

# An Interactive Tablecloth for Facilitating Discussion in a Culturally Diverse Group

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## ABSTRACT

Group discussions are a useful tool in a number of environments: from working towards a common goal in a business setting, to gathering feedback on an exhibit in a museum for example. One issue in such sessions is that some group members can talk more loudly and confidently than others, making some group members change their mind or keep quiet, this can result in interesting differences of opinion being lost. In this paper we present a tool for facilitating such group discussions. The tool is an interactive tablecloth that is controlled with tangible interfaces, and provides a method for each group member's voice to be heard prior to discussion, thus preserving the diversity of responses. When tested after an immersive theatre performance, the tool effectively allowed each group member to answer questions individually prior to beginning group discussion. This also allowed the facilitator to effectively coordinate the discussion in an efficient manner.

## Categories and Subject Descriptors

H.5.2 [Information Interfaces and Presentation (e.g. HCI)]: User Interfaces – *auditory (non-speech) feedback, evaluation/methodology, haptic I/O, prototyping.*

## General Terms

Human Factors

## Keywords

eTextiles, Group Discussion, Non-visual interaction, Accessibility

## 1. INTRODUCTION

Group discussions are used in many settings: from business meetings to art galleries. The purpose may vary from working collaboratively towards a common goal, to simply understanding the opinions and views of each member of the group. There are a number of associated issues with such social interactions, for instance the possibility of “group think”, where one member of the group sways the opinion of the rest [1] or the problems of censorship that occur when members of the group have differing opinions [2] or one member dominates the group [3].

This is particularly problematic in groups with diverse cultural backgrounds, where differing experiences and ideas can mean group members have very different opinions and reactions to a discussion topic. This difference can in fact be a positive influence on discussion and may result in groups performing more effectively [4]. It is therefore important that cultural differences are preserved and protected in group discussion situations, and that group think, and single member dominance are prevented.

In this paper, we explore how a technological intervention can be used to better facilitate group discussion, in this particular

instance, the evaluation of an immersive theatrical performance with participants of varying cultural backgrounds, experience and accessibility requirements. The piece was performed in the dark and aimed to explore how a theatrical experience could be created for both sighted and visually impaired audience members to experience equally. The motivation for the work presented in this paper was to create a tool that could be used by sighted and visually impaired people simultaneously as the audience for the performance was composed of people with varying degrees of sight. We present an interactive tablecloth and highlight how it was able to facilitate and enhance group discussion by allowing each member of the group a chance to express their opinion before discussion began.

## 2. RELATED WORK

A common setting for an organized group discussion is sat around a table; this has led to table-based interventions aimed at facilitating group discussions. One such intervention aimed to balance the speaking time of a group by providing feedback in the form of lights in front of each participant, representing the amount of time they had been speaking [5]. This intervention was used for a group of bachelor's students attempting to solve a problem together, and was partially successful at addressing the speaking balance, causing participants to alter the amount of time they spoke.

Similar results have also been replicated in other research investigating the effect of shared displays when facilitating group decision making [6], [7]. In this work however, the authors highlight that time spent speaking is not necessarily conducive to the quality of information that the speaker is sharing with the group.

Other technology aimed at facilitating group discussion goes beyond providing feedback regarding speaking time and looks to sociometric feedback regarding body positioning, posture, face-to-face interaction for example [8]. This data is then fed back to each participant's mobile phone, showing participation levels of each member of the group on a screen. Such feedback reduced instances of group members speaking over one another.

All of these examples show how real time feedback can affect the way a group discuss a topic together. However, each of these experiments involved a group working towards a common goal, where the ultimate aim was for the whole group to reach a consensus. What if the aim of the discussion is not to reach a common opinion, but rather to discuss more subjective topics where a group may not all agree or share the same opinion? In such contexts, simply ensuring that everyone has the same amount of time to speak may not be enough. Dominant group members in such instances may alter the opinion of quieter participants;

something that would not be reflected in data showing the amount of time spent speaking.

