

Chatbot Mediated Group Decision Making

GroupLens, Department of Human Computer Interaction, University of Minnesota, Minneapolis, MN, USA.

Deana Bui
Mills College '18
dbui@mills.edu

Mary Solomon
Bowling Green State University '19
solomom@bgsu.edu

ABSTRACT

The foundation of this research was built on finding the best design for a chatbot used in group decision making. We created MLBot, an interactive chatbot that aids group decisions for movies by interacting with users in a chatroom, providing movie recommendations, and assisting the decision making process.

ML Bot's creation is based on MovieLens, a collaborative filtering recommender system that curates recommendations through user inputted ratings. Our objective with MLBot is to understand and analyze factors of intelligent agents that impact group decision making.

To do so, we are comparing different bot behaviors in a $2 \times 2 + 1 + 1$ factorial design, where ML Bot will have personalities from active to passive, opinion and no opinion, to structure and no structure.

We hypothesize that a chatbot that actively interacts with users and helps facilitate the group decision making process could lead to higher user satisfaction and a faster group decision making process. To test this hypothesis, we are conducting a Wizard of Oz study in which the bot will appear to be

an intelligent agent to the participant, but will actually be operated by a researcher.

In the future, this study can inform future researchers on designs of chatbots built for groups. The results of this analysis can be used to identify which bot designs are most efficient in aiding groups making a decision

INTRODUCTION

As more and more individuals are turning to intelligent agents for assistance in completing tasks, few, however, exist to assist groups of users in discussion or decision making. As a result, there were few references for designing chatbots that would be able to handle multiple users. Designing these agents for group decision making is difficult due to complex language structure in conversation; such as expression of preference and negotiation. With this in mind, we introduce MLBot, an interactive chatbot that aids group decision for movies by interacting with users in a chatroom, providing movie recommendations, and assisting the decision making process.

The goal of this research is to study, understand, and analyze design factors of interactive agents that improve group decision making.

By conducting this research, we are trying to answer following questions:

- i. What are the design factors of interactive agents that could improve group decision making?
- ii. How effective is each of the bot strategy/ design in improving group decision making?

By answering these questions we will be able to identify key attributes of the characteristics and design factors that enable chatbots to improve group decision-making. These findings would show new perspectives on chatbot development and provide a new direction in further investigation for future researchers.

Background

Technology and Group Decision Making

Technologies created to cater to group decision making is still in development and because of this there are few known characteristics that are foolproof in improving the group decision making process.

To gain a better understanding of how to implement such technology into the decision process, we referenced "A foundation for the study of group decision support systems" DeSanctis et al. [1] which presents ideas that yield guidelines for a Group Decision Support System(GDSS) design. The guidelines include, outlines of types of communication during group decision making meetings, the three levels of GDSS, and contingencies for future GDSS research. In addition, it presents testable hypotheses for future studies.

Our research will utilize the guidelines presented in this paper in order to test hypotheses on GDSS design. Putman et al.

[3] studied different phases of a group discussion, which helped us design the different behaviors of the intelligent agent during each phase.

MovieLens

MovieLens is a web based recommender site that was created in 1997 by GroupLens Research Lab. The site recommends movies for users to watch based on user ratings, reviews, and preferences that users have noted while creating their profile. In addition, users can add associated tags to each movie that adds to the accuracy of the movie recommendations. The site uses a variety of recommendation and collaborative filtering algorithms like item-item, user-user and regularized SVD. MovieLens also provides individual movie information such as lists of actors and directors, and a synopsis. MovieLens serves as the foundation of this study by providing movie information and recommendations for group decision on a movie.

Methodology

User Experience

Participants are groups of three to five people with previously existing relationships, who are English speaking adults over the age 18. The participants are recruited through the MovieLens website and by posters.

After the participants are recruited, they complete the consent form. Participants then create a MovieLens profile through an expedited sign up process where they will note their movie preferences. Upon completion, participants are directed to join Slack, an online communication platform, with an account provided by the researchers. On Slack, the participants are

informed that their goal of the study is to come to a group decision on a movie to watch together. They are then briefed on the general timeline of what they will be doing in the process. If the participants have any questions pertaining to the study, they are free to ask the researchers before the study begins.

During the session, participants engage with each other and the chatbot, operated by the researchers. All movie information, recommendations, and preferences are queried from the participants' previously created expedited profiles and from the web-based movie recommender site, MovieLens.

After the group of participants reach a consensus in their decision, the discussion will end. The participants will then be invited to complete a post-study survey.

The survey will focus on three areas:

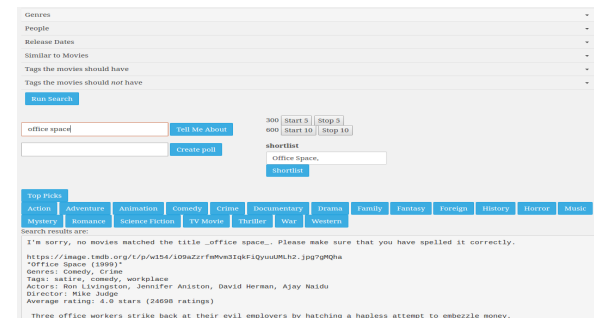
1. Participants' satisfaction towards the bot
2. Participants' satisfaction towards the final decision
3. Participants' satisfaction towards the group discussion process.

