AI-based Mediation Improves Opinion Solicitation in a Large-scale Online Discussion: Experimental evidence from Kabul Municipality

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Abstract

We present a large-scale case study using agent platform that facilitated and gathered public opinions on internet-based town discussion. The hypothesis set to test how agent-mediated argumentative messages leads the discussion structure in a "Issue-giving" and "Issue-solving" themes involving human precipitants. The agent facilitation's mechanism set to dynamically react to participants by moderating and supporting on the bases of "issue-solving" stance in both discussion types. We conducted two large-scale experiments to evaluate the influence of agent mediation while looking at elements of both discussion themes. The first experiment themed as a "issue-giving" with 188 participants, and the second experiment set as a "issue-solving" with 1076 citizens from Afghanistan. The goal of the first experiment is to contribute insights about the scale of the issues the residents facing at districts 1 and 2. The goal of second experiment is to contribute insights about the scale of issues and their solutions. In the first experiment, we found that the due to participants started by taking part with theme stance "issue-giving" the first post of submitters were issues, hence the themed "issue-giving" increased the number of issues but when agent started posting facilitation messages, the participants stance changed from issue-giving to issue-solving stance, while in second experiment the participants stance remain the same as the theme type.

1 Introduction

The growing use of Artificial Intelligence for social good has raised hopes that new ways for solving social issues may be opened up. It is also hoped that these technologies may revolutionized deliberative democratic communication practices and the ways in which people engaged and collaborate with town-developing process. AI-enabled Online discussion allows municipals to facilitate crowd opinions and extract the collective minds for urban policy-making. Such platforms have the potential to mediate the discussion and extract the discussion elements to improve collective decision-making. It is currently possible to answer the question that how citizens' collective intelligence can guide better policy and decision-making for municipal circles by employing these technologies as an AI representative application to dominate the super minds for the good of society. Moreover, AI-enabled large-scale discussion can challenge the Sustainable Development Goal (SDGs), in which the world has pledged to "leaving no one behind". Responding to goal No.4 on the agenda, efforts to establish a sustainable city and community to all the world population must be pushed forward. This is important to harness social insights by promoting civic engagement in city development process-related town meetings. These engagements can directly and indirectly support opportunities for city and community sustainability development.

Over the past decade, there has been a significant emphasis on urban policy process in Afghanistan, especially the capital city Kabul to engage crowd in civic life and urban development. But the challenges associated with civic engagement is the lack of capacity and resources limitation of municipal organizations to host and deliberate discussion and promote the inclusion. There are many strategies used in promoting civic engagement efforts including deliberative forums, using technology and social platforms [Brady et al, 2020].

The social media platforms (e.g., Facebook, YouTube, and Twitter) have showed their importance in distributing information and promoting civic engagement regardless of consensus building. However, further analyses required to be performed on collected data for policy-making.

In this light, we wanted to study that how conversational AI can be used for the good of society. We set to study the agent facilitation's mechanism in two different topics. The participants start by posting their opinions and the agent will adoptively reply to them based on pre-defined facilitation ratio setting. The contribution of this work is two-folds.

1. Verifying the role of agent-based mediation in an online large-scale Kabul municipality discussion by studying how it change the participants "issue-giving" stance to "issue-solving" stance.
2. A study on the effect of agent's mediation on leading the online discussion among two type of discussion topics considering discussion with and without agent

The paper is structured as following. we present the background and related work of online platform for social good. Next, our methodology discussed in section 3. In section 4, we present our social experimental setting. In section 5, we present the result of our social experiments. Finally, we provide discussion and conclusion in section 6.

2 Related Work

Discussion platforms are considered the next-generation democratic platforms for citizen deliberation in collective intelligence [Malone, 2018]. For instance, the CoLab platform was used to harnesses the collective intelligence of thousands of people all around the world to meet the goal of global climate change [Malone and Klein, 2007]. In [Sengaku. et al., 2016], proposed a discussion tree for managing large-scale internet-based discussion used for town meeting. A large-scale web discussion support system named "Collagree" and "D-Agree" was developed to conduct large-scale social experiment for gathering citizen's opinions for the next-generation city planning of Nagoya city, Japan [Ito. et al., 2014, 2015, 2019]. In [Takahashi. et al., 2016], proposed an incentive mechanism based on quality of opinions to motivate the debaters within the discussion to submit quality of opinions. The MIT "Deliberatorium" was created and used to enable large-scale deliberation about complex systemic problems [Klein, 2012]. Such platforms are also used to empower citizens to achieve desired goals [Savaget. et al.,2019]. For instance, An AI-assisted deliberative web discussion was employed to collect citizens opinion for Kabul city decade of action plan policy-making in Afghanistan [Haqbeen. et al., 2020a-b]. Another work has recently used the agent platform as an AI representative application to fight the COVID-19 by gathering cross-class public opinions about the COVID-19 situation [Haqbeen. et al., 2020c]. The same platform has been used to target SDGs goal No.4 localization through promoting civic engagement in collective intelligence, in Afghanistan [Haqbeen. et al., 2020d].