In group discussions that do not involve a problem solving task, often a facilitator will pose questions to the group to instigate discussion. In such circumstances, technology can be used as a form of input, rather than just output as seen in the previous examples. Using technology to both collect and share responses can help to facilitate discussion within an informal group [9].

In this paper, we present a technological intervention aimed at facilitating group discussions with participants of differing backgrounds in discussions that do not aim to reach a common consensus. The aim of the system was to encourage each member of the group to express their opinion, and have an opportunity to share it with the group before discussion began in an attempt to ensure that social dynamics in the group did not affect the opinions of others so that differences arising from cultural diversity might be preserved.

### 3. REQUIREMENTS GATHERING AND TECHNOLOGY DEVELOPMENT

One aspect of cultural diversity that was of particular importance to this project was to understand how users with visual impairments reacted to the theatre piece, meaning the tool that was designed would need to be accessible. The development for this technology began with Unstructured Interviews with seven accessibility coordinators from museums, galleries and theatres. The aim of the interviews was to understand what services were currently on offer for visitors with specialist accessibility needs, and to understand their effectiveness.

One accessibility coordinator from an art gallery emphasized the requirement for “intellectual accessibility” in for users with visual impairments: this refers to the ability for the visitor to “critically engage” with the content of the museum or gallery. This is often done via the medium of group discussions with tour groups, as recommended in *The Good Guide* [10]. In this book, the authors suggest that the Inquisitive/Discussion approach of asking questions of museum visitors, when compared to the Lecture/Discussion method is beneficial for groups of varying cultural backgrounds, “The Inquiry/Discussion techniques one of the most satisfactory for groups in general. For it invites interaction at all levels of learning”. For engaging visitors in discussion about art and culture as was being planned for the theatre production, it therefore seems beneficial to encourage group discussions in order to appeal to different levels of learning, and to help visitors retain information from the tour.

One accessibility coordinator from a different art gallery used this group discussion approach, getting small groups to sit down together after a tour in order to discuss their reactions to the work they had just seen or interacted with. He stated that the aim for the tours and post tour discussion was that the guide should be talking for “50% of the time and not more”, which highlights the importance of allowing the gallery visitors to discuss their views and reactions to the pieces. One issue in such cases however was the potential for louder members of the group to eclipse others, making their opinions heard more than those of the more introverted members of the group.

It was with these particular issues in mind that a technological intervention was designed. In order to facilitate intellectual engagement with cultural experiences, the group discussion technique would be used. The intervention would have to facilitate this and attempt to solve the issue of group think and

group dominance by one member so that any cultural differences between audience members, either due to occupational background, or due to differences in sight levels, would be encouraged and preserved.

The group discussions would be held with participants with varying levels of visual impairments. For this reason any technology needed to avoid either visual input or output.

## 4. THE SETTING

The resultant technology was deployed as part of a theatrical production. The production was an immersive theatre performance that could accommodate 4 audience members at a time. The performance was a pilot piece, and so feedback was gathered to assess how the audience had reacted to the experience, and what aspects worked particularly well and which elements did not. In the performance, audience members were walking around a large hall for around 40 minutes, being guided to interactive bits of scenery whilst listening to ambient sounds in the space and a narrative via headphones.

### 4.1 Participants

The participants included each member of the audience who had experienced the piece. Over a week of performances, 24 interviews were run, of which 21 were facilitated using the Zippy Tablecloth, this included 93 participants. Of the 93 participants, 18 identified as being visually impaired in some way, this ranged from people with low vision to people who were totally blind. Two participants used a wheelchair to navigate the performance.

Participants came from a range of backgrounds, some worked in cultural settings such as museums and galleries, some worked in technology, others were journalists. A key finding from these discussions was to understand how participants from different cultural backgrounds would respond to the piece, meaning differences in responses to questions were important. Group think or group dominance would therefore have been a problem.

### 4.2 Materials

The tablecloth used in this prototype was a circular linen tablecloth. The cloth was designed to have five people seated round it: the facilitator and four participants. Each position was evenly spaced around 72° around the table. At four of the positions zips were inlaid in the tablecloth. These zips were metallic, conductive zips with no plastic covering. Behind each zip a piece of white fleece fabric was sewn to prevent the open zip from creating a gaping hole in the tablecloth.

