

Augmentative and Assistive Smart Technologies

HTI.470 Human-Centred and Societal
Perspectives to Artificial Intelligence

Guest Lecture – 02 February 2026

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Augmentative Technology Research Group

- ❑ We are a multidisciplinary research collective of nurses, speech and language therapists, hardware and software engineers, communication interpreters, and psychologists, developing technologies that augment everyday life.
- ❑ We work as part of Tampere University Computer-Human Interaction Research Center and Research Centre of Gameful Realities.

Question

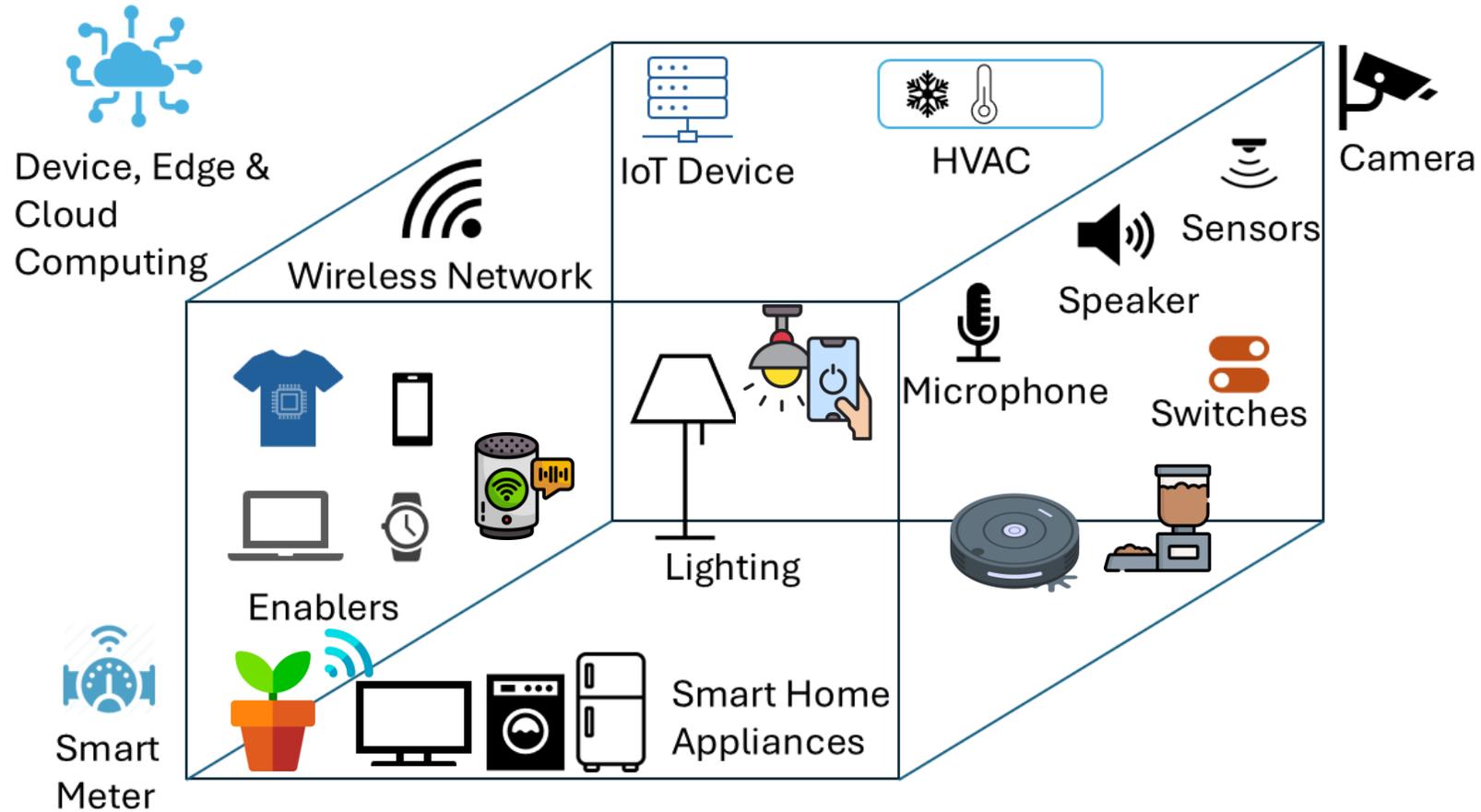
What makes your home smart?

- A) Sensors
- B) AI
- C) Automation
- D) Decisions made without asking
- E) Something else

Let's study what actually makes these environments work and what that means for people inside them.