In practice, these AI-assisted discussion platforms employ algorithmic methods and machine learning techniques to harness the collective social intelligence. In this work, we particularly focus on the use of conversational agent to adopt human conversational behavior by agent's facilitated messages to lead the discussion towards result-driven discussion. In this case a defined computer program as a representing AI facilitator interact with user using natural language processing technologies to mimic discussants submitted items throughout the conversation at large-scale. However, using agent platforms raises ethical problem and has ethical side effect on the discussion to meet the collective agreement. It

is becuase the agents are expected to make judgment when interacting with discussants in discussion, and has strong effect on changing the minds of discussants during the discussion due to argumentative messages. For instance, several studies have investigated the effect of artificial agents on social media platform. In [Ozer. et al., 2019], the work focus on the polarization effects of agent's activities on a political social network by studying the retweet network of 3.7 million users during the tragic Stoneman Douglas high school shooting event. The research found that agent accounts heavily contributed to online polarization.

In this work, we conducted as non-polarized discussion where the conversational agent does only provide support the participants throughout discussion by mediation support not attacking to raise ideas to the given issue. We set 3:1 (participant post: AI post) facilitation ratio for agent, it means that agent post facilitated message once every three post on participants and not posting to all participants. In the future, we will study that how agent's facilitation has effect on others which not get the post and the one which get the agent post. Also, we will consider the side effect of agent by studying that how agent help to increase the percentage of polarization of discussed items, and the side-effect of agent on increasing polarization in the discussion.

3 Methodology

Our research general methodology is to conduct two large-scale (hundreds and thousands-scale) discussions using conversational agent as a facilitator where the agent expected to encourage the participants to engage in themed discussion. We used accidental sampling and the participants joined the discussion and engaged to themed discussion based on their availabilities. We have set "Issue-solving" and "Issue-giving" discussion topics. The topics was not "Debate" type of topic. The discussion stated from two types of topics that needs to be elaborated by the users as human participants. The agent will then operate the content according to the following algorithm:

1. Collect and restructure the content as a tree.
2. Classify the node of tree base on IBIS type: issues, positions, pros or cons.
3. Construct or update the IBIS discussion tree
4. Set the desired argumentation semantics.
5. Infer the target argument(s) based on semantics and more than 200 predefined facilitation rules which is based on support facilitator's mechanism.
6. Apply the Natural Language Generation (NLG) on the obtained target argument (s).
7. Post the facilitation messages to the discussion at a particular argument point.
8. Go to 1 and repeat.

In step 5, the agent uses a specific semantic in order to decide whether to ask the author of the posted opinion to provide support argument related her/his posted opinion or request other discussants to provide supportive arguments related to posted opinion of (author) discussant. For instance, in case

one the agent could prompt to ask the author of posted opinion to support his own self argument. Such as "Thank you very much, {name}, for your view. What do you think is causing {issue} currently"? In case 2, the agent calls on the other discussants to provide α_2 to support discussant 1's argument α_1. Such as "Please feel free to provide anything that come to your mind about {name}'s {issue}". Here the variable {name} is the name of the author of the post, and {issue} is the issue extracted by agent from the posted message of author's post. The agent can call other IBIS's elements such as idea, pros and cons as well. The process performed consistently to improve soliciting of opinions. We apply this on both topics to evaluate the effect of agent on leading the discussion's elements and structure. Additionally, to verify the effects of agent we did not introduce the agent in partial of discussion with *issue-solving* social experiment. The methodology benefits from such computational tools as machine natural language and mining technologies and such crowd coloration as Kabul Municipality and residents.

3.1 Navigating People Opinions using Agent Tech

This study used D-Agree as a representative application of AI to gather diverse public responses related to the social problems surrounding Kabul city. The proposed system and social platform were methodically used to collect social network opinions by boosting the call using Facebook Ad. service. We set to promote the social experiment Facebook page by using Facebook Ad. to target the audience inside Kabul city. Additionally, KM and A-SDGs organizations assisted us with inviting citizen by posting call for participation into their official Facebook and homepages. Figure 1, shows system general architecture.
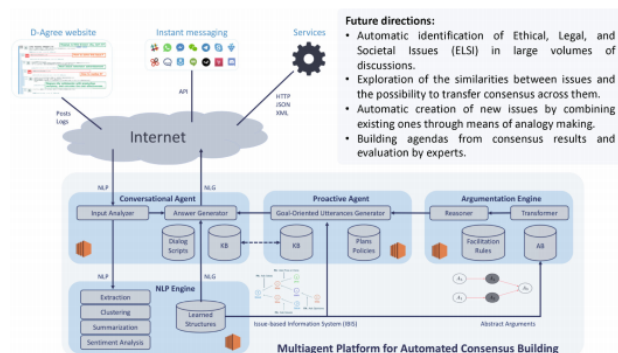