Each zip had conductive thread sewn along each row of teeth. This effectively turned each zip into a variable resistor: the zip toggle itself bridged the two rows of conductive thread, if the zip was done up the resistance was therefore higher than if it was completely open.

The resistance of each zip was measured using an Arduino Uno board. This board would survey the resistance of each zip when a button was pushed by the facilitator. These resistance levels were converted into an audio tone and played through 4 0.2W speakers placed under the cloth in front of each participant. The resistance readings were divided into 10 positions, corresponding to short audio tones from C4 (middle C) to E5. These positions were also recorded to an SD card using the Arduino data logger shield. The physical input method, and audio output method meant this table cloth was accessible to audience members with visual impairments.

The sessions were audio recorded using a Dictaphone placed in the centre of the table. A video camera was used to record the group discussion.

### 4.3 Procedure

After the performance, each audience member was guided to a round table that was covered by the Zippy Tablecloth. The facilitator was at this point sitting at one position at the table.

The facilitator had a list of questions that were determined by areas of interest that the researchers on the theatre performance wanted to gather data about. These included questions about what audience members thought was happening in the performance, how they reacted to technology throughout the performance and what elements they were aware of and which they missed.

The researchers were keen not to stifle any avenues of interest that they had not predetermined, and therefore opted for the open interview technique rather than a more rigid structured interview or questionnaire.

The group was introduced to the Zippy Tablecloth in stages. The first stage was to introduce the method of input, this was done by asking the group to express their ages on the zips, assuming left was 0 and right was 100. This allowed each participant to get used to operating the zip and also introduced the concept of seeing the zip as a scale. The second question was used to present the audio feedback to the group and to introduce more abstract questions without a numerical answer. Participants were asked “You had 40 minutes to explore the space. Did you want more or less time? Move the zip to the left if you ‘wanted less time’, and to the right for ‘wanting more time’, and leave it in the middle if it felt about right”. Participants were reminded that the zip represented a scale, and not simply three different positions. At this point the button was pressed that caused the audio tones to play. The facilitator explained how lower tones signified responses to the left and higher tones represented responses to the right. Figure 2 shows a group interacting with the Zippy Tablecloth.

After this, questions specific to the research were asked. The facilitator presented the question, gathered responses to the question and then managed the group’s discussion by collecting similar answers from participants and juxtaposing them with differing viewpoints. At any point, the participants were free to question one another on their responses if they wished. Once discussion on one topic had ceased, a new question and scale for the zips was introduced.



**Figure 1** Participants interacting with the Zippy Tablecloth. The facilitator can be seen in white at the back of the table.

## 5. RESULTS

### 5.1 Facilitator Reaction

The Zippy Tablecloth was used in most of the interviews to facilitate the post-performance discussion. The device was easily introduced to groups and provided not only a means of eliciting answers to the presented questions, but also acted as a chapter marker throughout the discussion, allowing the facilitator to clearly define the sets of questions that were to be asked. Requiring the group to stop discussion and focus on the zip in front of them acted as a physical cue that a new topic was to be discussed. This meant that there was little blurring of discussion between questions.

The aim of the Zippy Table cloth was to allow each member of the group their chance to be heard, regardless of how loud or confident they were with their response and therefore maintain cultural differences. In practice, the device allowed this to happen in two different ways. Firstly through the use of the audio (and sometimes visual) feedback, each member of the group was made aware of the differing responses within the group. The tablecloth made it clear that every member of the group potentially had something to say.

The Zippy Tablecloth additionally helped to prevent imbalance in the group’s responses by allowing the facilitator to coordinate the group easily. By collecting responses to questions before the discussion began, the facilitator was able to orchestrate the discussion, allowing participants with similar responses to talk together before then asking participants with differing responses to speak. This ensured that if one participant wanted to express a similar opinion to someone else, there was no fear that the topic of conversation would change before they got a chance to have their say.

### 5.2 Participant Reaction

The reaction to the use of the Zippy Tablecloth from participants ranged from joy and delight, to no clear preference. No participants expressed discomfort or a dislike of using the system, though this may obviously be due to politeness.

