

Thinking Outside the Box: Co-planning Scientific Presentations with Virtual Agents

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Abstract. Oral presentations are central to scientific communication, yet the quality of many scientific presentations is poor. To improve presentation quality, scientists need to invest greater effort in the creative design of presentation content. We present AceTalk, a presentation planning system supported by a virtual assistant. This assistant motivates and collaborates with users in a structured brainstorming process to explore engaging presentation structures and content types. Our study of AceTalk demonstrates the potential of human-agent collaboration to facilitate the design of audience-centered presentations, while highlighting the need for rich modelling of audiences, presenters and talk contexts.

Keywords: Presentation planning, embodied conversational agents, scientific presentations, slideware, PowerPoint, collaboration, creativity support.

1 Introduction

Although oral presentations are an integral feature of science, the typical quality of scientific presentations is low [5], resulting in their failing to engage, motivate, and persuade their scientific audiences and the public. In a survey of 2,501 professionals [5], support for better organization of presentation content was highlighted as one of five areas in most need of improvement. To shift away from their stereotypical presentations, scientists need to spend more time and energy on the planning of creative content for the benefit of their anticipated audiences. This requires exploring multiple narrative structures as well as incorporating a range of narrative devices (e.g., stories, anecdotes, summaries) that go beyond the dry recollection of topics, facts, and figures.

One way to encourage presenters to “think outside the box” is collaborative brainstorming of alternative presentation formats. Studies have shown that brainstorming in groups – when certain guidelines are followed – can be more productive than individual brainstorming, because it allows members to share ideas and to contribute their unique viewpoints and problem-solving approaches [10].

Our research explores the potential of human-computer collaboration to support presentation planning for the scientific community. We aim to take advantage of collaborative brainstorming dynamics to create engaging, audience-centered presentations that diversify presentation forms while better delivering on their intended functions.

We began with a workshop study of how human dyads collaborate on the design of conference presentations, to understand the concerns and processes involved when humans perform this task. Inspired by findings from our study and recommendations from the literature, we developed AceTalk, a PowerPoint add-in that supports collaborative presentation planning between a human and a virtual agent. Using conversation, the virtual agent motivates and guides the human presenter through a structured planning process. Our structured process consists of three stages: elicitation of presentation context; guided brainstorming with rhetorical templates; and narrative structuring. Our contributions include:

1. Derivation of three grounded themes that describe current practices in scientific presentation planning and motivate a human-agent collaborative planning approach;
2. Design of the AceTalk system that supports structured presentation planning with a virtual assistant;
3. Demonstration in a formative study of the benefits and issues arising from presentation planning with AceTalk.

2 Related Work

2.1 Human-agent Collaboration and Creativity Support

Virtual agents have been used in a number of pedagogical applications across various domains (e.g., AutoTutor [8]) to improve learner motivation [13] and learning outcomes [12]. However, most of these systems focused on tasks with well-defined solutions. There have been limited studies exploring the potential of agents to support brainstorming and the open-ended task of creative content composition. One such example is Wang et al.’s study on agent-based dynamic support for collaborative brainstorming in scientific inquiry [17]. In this study, individuals or dyads of participants brainstormed ideas to solve a scientific problem in a chatroom-like interface. During their brainstorming sessions, an agent offered feedback and contributed questions based on the topics being discussed. Results of the study suggested that the agent could be beneficial in mitigating process losses traditionally associated with group brainstorming. To our knowledge, there has been no research to date that explores the use of agents, either as a coach, collaborator or audience, to support the creative process of presentation design.

2.2 Best Practices in Presentation Planning

In his book “*Presenting to Win*”, Weissman [18] describes five cardinal sins of presentations: no clear point; no audience benefit; no flow; too detailed; too long. As the first step to avoid committing these sins, many presentation books (e.g., [1, 4, 18]) advise to begin the planning process with a clear definition of the presenter’s objectives and the target audience. Abela [1] recommends making a list of “important” audience members with specific personality types and communication preferences, while Weissman [18] suggests to start with the key question of “*What’s in it for you?*” as a way to establish audience benefits.