Fig.1: System general architecture

3.2 Issue-giving Discussion Topic

There were two objectives behind this experiment. First, Kabul municipality wanted to promote public engagement by collecting insights from citizen related most important issues participants facing in districts 1 and 2, and based on crowd insights they wanted to priorities the issues to be fixed in the future. Second, we wanted to verify the effect of our conversational agent in none-Issue-solving discussion topics. The agent facilitation's mechanism is based on Issue-solving

discussion topic, but here we wanted to know the discussion structure that how the tree's element composition in none-creative topic. The experiment gathered 1728 opinions from 188 registrants. 173 were males, and 15 were females. 85 facilitation messages posted by agent. The experiment was conducted from January 28th to 31th during early days of COVID-19 pandemic. We set the discussion duration as 24/7, and discussion revolves around one theme as bellow:

1. What are the most important challenges and problems Kabul residents facing in Districts 1 and 2?

We choose to activate the agent to facilitate the discussion based on same facilitation mechanism which we applied for themed with Issue-solving topic.

3.2 Issue-solving Discussion Topic

The goal of experiment was to check the scale of the IBIS distribution and effect of agent in raising the ideas. We wanted to perform comparative verification of the discussion structure of online discussion among two discussion topics, and verify the effect of agent in Issue-solving and issue-giving discussion topics. The experiment gathered 1665 opinions from 1076 participants. 1000 were males. The experiment was conducted from January 20th to March 18, 2020 divided to two equal phases. We set the discussion duration as 24/7, and discussion revolves around one theme as bellow:

1. How to promote civic engagement in Kabul city planning process-related town meetings?

The first phase was conducted without the agent facilitation and the second phase used the agent to facilitate the discussion. We choose not to activate the agent in first phase to kick start the discussion by human participants alone and compare the phases with each other to verify the effect of agent.

4   Experimental Setting

In both experiments, the agent plays the role of moderator with supporting messages. In both experiments, the agent facilitates the discussion by using a specific semantic in order to decide whether to ask the author of the posted opinions or call upon other participants for soliciting opinions. If the agent encounters a message provided by a participant that agree with the agent's facilitation mechanism stance and positioned within an IBIS element such as *idea, issue, pros or cons*, then the agent will reply to participants by considering the mined messages and are exploited the same way as explained in section 3. The setting of agent's facilitation assumes to facilitate fairly for both discussion types.

Our agent platform was deployed on Amazon's EC2 infrastructure with each model being allocate to a separate EC2 instance (Amazon, 2020). The interactive between agent and human participants by a period of 1-minute specific to Amazon CloudWatch [Wittig. et al., 2016], and a threshold of 3 people per agent facilitated message. This threshold sets

counting the number of messages of human participants that the agent should take part in the discussion.

5 Results

The results of first experiment, discussion with "issue-giving" type are shown in Fig. 2. For "Issue-giving" the number of issues (806) was higher than that number of ideas and pros (520). It is because the participant started posting their first message based on discussion topic stance. Furthermore, the number of pros (248) is higher than then number of cons (154). The increasing number of ideas and especially pros, exactly shows the effect of agent's facilitation stance "issue-giving" and her mediation role after taking part in discussion. Additionally, the overall number of issues and cons (960) are higher than that number of ideas and pros (768) for the "issue-giving" discussion.

The results of second experiment, discussion with and without conversational agent for the "issue-solving" topic type are shown in Fig. 3. For the theme "Issue-solving" without agent, the number of issues and cons are higher than that to ideas and pros. But the number of ideas and pros are increased after the introduction of agent in the "Issue-solving" theme with agent.
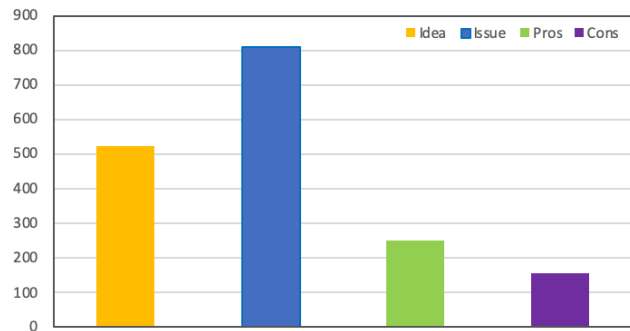