It was successful in its aim to inform the group about the varying opinions and responses, for instance one participant responded, “oh wow” after hearing the audio tones and noting how different they were. Others used it to compare their responses to other audience members stating “I think I’m only a little bit more to the left of [what] she said there” and “Very similar to P1...that’s why I put it in the middle”. The tablecloth served to surprise group members with differences and confirm the similarities.

One common issue with the use of the tablecloth was that participants often needed clarification of the scale for the answer to the question. This largely fell into two categories: those needing a reminder of what the scale was “Wasn’t it short to the left?” or “Wait, the left is very easy?” or clarification of how the scale should be read, whether it represented a continuous spectrum or not: “Can you go in graduations?”. At these points the facilitator was required to restate the question and clarify any confused points.

The tablecloth not only acted as a physical representation of the participants’ answers to questions, but also began to affect the language that participants were using. Some responded to it when justifying and explaining their answer, “Yes, no, so I’m not all the way over to the left”. This gave people a vocabulary to discuss their answers.

An additional benefit of responding using the zip interface was that it acted as a memory aid. If the participant had not had a chance to respond immediately or the discussion had moved in a tangent away from the original question, they could recall their response to the question by looking down or touching to the zip in the tablecloth in front of them.

At times the zip was not an appropriate way for the participants to express their response to the posed question, in one instance a participant chose not to use the zip because they felt they could not place their answer on the provided scale.

## 6. EVALUATION

The Zippy Tablecloth successfully facilitated 21 discussions with participants from a variety of cultural backgrounds who had jointly experienced a theatrical performance.

The device appeared to serve its primary purpose: to prevent those with louder opinions from talking over others, or talking for the group entirely. It both aided the facilitator in coordinating the discussions, but also allowed the participants themselves to understand each other. In this way the device was successful at maintaining differences in responses that may have arisen due to cultural differences.

There was also an unexpected consequence of using the device in order to combat the issue of one member dominating the group. Whereas it was designed in order to allow quieter members to speak, it additionally appeared to reduce concern for those group members who were talking a lot. When the device was not used, one participant became aware and concerned that she was speaking too much. The Zippy Tablecloth may therefore also help to relieve the concern for group participants that they are speaking too much.

Another benefit of the tablecloth was that it gave participants a vocabulary to express their opinions. They were able to explain their opinion by using phrases such as “to the left” or “50/50” which may have helped them articulate their opinions with other group members, despite them perhaps not having the appropriate vocabulary for this setting due to not coming from an artistic background.

One key query about this technology is about why it needs to be a technological intervention, why it could not just have used a zip inlaid in a tablecloth. Such a design would have had the benefit of encouraging each participant to reflect upon his or her answer before speaking. And would have additionally helped the facilitator to organize the discussion. However, it would not have supported members of the group with visual impairments. The conversion of the zip position to the audio output was necessary for members of the group who were unable to see the position of the zips of other group members. For this reason, technical intervention was required to ensure that each group member had access to the same information.

This device was a prototype, which meant that at times the technology did fail. On a small number of occasions, the device was unable to create the audio output. During two such instances, the participants jokingly offered to make their own sounds, suggesting that even when the tablecloth was not functioning as it should, users still enjoyed the experience.

## 7. CONCLUSION

The Zippy Tablecloth acted as an unobtrusive technological aid during a group discussion, which helped group members from very different backgrounds discuss a topic together. It ensured that conversation was balanced between all members of the group,

regardless of their knowledge levels of the subject whilst creating a playful environment for the group.

This study has shown that the Zippy Tablecloth has real potential to facilitate discussions amongst groups with varying cultural backgrounds. It is now important to understand how it performs in different settings, perhaps at a museum or gallery in the first instance, and then in other situations such as committee meetings. It is not only necessary to understand how users might react in these different settings, but also to see how other group facilitators choose to incorporate it into their discussions. The Zippy Tablecloth has shown itself to be useful to facilitate discussions in one context; future research will show whether this success can be replicated elsewhere.

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