Once the target audience has been established, many books (e.g., [1, 4, 18]) advocate a bottom-up, brainstorming approach to content planning. The presenter is encouraged to generate as many content items as possible through divergent thinking, before filtering them down and organizing them into a compelling narrative structure. The result of this process should be a balanced collection of facts, stories, anecdotes and visuals that flow logically and naturally to tell a compelling story to the audience. Various narrative structures have been proposed in the presentation literature, such as Weissman’s sixteen flow structures [18], and Duarte’s “*What is – What could be*” contrast structure [4]. These structures could potentially serve as templates to guide the presenters through their exploration of alternative formats for scientific presentations.

2.3 Presentation Technologies

A number of research projects have proposed methods to support the planning, rehearsal, or delivery of oral presentations. The advantages of narrative-driven presentation planning have been demonstrated by TurningPoint [11], a PowerPoint add-in that supports sticky-note-style ideation and clustering of content in parallel with the use of narrative templates to both elicit content and guide its sequencing into a meaningful flow. The PitchPerfect system [16] has shown that a more structured approach also benefits presentation rehearsal, while DynamicDuo [15] has demonstrated that virtual agents can effectively co-deliver presentations with human presenters. We extend this prior work by investigating the potential of human-agent interactive collaboration to facilitate presentation planning.

3 Scientific Presentations and Collaboration

We conducted an exploratory study to explore the potential benefits of collaboration during presentation planning, as well as attitudes towards scientific presentations.

3.1 Procedure

We conducted a workshop in which dyads of participants each delivered a 5-minute presentation of a pre-selected scientific conference paper. Each dyad received their assigned paper two days prior to the workshop. They then took part in a 1-hour design session a day before the workshop, where they collaborated on the preparation of their presentation. Beyond the design session, participants were encouraged to spend extra time composing their presentation, if desired. We also provided participants with a summary of best practices in designing presentation content and flow, synthesized from advice in popular presentation self-help books [4, 18]. Following the workshop, we conducted a semi-structured interview with each dyad to better understand their collaboration process, as well as the typical practices of each member of the dyad when preparing scientific presentations.

3.2 Participants

We recruited 12 students and professionals (5 male, 7 female, ages 20-54, mean 30) with varying levels of presentation experience and backgrounds in computer science, communication, and life sciences. Of the 12 participants, 3 were categorized as high competence public speakers, 2 as low competence public speakers, and 7 as moderate competence according to the Self-Perceived Communication Competence Scale [6].

3.3 Findings

The interviews were recorded, transcribed and coded by two researchers using thematic analysis techniques [2]. Our initial open coding resulted in 223 process codes capturing actions in data. We categorized these codes into six categories related to the planning, authoring, rehearsal and delivery of scientific presentations. Here we present the three categories that are directly related to presentation planning, demonstrating the effects of stereotypes, motivation and collaboration on the planning process.

Modelling Presentations after Stereotypes. Many participants expressed low expectations towards the general quality of scientific presentations, yet they were resistant to break away from the norm, because “*by nature, academic stuff is like, controlled, to the point, and kind of bland*” [P1]. Although some presenters recognized the need to create engaging presentation content, they were discouraged by the perceived conflict between engagement and seriousness in academic presentations:

“Before I was trying to make the presentations more engaging, more interactive. But once I went to conferences, I see a lot of people make their slides more serious, more scientific. So I think maybe that’s the way we should present” [P7]

Most participants also reported that they did not follow the best practice guidelines we had provided. Reasons included a lack of preparation time, low motivation, and difficulties applying the “*meta-level*” [P11] recommendations in specific cases. However, those who followed the guidelines appreciated their benefits, e.g., in making their presentations “*a little more fun and engaging instead of just heavy facts and information*” [P4]

Planning on Slides with Scientific Templates. In contrast to the brainstorming approach recommended in the guidelines and literature in general, most participants started planning their presentations by first highlighting important points on printouts of their assigned paper, then creating slides following the written structure of the paper:

“We just took the sections in the paper and added them out as main points” [P9].