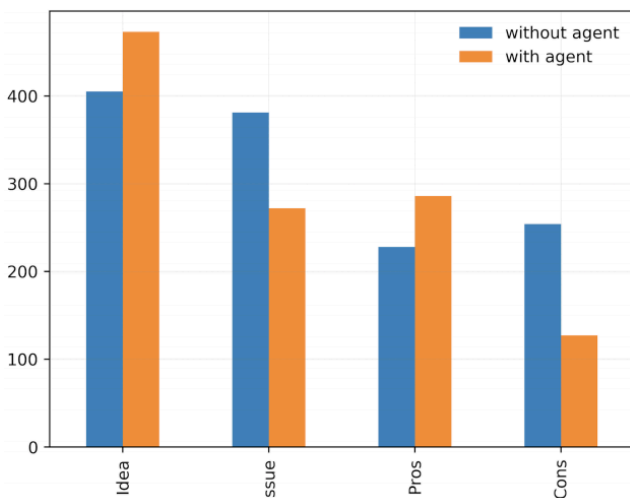Fig. 3 Distribution of IBIS's element for the "issue-giving" discussion.

Fig. 4 Distribution of IBIS's element for the "issue-solving" discussion with and without agent's facilitation.

6 Discussion and Conclusion

First, the evaluation of IBIS counts in Fig. 2 and Fig. 3 suggest that the raising of discussion IBIS elements directly related to both discussion types and facilitation effects. The discussion in "issue-giving" topic is centered around raising issues, and in the "issue-solving" topic it is centered around raising ideas. Also, in "issue-solving" topic the discussion without the agent is centered around raising issues, and that once the agent is introduced, the discussion will evolve as to find solution and ideas to the stance of theme. Moreover, the agent's facilitation helps to increase the number of IBIS ideas and pros elements in both discussion types. This evaluation could be a precondition on how discussion types evolve towards a general consensus with predomination of ideas and pros, or towards a divergent deliberation with the predomination of issues and cons. All discussants taking part in first experiment discussion by posting their first message based on the theme's stance, but their stances change drastically under the effect of agent facilitation mechanism. Therefore, the number of ideas and pros increased.

For the second experiment, the discussants prior knowledge of the theme type "issue-solving", helps to increase the number of idea generation in discussion. But in order to know the effect of agent on other IBIS elements generation, we divided the discussion into two equal phases. We procced the first phase without agent and second phase we used artificial agent. We choose not to activate agent in the first phase to kick start the discussion by the human alone, and then compare both phases to find the effect of agent's facilitation.

All discussants taking part in discussion based on the stance of themed but after the agent posting facilitated message, their stances do not change drastically under the effort of agent. It is because the stance of theme and agent were same *issue-solving*. The evaluation of IBIS count in figure 3 suggest that the first phase of discussion which is without agent is centered around raising issues compare to ideas, but once the agent is introduced in second phase of discussion, the discussion evolve to the stance of themed which was finding solutions and ideas to the themed topic. Also, the result of second experiment suggests that the agent increased the reactiveness of the participants to the messages for the discussion with agent compare to that discussion without agent.

To conclude, both the conversational agent's facilitation mechanism and selecting a discussion topic had strong effect on the argumentative nature of discussion as well as the solicitation of IBIS elements in discussion. On another hand, the artificial agent had superior effect on solicitation of *ideas* and *pros* in "issue-solving" topic compare to that "issue-giving" but help the generation ideas and pros in "issue-giving" topic as well. Additionally, the artificial agent had superior effect on solicitation of *pros* compare to that *cons* in both experiments. The persuasive effect modulated the distributions of the IBIS elements in both experiments by reducing the *cons* while increasing the *pros*.

In the first experiment, we found that the due to participants started by taking part with theme stance *issue-giving* the first post of submitters were *issues*, hence the themed *issue-giving* increased the number of issues but when agent started posting

facilitation messages, the participants stance changed from *issue-giving* to *issue-solving* stance, while in second experiment the participants stance remain the same as the theme type. The results show that the effect of agent's facilitations helps to change participants stances from *issue-giving* to an *issue-solving*, and by this it helps achieve outcome-based discussion.

There were several limitation and challenges faced while conducting experiment. We had limitation of collecting same population and gender, and same socio-culture for both experiments due to constraints of nature of accidental sampling. However, we tried to call on first experiment participants to try to participate in second experiment as well but due to the convenience sampling method we couldn't collect the consent of same samples for both experiment

Our next direction is to apply our agent facilitation's mechanism on two theme's stance considering same samples on a controlled experiment. This would allow us to establish a clear verification rule and evaluate the impact of both agents involving same human participants.

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