. REFERENCES

[1] H. Adachi, S. Myojin, and N. Shimada. Scoringtalk: A tablet system scoring and visualizing conversation for balancing of participation. In *SIGGRAPH Asia 2015 MGIA*, SA '15, pages 9:1–9:5, 2015.

[2] N. Ohshima, K. Okazawa, H. Honda, and M. Okada. Tabletalkplus: An artifact for promoting mutuality and social bonding among dialogue participants. *Human Interface Society*, 11(1):105–114, 2009. (in Japanese).

[3] J. Terken and J. Sturm. Multimodal support for social dynamics in co-located meetings. *Personal and Ubiquitous Computing*, 14(8):703–714, 2010.