Smart Home

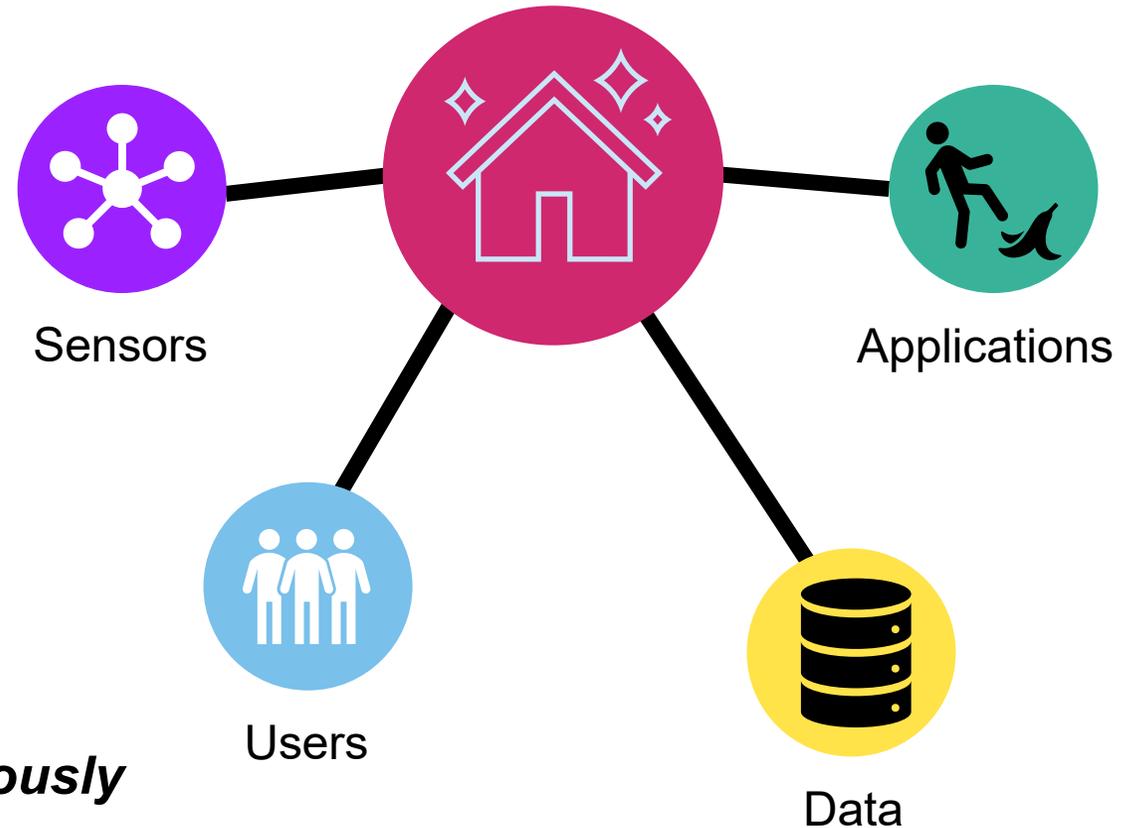


“IoT enables objects to connect, communicate over the Internet”

Key Characteristics – Smart Home

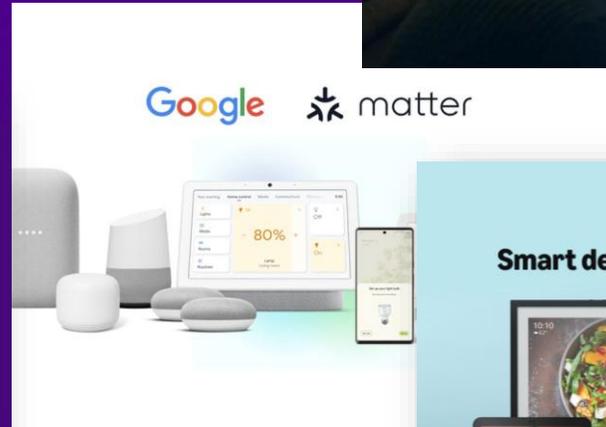
- Users
- Sensors
- Communication technology
- Network
- Data collection
- Data processing

- We won't go into the technical details of sensors or networks today.
- What matters is that ***smart technologies continuously collect data about people and activities.***



Real World Examples

- ❑ Energy management
- ❑ Environmental monitoring
- ❑ Automation and control
- ❑ Stress management
- ❑ Sleep regulation



Still/screenshot from Gibi. © Exxen / respective rights holders. Used for educational illustration and commentary.

