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Use of STPA for Analyzing Hazardous Information Flows in **Distributed Autonomous Systems**

Tom McDermott

2022 STAMP Workshop

June 9, 2022

NBC NEWS

Complaint claims Tesla's 'Full Self-Driving' software caused crash

14 November 2021

US safety regulator opens investigation into Tesla Autopilot following crashes with parked emergency vehicles

U.S. auto regulators have opened a preliminary investigation into Tesla's Autopilot advanced driver assistance system, citing 11 incidents in which vehicles crashed into parked first responder vehicles while the system was engaged. The Tesla vehicles involved in the collisions were confirmed to have either have had engaged Autopilot or a feature called Traffic Aware Cruise ... Continue reading

TechCrunch 0

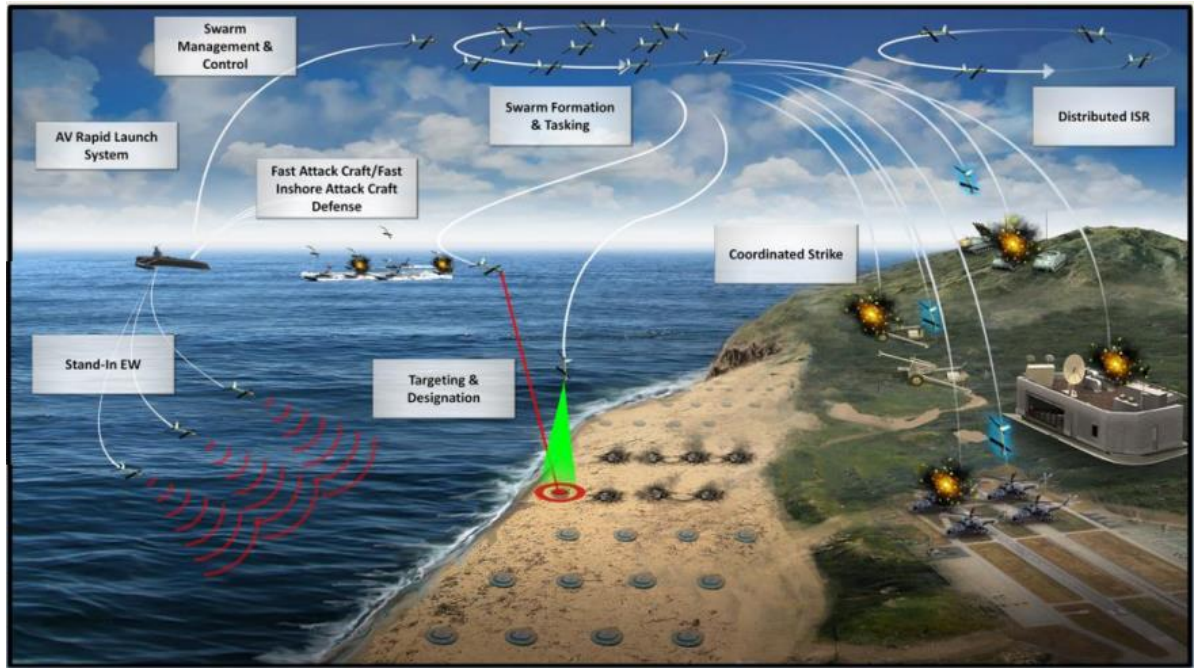
Distributed Autonomy	Human-Machine Teaming and Co-learning

NY Times photo

There are 9.1 driverless car crashes per million miles driven. Regular vehicles have a rate of 4.1 crashes per million miles driven. Fewer severe injuries are caused by self-driving cars. (carsurance.net/insights/self-driving-car-statistics)

Hierarchical Control of Distributed Autonomous Human-Machine Teams

- Stochastic decision processes
- Controlled by both machine agents and humans
- Ideally leverage the distinct capabilities of each
- Must address the challenge of transferring control quickly, safely, and smoothly back-and-forth between the agent and the human
- Can be viewed as hierarchical levels of control using non-hierarchical distribution of information



Office of Naval Research, Code 30 overview briefing

Why STAMP and STPA?

