

## **Project Summary**

The proposed research will study creativity in improvisation in both standard theatrical techniques where a script's interpretation, including the physical performance, is improvised by an actor, and "improv theatre" where entire scenes are created by actors in real-time through improvisation. This research will increase the state of knowledge about improvisation, creativity, and intelligent agent design, as well as contribute meaningfully to theoretical and academic understanding of creative practice in theatre. In addition to integrating engineering scientific methods with the theory and practice of acting, this research will contribute cognitive and computational models of improvisation, emotion, acting styles, and problem-solving in the context of theatre. These models will pave the way to the development of more sophisticated synthetic characters, virtual humans, and other intelligent autonomous agents that can interact with humans and with each other for purposes of entertainment, education, and training.

The proposed research involves stages of experimentation with live actors informed by the theory and practice in theater, advanced multimodal technology based measurement of these performances, systematic codification of experimental results, and construction and evaluation of models and theories derived from the data. Experimentation involves investigation into new modes of research involving theatrical practitioners in order to discover means for effectively collaborating with theatrical performers and effectively capturing data and acquiring cognitive knowledge during performance. Types of experimentation will include ethnographic studies of theatre performers; think-aloud protocols; and video, audio, and motion capture data of a range of scripted and improvised performances. Data and knowledge acquired through experimentation will inform the creation of new theories and models of improvisation in theatre that will contribute to understanding of creativity and improvisation, computational models of emotion, autonomous agent design, and academic studies of practice-based performance. Evaluation includes various methods to establish the validity of theories and models produced through research efforts. Theories and models of cognitive processes in theatrical improvisation will be evaluated through implementation of models in cognitive architectures that can be executed to produce observable results that can be qualitatively and quantitatively analyzed.

**Intellectual Merit:** This research will address the objective of understanding creative cognition and computing in the following ways. First, research will be performed to discover the most appropriate means for eliciting understanding and knowledge from theatre to inform new computational models of emotion, behavior, cognition, and improvisation. Second, computational modes of data capture and knowledge acquisition will provide insight into academic research on theatre performance. Third, investigation into creative theatrical performance will inform and expand upon existing literature on cognitive creativity, leading to new theoretical and practical models of creativity in computation. Fourth, research will be performed to evaluate these models in an applied setting (e.g. improv agents performing in a digital theatre) and provide feedback on the models' quality. Throughout the iterative process of experimentation, codification, and evaluation, AI specialists on the team will identify key cognitive and computational processes which can contribute new designs and techniques to the autonomous embodied agent and synthetic character research communities.

**Broader Impacts:** This work will benefit society by moving us closer to the development human-agent and agent-agent digital experiences that facilitate creative expression. It will build on existing understanding of human creativity and emotion in a way that directly informs computer science, cognitive science, and the study of performance arts by making the following contributions: (1) Creating cognitive models of creative improvisation; (2) Furthering research on emotional intelligence and its computational modeling; (3) Creating autonomous agents with advanced improvisational problem solving and acting capabilities; (4) Fueling the practice based methodologies in theater and cinema: This approach brings traditional scholarship and embodied practice together, holds great promise for the wider field of theatre studies as we move into a century of interdisciplinary knowledge and rapid technological change. Finally, the project promises a fertile ground for interdisciplinary training of graduate and undergraduate students, and a new wealth of human interaction data that will be shared with the scientific community.