Wizard of Oz

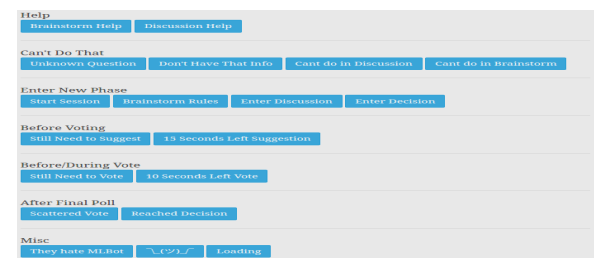
A Wizard of Oz experiment is an experimental design in which subjects interact with a computer system that they believe to be autonomous, but is actually being operated by an unseen human [2]. Using this experimental design enabled us to efficiently test which behaviors to use for each chatbot design, and allowed us to test more complex bot behaviors that are not easily achieved with current intelligent agents. This method of study can inform us of the design choices of intelligent agents.

During the study, it appears to the participants that the chatbot is an intelligent agent. However, the behavior of the chatbot is operated by one of the researchers based on a predetermined script. The script determines how and when the researchers should interact with the participants and respond to group conversation.

To make the actions of the bot appear to be automated, we constructed an operator interface that allows the researcher to send MLBot responses from the predetermined script to the participants instantly at the click of a button.



The operator interface pictured above, is used by the researcher to handle participant's queries and send movie information as MLBot.



This operator interface is used by the researcher to send MLBot dialogue to the participants.

MLBOT

ML Bot aids group decision making by interacting with users in a chat room, providing movie recommendations, assisting the decision making process.

We will be comparing bot behaviors in a 2x2 +1 +1 factorial design:

Active Bot	Structure	No Structure
Opinion		
No Opinion		

+

Passive Bot

+

Control

Bot Designs:

In the control groups, participants are placed in a chatroom to engage in a discussion to unanimously decide on a movie to watch without the assistance of a bot.

Passive bot assists their groups by providing movie information or movie recommendations when directly requested from the users.

Active Bot facilitates the discussion process in addition to carrying out the services of the passive bot. The following bot designs make up the two interventions of the active bot.

Opinion Bot gives comments on movies, based on the user's preferences (indicated in the MovieLens signup). For example, it will point out whether there are positive or negative opinions and whether the movie being discussed will be a good or bad match based on their group preferences.

Structure bot enforces 3 phases of the decision making process.

Brainstorm	Discussion	Decision
10 minutes to explore movies	5 minutes to discuss movies	Preliminary and final vote for movie

During the Brainstorming phase, the users are encouraged to ask for movie information and recommendations. Then the bot will guide the users into a Discussion phase.

In the Discussion phase, users cannot ask for movie recommendations, but are encouraged to discuss their opinions on movies as a group. This phase is designed for the participants to share their thoughts and opinions on movies and to negotiate which ones to watch.

The final Decision phase is introduced by ML Bot giving a shortlist of movies that the participants have previously inquired about. ML Bot then prompts a preliminary vote by asking each participant to suggest one to three movies to vote on. The top two movies from the preliminary votes are then used for the final decision poll. If the votes in the final poll are unanimous then the participants have successfully decided on a movie. If participants are unable to make a decision for either the preliminary or final vote, ML Bot will prompt them to choose what action to take next: brainstorm, discuss the movies, or revote.

Results

While we haven't launched the official study, we have run a few pilot tests and observed the following trends in user satisfaction. Participants like the recommendations and information provided by MLBot. Furthermore, they believe that the bot has the ability to recommend more unique movies than what the group themselves would have been able to suggest. For the participants that interacted with the Active bot with structure, they did not like being confined to each phase of the decision making process.

Conclusion

We designed a user study to understand and analyze design factors of interactive agents that improve group decision making. Once the study is complete, the results will help future research in designing interactive agents for groups. Furthermore, this research can give further insight to which designs of interactive agents make group decision making more efficient.

Acknowledgements

We would like to thank our mentors, Dr. Haiyi Zhu, Assistant Professor of Computer Science at University of Minnesota, Twin Cities, Dr. Max Harper, Research Scientist at GroupLens of the University of Minnesota Department of Computer Science and Engineering for their guidance throughout our research. We would also like to thank our project lead, Hao Fei Cheng, PhD student at GroupLens at the University of Minnesota, Twin Cities, and our labmate Joshua Wissbroecker, undergraduate at the University of Minnesota, Twin Cities. Finally, we would like to express our gratitude to the Distributed Research Experience for

Undergraduates (DREU) for giving us this opportunity.

Citations

- [1] Desanctis, Gerardine, and R. Brent Gallupe. "A foundation for the study of group decision support systems." *Management science* 33.5 (1987): 589-609.
- [2] Dahlbäck, Nils, Arne Jönsson, and Lars Ahrenberg. "Wizard of Oz studies—why and how." *Knowledge-based systems* 6.4 (1993): 258-266.
- [3] Putman, Vicky L., and Paul B. Paulus. "Brainstorming, brainstorming rules and decision making." *The Journal of creative behavior* 43.1 (2009): 29-40.