This resulted in nearly identical presentation structures (Introduction, Related Work, etc.) being used for all the presentations – “*pretty boring for people*” [P4]. Only a few participants recommended structuring the presentations around the audience’s benefits, because: “*I can be like, here it is, here’s what we did and here’s the result, but that doesn’t mean it matters to anyone*” [P5].

Strengthening Content through Collaboration. Many participants highlighted the benefits of collaboration in terms of avoiding content bias, since they were encouraged to consider and incorporate different viewpoints:

“If you are working on one slide, you might have some bias about this section, but the other one will give you wonderful ideas about how to present, what is the most important thing” [P7].

Several participants reported that the collaboration process motivated them to create more audience-focused content, because “*your collaborator could be your first audience in the process*” [P8]. This prompted them to “*make [the presentation] more interactive by adding images and videos*” [P7]. The feelings of shared workload and companionship through collaboration also helped presenters to reduce anxiety, both during preparation and delivery. However, these benefits came at the cost of increased effort and time invested during the presentation planning stage.

3.4 Design Implications

Informed by the findings of our interview analysis and best practices from the presentation literature, we derived three implications for the design of presentation planning support tools:

1. Motivate creation of audience-focused content by acting as an audience advocate to proactively elicit and review content from the audience’s perspective;
2. Support exploration of non-stereotypical presentation structures through collaborative brainstorming guided by diverse narrative templates;
3. Provide expert advice in an interactive and digestible manner, dynamically adapting to the content matter, presenter’s objectives, and talk context.

4 Design of AceTalk

Based on our design implications, we developed AceTalk (**A**gent for **C**reating **E**ngaging **T**alks), a PowerPoint add-in that supports collaborative presentation planning between a human and a virtual assistant. Through conversation, the assistant motivates and collaborates with the human presenter in the brainstorming of engaging presentation structures and content types. During the process, she provides the presenter with narrative templates and recommendations drawn from the literature on presentation and classical rhetoric. To compensate for the time spent on planning, the system automatically generates provisional slides from the brainstormed content. We now describe our virtual assistant and the structured planning process that she mediates.

4.1 Virtual Assistant

Our virtual assistant, Angela, is an embodied conversational agent developed using Unity (Fig. 1). Angela communicates with the human presenter using synthetic speech. She is capable of displaying a variety of nonverbal behaviors, including facial expressions, eyebrow movement, directional gazes, head nods, posture shifts, and hand gestures (contrastive gestures for comparisons, beat gestures for emphasis, and deictic gestures for on-screen spatial references). Most of her nonverbal behavior is automatically

generated using the BEAT text-to-embodied speech system [3]. Human-agent dialogues are scripted using a custom scripting language based on hierarchical transition network. User input to the conversation is obtained via multiple choice selection of utterance options, updated at each turn of the conversation.



Fig. 1. Collaborative planning environment with the virtual agent (left), brainstorming canvas (bottom), and narrative strip (top).

4.2 Conversation-led Presentation Planning Process

Through conversation, Angela guides the human presenter through three stages of the planning process:

Elicitation of Presentation Context. At the beginning of the process, Angela engages the user in a brief Motivational Interviewing [7] dialogue to enhance the presenter's intrinsic motivation and confidence to prepare an engaging presentation. She then prompts the user for general information, including presentation length, preparation duration, and target audience, before introducing them to the brainstorming approach recommended in the literature. At the end of this stage, Angela asks the presenter to identify the most important contribution of their work with regard to the target audience, and uses it to suggest a high-level rhetorical template to guide the brainstorming stage.

