Introduction

Two people performing an activity together naturally display an impressive level of coordination and flexibility. Their timing is—for the most part—impeccable, and this behavior emerges often without exchanging much verbal information. On the other hand, human-robot interaction (HRI) is unintuitive, restrictive, and usually limited to a rigid command-and-response structure. If robots are truly to enter human environments, be it homes, offices, hospitals or schools, they must steer away from this trend and display a significantly more fluid meshing of their actions with ours. To that end, robot designers must address many issues, such as mutual responsiveness, intention-reading, the concoction of shared plans, and the mastery of nonverbal communication.

A good platform for the investigation of such synchronized human-robot behavior can be found in animatronic robots (sometimes called “robotic actors”). Much like future consumer robots, robotic actors are meant to be used in a non-repetitive fashion, and need to operate in close sync with untrained humans. This calls for robots that are easy-to-use, flexible, and adaptive. Instead, today’s robotic actors are still extremely complex machines that need to be operated by skilled professionals and even then are capable only of the most simple, predictable, and carefully rehearsed action.

This proposal lays the groundwork towards animatronic robots capable of high-level control—“robotic actors” that can be directed to perform a duet in fluid sync with a human. My focus will be on the question of action timing in a loosely structured performance. It is my belief that the road to this goal passes through many of the core HRI challenges mentioned above, reaping benefits for HRI far beyond the entertainment industry.

Subsequently, my main area under Prof. Cynthia Breazeal investigates research related to the coordinated behavior between artificial actors and humans. The readings in the technical area guided by Prof. Sandy Pentland support one of the prime technical challenges of coordinated behavior—the automated analysis of human action and the parsing of intention from this nonverbal communicative behavior. Finally, my contextual area under the supervision of Prof. Janet Sonenberg looks at techniques and theories of dramatic dialog and improvisation.
Main Area: Coordinated Behavior for Robotic Actors

Examiner
Cynthia Breazeal
Assistant Professor of Media Arts and Sciences
Director of the Robotic Life Group
MIT Media Laboratory

Description
The main topic of this exam covers recent and foundational research informing the coordinated activity of robotic actors and humans. Since this is a novel area, the readings draw from a variety of related research subtopics: collaborative dialog systems address the study of believable embodied agents engaging in task-related dialog with humans, artificial theater looks at past efforts to build virtual actors and robotic performers for entertainment purposes; co-planning is the recent rethinking of the AI field of ‘planning’ arising from the challenge of planning in teams. These, in addition to a survey of recent HRI projects, are the content of my main exam area.

Requirement
The completion requirement for this area will be a publishable paper, evaluated by Prof. Breazeal.

Examiner’s signature: ________________________________

Reading List
Collaborative Dialog Systems


Artificial Theater and Synthetic Actors


Co-planning


**A Survey of Human-Robot Interaction and Collaboration**


Technical Area: Automated Gesture Parsing

Examiner
Alex (Sandy) Pentland
Professor of Media Arts and Sciences
Director of the Human Dynamics Group
MIT Media Laboratory

Description
For an agent to perform in close sync and fluid timing with a human, it is not enough to analyze the verbal channel of communication. The automation of action-reading and the parsing of intentions from these actions, a proficiency humans have from infancy, is the technical focus of this proposal.

Requirement
The completion requirement for this area will be 24-hour written exam, administered by Prof. Pentland.

Examiner’s signature: ________________________________

Reading List
Human Use of Nonverbal Communication


Anchor, 1967.


**How People Learn to Parse Intentional Action**


**Techniques for Automated Gesture Parsing**


Contextual Area: Dramatic Dialog and Improvisation

Examiner
Janet Sonenberg
Associate Professor of Theater Arts
Director of the Theater Arts Program
MIT

Description
The contextual area looks at improvised dialog, not as a computational framework, but based on time-earned insights from the study of dramatic dialog and improvisation. This literature can hopefully both frame my research in robotic actors, and offer an alternative viewpoint on the challenge of human-robot dialog.

Requirement
The completion requirement for this area will be 24-hour written exam, administered by Prof. Sonenberg.

Examiner’s signature: _______________________________

Reading List
Books - Acting Technique


**Journal Articles - Robots and Puppets in Theater**


Candidates for the PhD degree must satisfactorily complete a Qualifying Examination, the purpose of which is to ensure that students have a general understanding of the biomedical sciences and sufficient knowledge of their chosen area of thesis research to proceed towards the PhD degree in a timely manner. iii) The key responsibility of the examination committee is to judge whether the student’s written Qualifying Examination proposal and the oral defense of it demonstrate critical Examination of testing proposals. Registrants must submit a testing proposal if they intend to perform a new test listed in Annexes IX and X to REACH. There are several reasons for closing a testing proposal examination before referral to the Member State competent authorities. These include the cessation of manufacture or import by the registrant, withdrawal of the testing proposals, and inadmissibility. Inadmissible testing proposals are those where REACH does not foresee a testing proposal examination.