Assistive Smart Home

- ❑ **Continuous sensing and routine learning**
The home continuously observes movement, presence, and everyday actions, and learns individual daily routines and schedules over time.
- ❑ **Context-aware decisions and reminders**
When routines are delayed, missed, or deviate from the norm, the system reacts by giving reminders, adjusting the environment, or escalating the situation if needed.
- ❑ **Low-effort interaction and control**
Interaction is designed to require minimal language, memory, and motor effort through fixed voice commands, symbol support, and one-button scenes.
- ❑ **Safety, daily support, and human connection**
The system supports everyday life with scheduled and context-based reminders, detects potentially unsafe situations, and maintains easy contact with family, caregivers, or other trusted people.



Scenario

You're visiting a friend's apartment. As you enter, you notice a camera in the living room and a smart speaker in the kitchen. Your friend didn't mention them.

- How do you feel?
- What would you want to know?



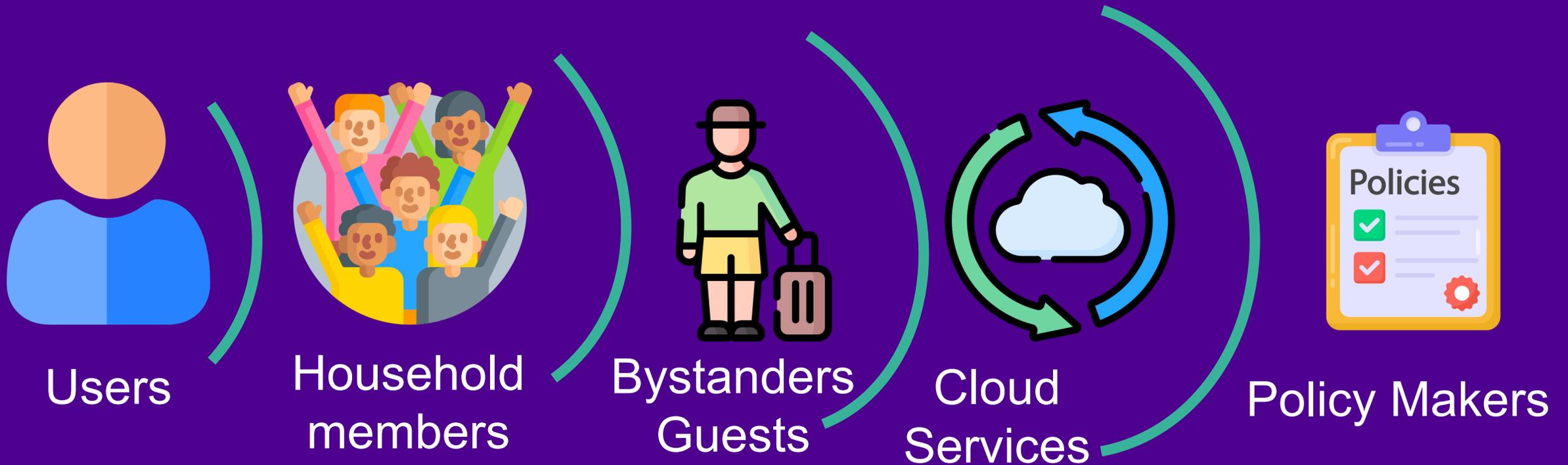
Pokémon series. © Nintendo / Game Freak / Creatures Inc.
Used for educational purposes.

Societal Impacts in Smart Environments

- ❑ Smart home AI decisions affect multiple stakeholder groups: residents, users, bystanders, guests, etc.
- ❑ Societal impacts show up as power imbalance together with social friction.
- ❑ Design goal is to protect privacy and autonomy for both owners and bystanders, without creating safety/security loopholes.

