LuminAI: A system for collaborative movement improvisation

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Abstract
In this paper, we introduce a system, *LuminAI*, that facilitates collaborative movement improvisation between artificially intelligent agents and both expert and novice dancers. This system has previously been evaluated in settings with novice dancers [7, 4], but a formal evaluation has yet to be conducted with expert dancers. We propose a case study that documents and evaluates an expert dancer's interaction with the system. The documentation for this study will involve both qualitative interview analysis and a video-based analysis of the interaction dynamics between the dancer and the virtual agent.

Author Keywords
Artificial intelligence; collaborative creativity; computational creativity; Viewpoints; dance improvisation; interactive installation

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Introduction
Computational agents that can creatively collaborate with humans in open-ended improvisational settings can be useful for both experts and novices. In addition to provid-

Figure 1: The dome-based installation of LuminAI.

ing enjoyable experiences, these *computer colleagues* [9] can help reduce intimidation for novice users and facilitate creative ideation for expert users. Numerous computer colleagues of this sort have been created in the past in domains ranging from visual art [2] to theater improvisation [8]. Prior work has found that there are additional barriers to developing improvisational agents in open-ended narrative-based settings like theater, including the need for extensive knowledge engineering and authorship [8]. Our work has emerged as a response to these difficulties, circumventing the authorship challenge by creating an agent capable of collaboratively building proto-narratives, or loosely-structured movement based narratives, in real-time with a human partner [5].

LuminAI

LuminAI, the result of these efforts, is an interactive art installation in which human participants can collaboratively improvise movements with each other and artificially intelligent agents.The installation has two forms: a shadow theater installation that facilitates one-on-one collaboration between a human and a virtual agent and a dome-based installation that allows multiple humans and agents to dance together.

In both installations, the LuminAI agent(s) use the SOAR cognitive architecture [6] to learn and reason about their partner's movements. The agents are equipped with a formalized version of Viewpoints movement theory [1], which is a technique used in theater and dance to help performers reason about improvisational movement. The formalization of the theory was developed in a collaboration between Georgia Tech researchers and the Atlanta-based Out of Hand Theater company. Using Viewpoints movement theory, the LuminAI agent(s) are able to reason about movements along dimensions such as tempo, duration, repetition, kinesthetic response (natural movement timing), spatial relationships, topography (traced floor patterns of movement over time), shape (of movement and body), gesture, and architecture.

Case Study

LuminAI has previously been evaluated in settings with novice users, where it has been found to be effective in creating enjoyable experiences and reducing the barrier of entry into a potentially intimidating creative activity like dancing in public [7]. However, while we have worked in collaboration with professional dancers to develop and train the LuminAI system, LuminAI has not been formally evaluated as a tool for professional dancers. In order to document LuminAI, we propose a case study of a professional dancer in order to assess the effectiveness of LuminAI as a tool for creative ideation for experts as well as novices.

Documentation

For this study, a professional dancer will be asked to interact with a LuminAI agent for 30 minutes to 1 hour. The

dancer's interaction will be videotaped and the agent's responses will be recorded in a log. The dancer will be interviewed after the interaction session with questions directed at assessing the usefulness of the system as a tool for creative ideation and the quality of the artistic collaboration between the dancer and the virtual agent. Playback of the recorded video may be used to guide the interview.

A qualitative analysis of the interview will be supplemented with an analysis of the interaction dynamics observed in the video recording. Recent work at the intersection of cognitive science and computational creativity has resulted in a new analysis method for evaluating interaction dynamics in collaborative creative contexts [3]. This method uses a novel coding technique and customized software to code continuous quantitative data about the cognitive state of the user and the type of interaction that is occurring [3].This method will be used to code the video and examine the interaction dynamics between the dancer and the virtual agent.

Conclusion

In conclusion, we propose a study that documents an existing system for collaborative creative movement improvisation, specifically focusing on assessing the ability of this system to assist in the creative ideation of expert users. We will document and evaluate the LuminAI system by recording a movement improvisation session with our virtual agent and a professional dancer and conducting a post-session interview with the dancer. Both the interview and the recording will be analyzed and these results will be presented at the workshop as documentation.

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