

NEWHRI: Unifying Characteristics of Research in Human-Robot Interaction

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ACFR Robots



What characteristics unify and should be common to all areas of HRI research?

- Human-robot **communication/information exchange**
 - Covers both *social HRI* and *task-oriented HRI*
- **Research questions**
 - What type of information should be communicated?
 - When should communication occur?
 - Who should communicate with whom?
 - What medium should be used for communication?
- **Factors** which influence answers:
 - Proximity (remote, proximate)
 - Authority relationship (peer-to-peer, supervisory)
 - Number of humans and robots (one, few, many)
 - Human factors (operator workload, expertise)
 - Communication bandwidth
 - Task priority (safety, timeliness, social)

What properties typify novel and significant research in HRI?

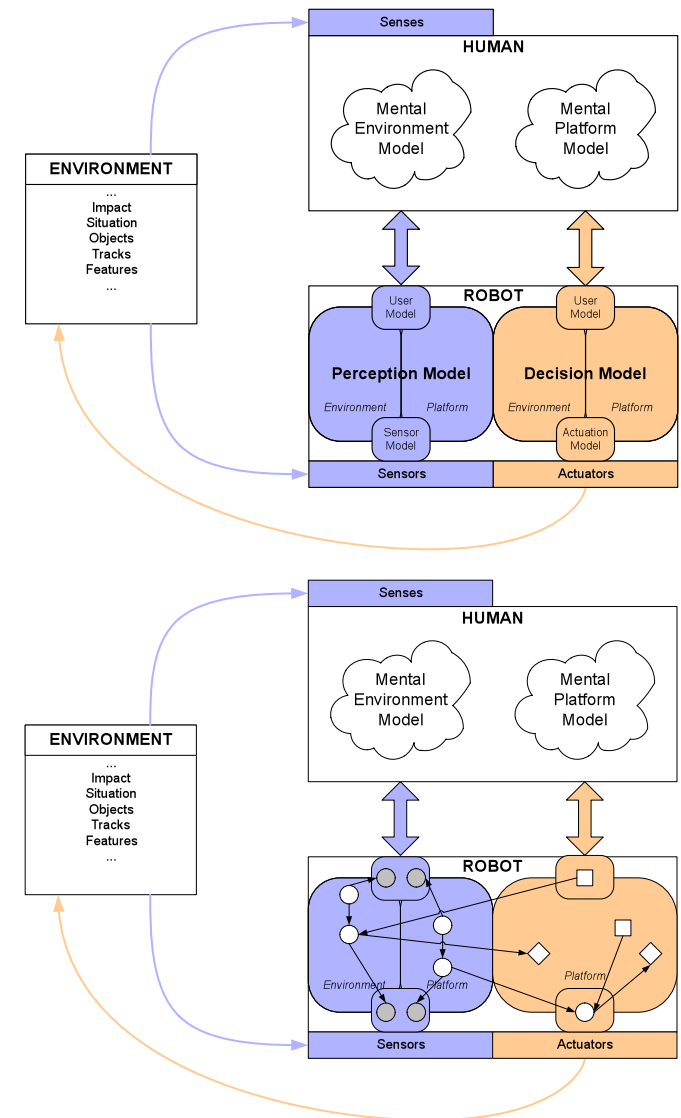
- **Comparison of HRI systems**
 - **Problem:** generalisation of results difficult
 - HRI studies require end-to-end systems
 - Specialised, application-specific systems
 - **Solution:** mathematical interaction models
- **Evaluation of HRI systems**
 - **Problem:** find valid metrics
 - Dependent on domain (social, task-oriented HRI)
 - Often subjective (questionnaires, coding)
 - **Solution:** mathematical formulations help to quantify

How can we further synergize research between HRI and the broader robotics community?

- **Gap** between HRI & “traditional” robotics
 - **HRI studies:** often assume highly capable robots
 - See Wizard-of-Oz experiments
 - **Traditional:** focus on localisation/navigation/mapping
 - Often a pessimistic view of “intelligent” robots
- **Close the gap:** HRI research with current systems
 - Shared representations (e.g. human-augmented mapping)
 - Combine respective abilities (e.g. perception)
 - Teach robots navigation policies
 - Express navigation uncertainties/failures to operators
 - Enhance trust in robots’ behaviours

Human-Robot Communication

- **Domain**
 - Task-oriented HRI
- **Requirement**
 - Human-robot communication
- **Approach**
 - **General:** use *probabilistic* robotics representations for bidirectional communication
 - **Robot** → **human:**
 - Increase situational awareness
 - Enhance trust in robotic systems
 - **Human** → **robot:**
 - Scalable control (e.g. specify policy)
 - Information fusion



Probabilistic Human-Robot Information Fusion

- **Problem**

- Combine *perceptual* abilities of humans and robots to execute tasks cooperatively

- **Approach**

- Operator = *information source* or “sensor”
- Probabilistic *information fusion* with robotic observations
- *Human Sensor Models* to account for operators’ inaccuracies
- *Value of Information* to account for operators’ limited resources

- **Application domains**

- Scalable human-robot information gathering (mapping)
- Cooperative human-robot decision making (navigation)