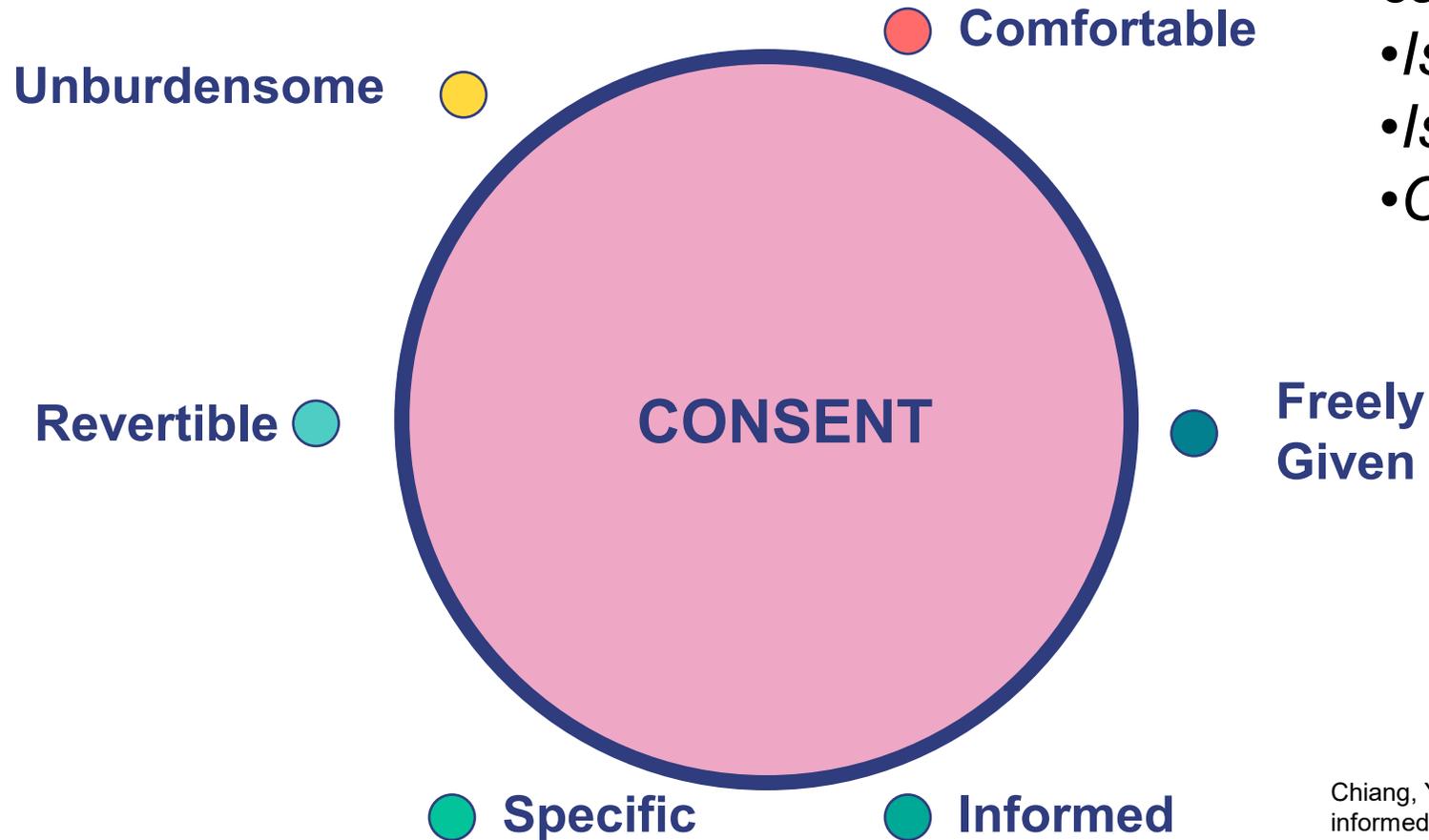


Stakeholder Map



Decision points and data flow

Consent Facet Wheel



Question

You visit a friend's home with cameras and a voice assistant.

- *Is it informed?*
- *Is it freely given?*
- *Can it be revoked?*

Chiang, Y. S., Khan, O., Bates, A., & Cobb, C. (2024, May). More than just informed: The importance of consent facets in smart homes. In *Proceedings of the 2024 CHI Conference on Human Factors in Computing Systems* (pp. 1-21).

User Control – (owners *and* bystanders)

❑ Bystanders want:

- ❑ **Awareness** (detect nearby devices & understand behaviors)
- ❑ **Preference expression / requests** (ask owner for settings changes)
- ❑ Controls over data collection/processing (limit collection, control processing/sharing)

❑ Two design families:

- ❑ **Cooperative mechanisms** (owner & bystander negotiate norms)
- ❑ **Bystander-centric mechanisms** (bystander-only tools for awareness/control)

❑ Warning: awareness tools can create **security risks** if misused (e.g., burglars discovering camera locations).

Yao, Y., Basdeo, J. R., McDonough, O. R., & Wang, Y. (2019). Privacy perceptions and designs of bystanders in smart homes. Proceedings of the ACM on Human-Computer Interaction, 3(CSCW), 1-24.

