

Mental Models

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Human-in-the-loop

- **Broad goal**
 - Verification of cyber-physical systems (CPS)
- **“User in the loop”**
 - One of the CPS challenges
 - User models are critical for verification
- **Research questions**
 - How do we model a user?
 - How do we incorporate user models in the verification process

User Modeling

- “Random user” is too general
 - Systems are typically designed for a trained user
- User model should capture the mental state
 - Expectations about the system throughout the system execution
 - Mental state changes based on interactions
 - Reflects training and experience
- Deviations from the user model should be treated as faults

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Number entry errors

- Reducing number entry errors: solving a widespread, serious problem, Harold Thimbleby and Paul Cairns, Journal of the Royal Society Interface, 2010.
- Example
 - The Alaris Infusion Pump involved was accidentally programmed for 68 mL/hr instead of the ordered rate of 6.8 mL/hr. [. . .] The patient expired the next day. It is believed that, although the pump did not malfunction, inherent design flaws in the infusion pump may have contributed to this event.
(Food and Drug Administration 2009)

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Human Factors Problems: Aviation Background

- Rushby's slides