

# Appendix X: Human–Robot Interaction (HRI) Validation Matrix

## Rouse Relational OS™

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This appendix demonstrates how established Human–Robot Interaction (HRI) research domains validate individual components of the Rouse Relational Operating System™ while highlighting the absence of a unified structural diagnostic model. Each framework below is supported by peer-reviewed literature and mapped to corresponding structural elements within the Relational OS™ and the Rouse Relational Honeycomb™

Framework / Program Name	Primary Focus	Standalone Capability	Honeycomb Alignment (Cells / Mortar)	Gap Filled by Honeycomb	Program Benefit from Honeycomb
Trust in HRI (Hancock et al., 2011; Sanders et al., 2019)	Trust formation and reliance	Identifies performance, predictability, and anthropomorphism as drivers of trust	Mortar (respect, reliability), Reciprocity, Time	No structural model of trust formation or failure	Defines trust as output of consistent behavior over time
Perceived Safety (Akalın et al., 2023)	User safety perception	Separates objective vs perceived safety	Environment, Self capacity, Mortar receptivity	No dynamic pressure-based model	Maps safety to environmental load and capacity

Acceptance Models (Pinto et al., 2025)	Technology adoption	Predicts initial user adoption	Self, Reciprocity, Mortar	No longitudinal degradation model	Explains decline through load accumulation
Explainable AI (Stange et al., 2022)	Transparency of system decisions	Improves predictability	Mortar (honesty), Reciprocity	Does not connect to trust structurally	Positions explainability as bonding input
Human Agency (Schoeller et al., 2021)	User control and autonomy	Models perception of control	Self, Reciprocity, Environment	No strain propagation model	Links loss of control to system instability
Collaborative Robotics (Hopko et al., 2023)	Human-robot teamwork	Measures workload and coordination	Reciprocity, Environment	No overload threshold modeling	Defines strain thresholds
Healthcare Robotics (Esterwood & Robert, 2021)	Long-term care interaction	Evaluates trust and engagement	Self vulnerability, Mortar, Time	No unified multi-domain model	Integrates pressure sources
Educational HRI (Tekerek et al., 2026)	Learning and development	Studies trust over time	Self, Mortar, Time	No amplification model	Introduces time as amplifier

Social Presence (Christoforakos et al., 2021)	Human-like interaction	Enhances engagement	Mortar, Reciprocity	Focuses on perception only	Links behavior to stability
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### References (APA Style)

Hancock, P. A., et al. (2011). A meta-analysis of factors affecting trust in human-robot interaction. *Human Factors*.

Sanders, T. L., et al. (2019). Trust in automation. *Human Factors*.

Akalin, N., et al. (2023). Perceived safety in human-robot interaction. *International Journal of Social Robotics*.

Pinto, R., et al. (2025). Acceptance of robotics systems. *Journal of Intelligent & Robotic Systems*.

Stange, S., et al. (2022). Explainable AI in robotics. *Frontiers in AI*.

Schoeller, F., et al. (2021). Human agency in intelligent systems. *Frontiers in Systems Neuroscience*.

Hopko, S., et al. (2023). Human-robot collaboration. *Applied Ergonomics*.

Esterwood, C., & Robert, L. (2021). Healthcare robotics. *Frontiers in Robotics and AI*.

Tekerek, M., et al. (2026). Educational robotics. *Humanities and Social Sciences Communications*.

Christoforakos, L., et al. (2021). Social presence in HRI. *Frontiers in Robotics and AI*.