

# UC Merced

## Proceedings of the Annual Meeting of the Cognitive Science Society

### Title

The Contribution of Human Cognition and Decision-Making to Understanding the Dynamics of Chemical Manufacturing Process Tasks

### Permalink

<https://escholarship.org/uc/item/7qz063c4>

### Journal

Proceedings of the Annual Meeting of the Cognitive Science Society, 45(45)

### Authors

Sontakke, Mrunal V

Banerjee, Sounak

Ghosh, Sambit

et al.

### Publication Date

2023

### Copyright Information

This work is made available under the terms of a Creative Commons Attribution License, available at <https://creativecommons.org/licenses/by/4.0/>

Peer reviewed

# The Contribution of Human Cognition and Decision-Making to Understanding the Dynamics of Chemical Manufacturing Process Tasks

**Mrunal Sontakke**

Rensselaer Polytechnic Institute, Troy, New York, United States

**Sounak Banerjee**

Rensselaer Polytechnic Institute, Troy, New York, United States

**Sambit Ghosh**

Rensselaer Polytechnic Institute, Troy, New York, United States

**B Wayne Bequette**

Rensselaer Polytechnic Institute, Troy, New York, United States

**Wayne Gray**

Rensselaer Polytechnic Institute, Troy, New York, United States

## Abstract

We introduce the Cognitive Science Community to the challenges faced in human-in-the-loop (HiTL) decision-making for complex and dynamic industrial chemical processes. A microworld is presented which includes advanced dynamic simulations, an optimal control-based decision-support algorithm and a preliminary human machine interface. Three example applications are discussed, including decision-making in plant startup and shutdown, shared control using human and HiTL supervisory Model Predictive Control (MPC), and a pilot study of operator eye-tracking during a complex startup task. The paper also discusses ongoing and future experimental efforts highlighting the utility of the microworld in understanding human cognition and designing advanced operator training software for various process operation related complex tasks.