Guided Brainstorming with Rhetorical Templates. A rhetorical template is a structure used to elicit and categorize presentation content from the user at various levels of abstraction. Each rhetorical template has two components: a macro template addressing the overarching question of “*what’s in it for the audience?*”, and a collection of micro templates describing core details of the presenter’s work. An example is the “*Invention*” template, used to present the description of something new, which combines the macro template *What Is – What Could Be* [4], and the micro template *Feature – Advantage – Benefit* [18] (Fig. 1).

During brainstorming, Angela instructs the presenter to add four types of content notes (facts, stories, images and videos) to the rhetorical template they are currently instantiating, starting from macro templates, then progressing to micro templates (Fig. 1). Angela encourages the presenter to consider various possible arguments for their

presentation without concern for linear sequencing of content. On request, Angela provides specific examples of arguments that can go in the template, explaining their importance from the audience’s perspective. She can also review the content added by the presenter, reminding them to add stories, anecdotes or interesting visuals to help increase audience engagement.

Narrative Structuring. On completion of the content brainstorming process, Angela instructs the presenter to filter and select the most engaging content items from the filled templates, then linearly sequence them into the classic 3-act story structure: beginning, middle, and end (Fig. 1). The agent encourages the presenter to consider multiple structuring options with regard to how they benefit the audience. For example, presenting all benefits up front before going into the features and advantages, as a way to fully capture audience attention at the start, versus repeating the benefit-advantage-feature pattern for each benefit in turn, as a way of creating suspense. At the end of this stage, the system automatically generates PowerPoint slides from the selected content sequence. The presenter can then further polish these provisional slides within the PowerPoint environment.

5 AceTalk User Study

We conducted a formative study to examine the benefits and issues of the agent-assisted presentation planning approach embodied in AceTalk.

5.1 Procedure

The study consisted of a 90-minute session in which participants prepared and delivered a presentation with our system. Participants were asked to redesign a scientific talk that they had given in the past. This task was chosen as it allowed the participants to compare the process and presentation content created with AceTalk against their past presentation. The study began with an initial semi-structured interview about the preparation and delivery of the previous presentation. We then gave participants one hour to interact with AceTalk to create a new, 8-minute version of their presentation, before giving a video-recorded presentation. We assessed user satisfaction with AceTalk (Table 1), and State Anxiety [14] and Speaker Competence [9] for both their prior and new presentations. We concluded the study with a final semi-structured interview, prompting critical reflections on both the structured planning process, and the role of the virtual assistant in facilitating that process.

5.2 Participants

We recruited 11 graduate students and professionals (3 male, 8 female, ages 23-31, mean 27), with backgrounds in design, medicine, social science and different fields of computer science. 3 participants were categorized as high competence public speakers, 1 as low competence public speakers, and 7 as moderate competence, according to the Self-Perceived Communication Competence Scale [6].

5.3 Quantitative Results

The user satisfaction ratings for the agent were highly positive across all participants (Table 1).

Table 1. Average satisfaction ratings of the virtual assistant

Rating on scale 1 (not at all) – 7 (very much)	Mean (SD)
How <i>satisfied</i> are you with...?	5.45 (1.04)
How much would you like to <i>give future presentations</i> with...?	5.82 (1.32)
How much do you <i>like</i> ...?	5.91 (1.14)
How <i>easy</i> was it to use...?"	4.00 (2.05)
How much do you feel you <i>trust</i> ...?	6.10 (1.22)
How much <i>help</i> was ...?	5.10 (1.64)

Participants reported significantly lower State Anxiety ($t = 3.28$, $p < .01$) and higher Speaker Confidence ($t = 2.27$, $p < .05$) after using AceTalk compared to their retrospective assessment from their past presentation. These comparisons, however, have many potential confounds (e.g., comparing retrospective vs. current state, differences in presentation context, learning effect), so must be interpreted with caution.

5.4 Qualitative Findings

We derived four main themes from the high-level coding and analysis of our final semi-structured interview transcripts, relating to the elicitation of audience-focused content, the use of templates, and the agent's role as a companion in the planning process.