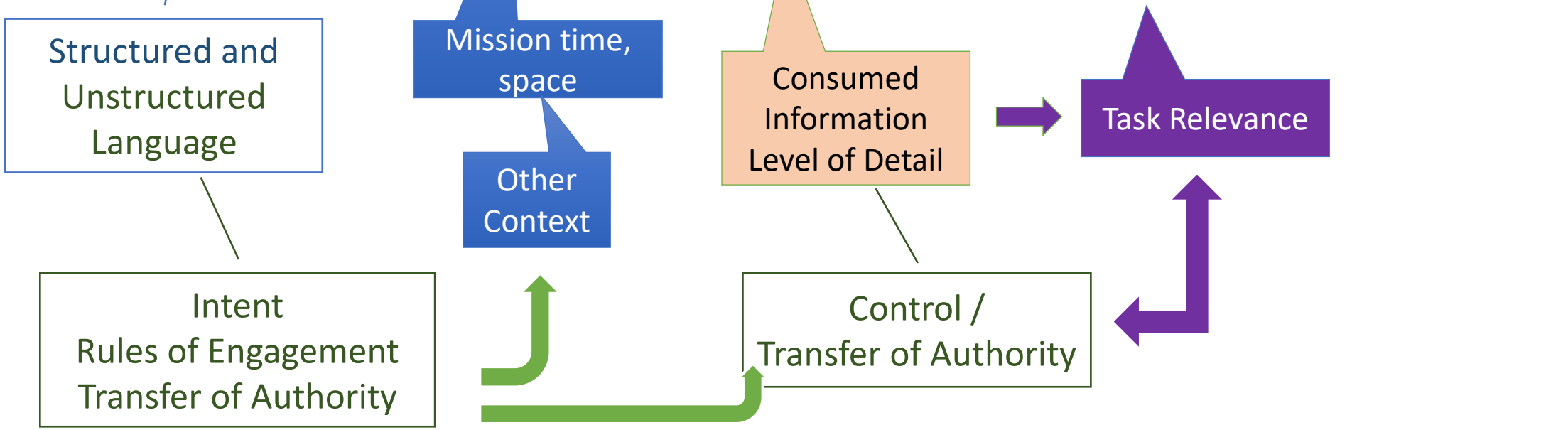
- Most accidents/mission failures will be caused by errors in interpretation of information by either the human or the machine
- Leading to errors transfer of control or authority made in the planning process
- Underlying concept of human informational transfer has subjectivity
  - **Intent**
  - **Rules**
  - **Authorities**
  - **Other Contextual Information**

- Consistently used in hierarchical control structures
- Lack of multi-disciplinary research

- Desire a Systems Engineering approach to address both information design and control mechanization across layers of hierarchy

Central Modeling Questions

- Can we model agents (groups of humans and machines)
  as consumers of information
  based on situational information needs
  to make appropriate decisions
  needed to perform complex tasks



Producer/Consumer Model of Information

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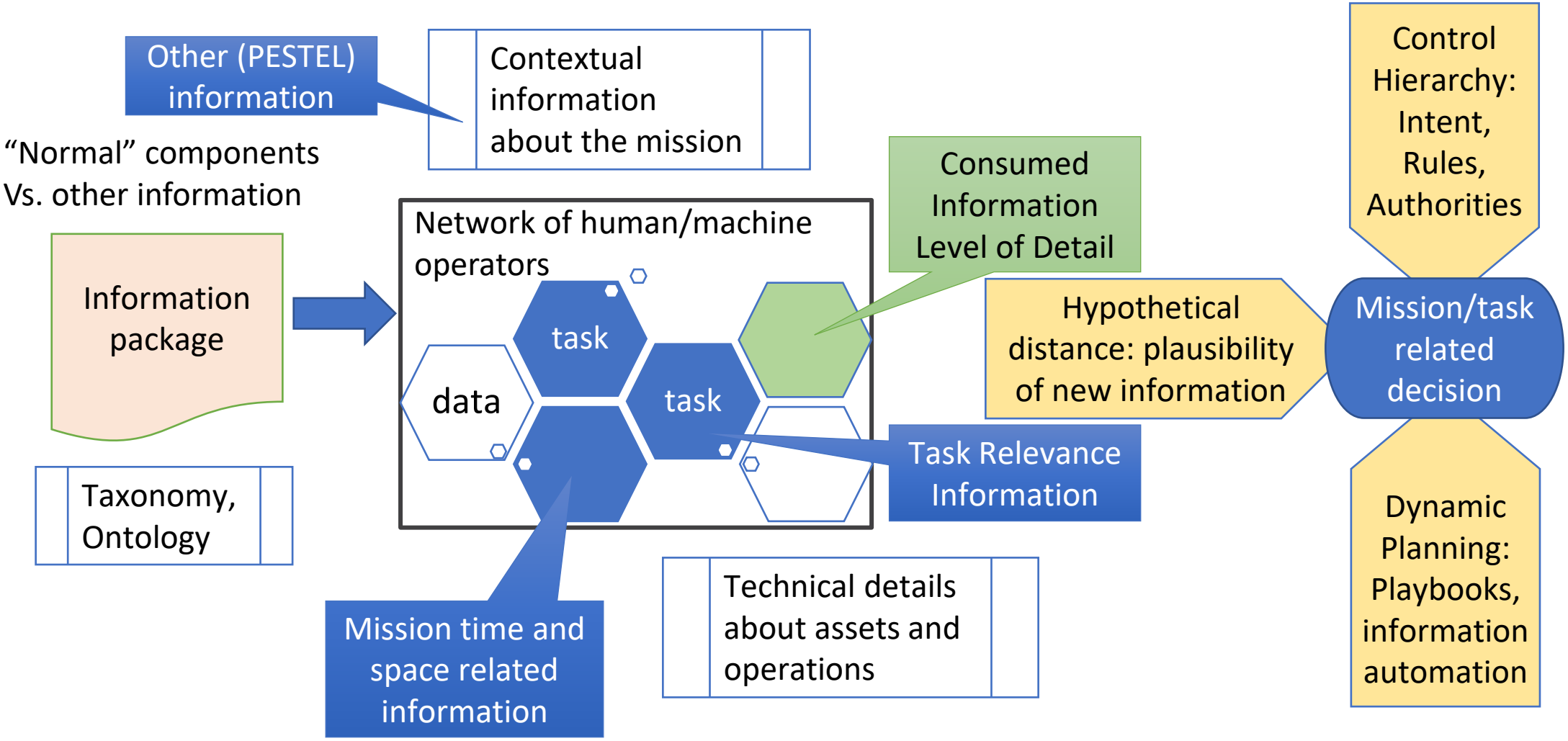
Theoretical basis: Construal level theory - how people perceive, comprehend, and interpret information with respect to their world



RECITAL Controller Model

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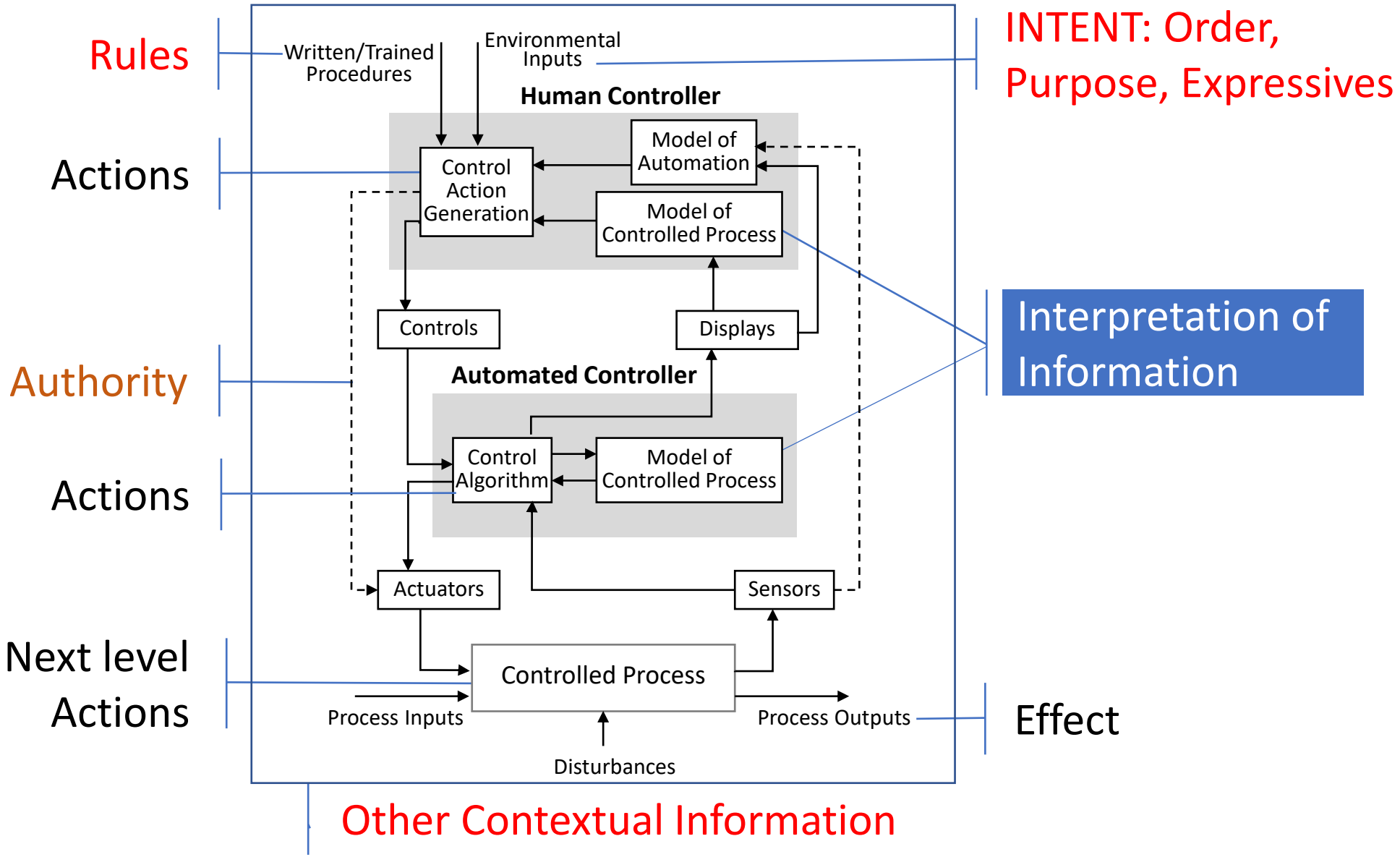