Eliciting Audience-focused Content. Most participants reported that working with the virtual assistant helped them change their presentation content and structure in ways that would be more engaging for the audience: "*I think the structure grabs the attention of the audience a little bit more...a little more striking*" [P10]. Through the questioning strategy, the agent encouraged the presenters to consider the soundness of their content: "*Because she asked me about the question 'what do you think about the benefits of your methodology', and I need to think about it*" [P5]. Several participants expressed that the presence of the agent made them feel "*like she was an audience*" [P9], with explicit needs: "*Before, I didn't think too much about it, I just assume everybody knows*" [P2]. By proactively reviewing existing content and making suggestions to add different content types such as stories, the agent also motivated users to "*think of interesting ways of presenting and conveying your information*" [P6]. One participant, however, suggested that the agent should be more knowledgeable about their target audience, to provide more specific recommendations: "*She didn't really ask much about who my audience is. She assumes everyone is interested in the same thing*" [P4].

Providing Interactive Guidance through Conversation. All participants expressed strong preferences for interacting with the agent over traditional text-based interfaces. Compared to written instructions, the conversation format could be more time

consuming, but its interactive nature encouraged them to “*pay more attention*” [P5] and therefore “*take more information in*” [P11]. The conversation method also allowed the agent more opportunities to persuade the presenters to follow the guidance: “*I remember when I went to fill up the beginning...and when I chose motivations, she gave me resistance and said ‘maybe you should include implications’ – it was really cool*” [P7]. The participants also appreciated the communication style of the agent: “*she communicated in a nice way, in that you felt comfortable having her guiding through the steps*” [P6]. Several participants, however, felt that the guidance should evolve and adapt based on specific content matters, presenter characteristics, and time constraints.

Providing Companionship through Collaboration. Several participants reported that the virtual assistant helped increase their confidence through a sense of shared workload: “*Preparing with her gives you a little more confidence because it seems like I have two different brains*” [P10], and thus, “*it doesn’t feel like it’s a lot of work that you are doing*” [P6]. The companionship provided by the virtual assistant also helped reduce presenter anxiety: “*I feel more relaxed... because I feel like there is someone to support me*” [P9].

Balancing Guiding Structure and Creative Freedom. While many participants reported that our brainstorming process was “*totally new*” [P7] for them, most found it to be helpful. Several participants expressed that the guiding templates and act structures were novel enough to encourage them to “*think outside your normal kind of thinking pattern*” [P6], while still being highly relevant and applicable to scientific research: “*I think the scientific research really falls into this pattern*” [P2]. The templates were reported to help focus the presenter’s attention on the overall logic of the presentation in ways that saved time: “*I liked how it took the broad structure, it got you thinking about the main points right away...I did it more quickly this time.*” [P11]. Having a “*clear picture*” [P1] of the rhetorical organization of the presentations also helped the presenters feel “*more confident*” [P2] in their delivery. However, once presenters had used the templates to establish their core content and talk structure, they felt comfortable adding more low-level content slides within the less-constrained PowerPoint environment: “*Once you know the way to do it, you want to follow the structure but fill in more of your own content*” [P5]. Several participants expressed the desire to either have more templates of diverse styles (e.g., more “*story structures*” [P3]), or have the flexibility to extend the current templates. One participant also requested “*backtracking*” opportunities [P4] to switch to other templates should they find the currently chosen template to be inappropriate.

6 Conclusions and Future Work

We have explored the potential of human-agent collaborative planning to facilitate the design of scientific presentations. Our results demonstrated the benefits of this approach in encouraging the exploration of non-stereotypical presentation structures and audience-focused content. We plan to extend our work in three directions. First, we aim to develop a computational model of audiences, presenters and talk contexts, in order to provide more contextualized feedback and recommendations during the brainstorming process of presentation design. Second, we plan to offer more diverse, flexible, and

substitutable rhetorical templates. Finally, we aim to evaluate the effectiveness of our system on the presentation quality through controlled, comparative studies.

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