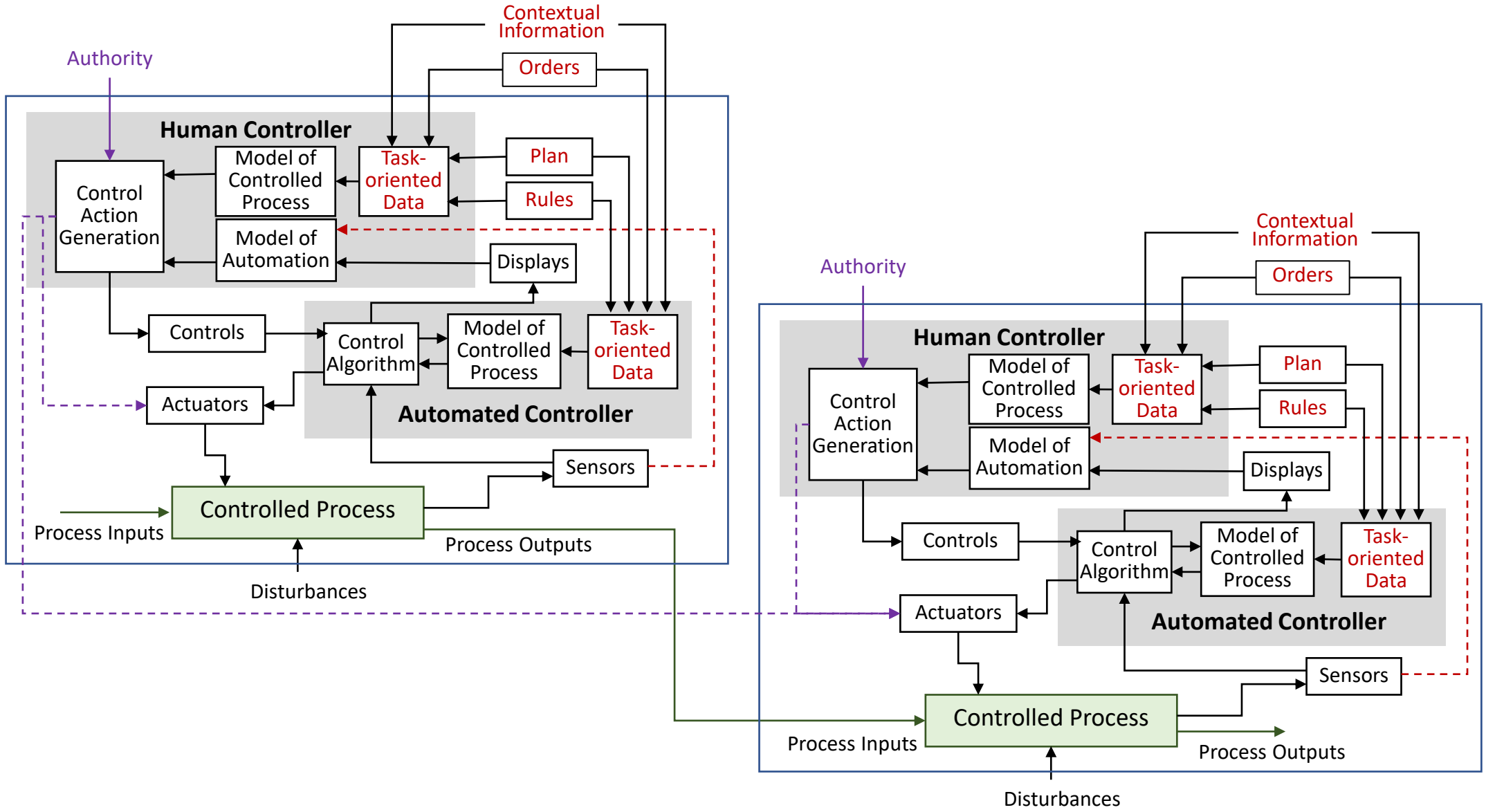


STPA-based Information Model



Example overall modeling flow