Multi-user Governance – Permissions, Roles

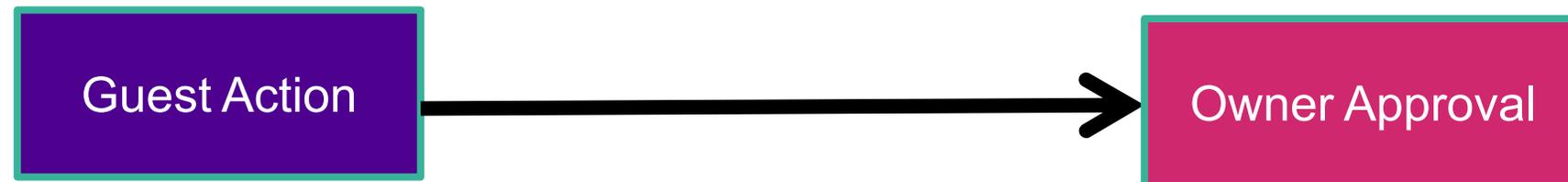
- ❑ Real homes are **multi-user**. Current devices often use “**all-or-nothing**” access.
- ❑ We need **authorization settings and usable authentication** (roles, privileges, and seamless switching).
- ❑ Example approach: roles (*alternate primary / secondary / guest*) and **on-demand privilege escalation** for high-risk actions.
- ❑ This can reduce misuse (kids/guests/roommates), improves fairness and accountability inside the home.

Jang, W., Chhabra, A., & Prasad, A. (2017, November). Enabling multi-user controls in smart home devices. In Proceedings of the 2017 workshop on internet of things security and privacy (pp. 49-54).

Multi-User Access Control Matrix

Role	View Camera	Delete Data	Purchase	Unlock Door	Change Routines
Primary Owner	✓	✓	✓	✓	✓
Secondary User	✓	✓*	✓*	✓	✗
Guest	✗	✗	✗	✓*	✗

* = Requires escalation/approval from primary owner



Jang, W., Chhabra, A., & Prasad, A. (2017, November). Enabling multi-user controls in smart home devices. In Proceedings of the 2017 workshop on internet of things security and privacy (pp. 49-54).

Trust and Privacy

- ❑ For voice assistants, **tangible (physical) controls** increase perceived **trust, reliability, usability, and control** (vs. non-tangible/software-only mechanisms).
- ❑ Key takeaway: if users expect a hardware mute, it must be **truly hardware-disconnecting**.
- ❑ “**Control paradox**”, feeling in control can reduce perceived risk. Good UI should support control **without hiding residual risk**.

Ahmad, I., Akter, T., Buher, Z., Farzan, R., Kapadia, A., & Lee, A. J. (2022). Tangible privacy for smart voice assistants: Bystanders' perceptions of physical device controls. *Proceedings of the ACM on Human-Computer Interaction*, 6(CSCW2), 1-31.

Tangible Controls to Trust Impact

Software Toggle



Lower perceived trust
Lower perceived control
Mental model mismatch

Hardware Switch



Higher perceived trust ✓
Higher perceived control ✓
Aligned mental model ✓

The Control Paradox:

Perceived Control ↑ → *Perceived Risk* ↓

Ahmad, I., Akter, T., Buher, Z., Farzan, R., Kapadia, A., & Lee, A. J. (2022). Tangible privacy for smart voice assistants: Bystanders' perceptions of physical device controls. *Proceedings of the ACM on Human-Computer Interaction*, 6(CSCW2), 1-31.

Transparency and Explainability

AI Activity Detection

Detected: "Leaving Home"

Why this was detected:

- Motion in hallway (7:42 AM)
- Front door sensor opened
- Duration pattern matches typical morning departure
- No return motion for 10+ min

Confidence: 94%

Device Transparency Card

Device: Smart Speaker - Kitchen

Status: Active, listening for wake word

Purpose: Voice commands, timers

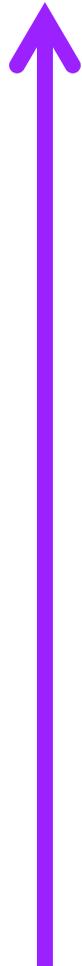
Data collected: Voice clips

Data shared: Amazon Cloud

Schedule: Always on

Implementation Checklist

**Build
upward**



Trust & Transparency

Tangible controls, clear indicators, AI explanations

Multi-user Governance

Role-based permissions, authentication, escalation

User & Bystander Control

Awareness + negotiation + meaningful controls

Consentful by Design

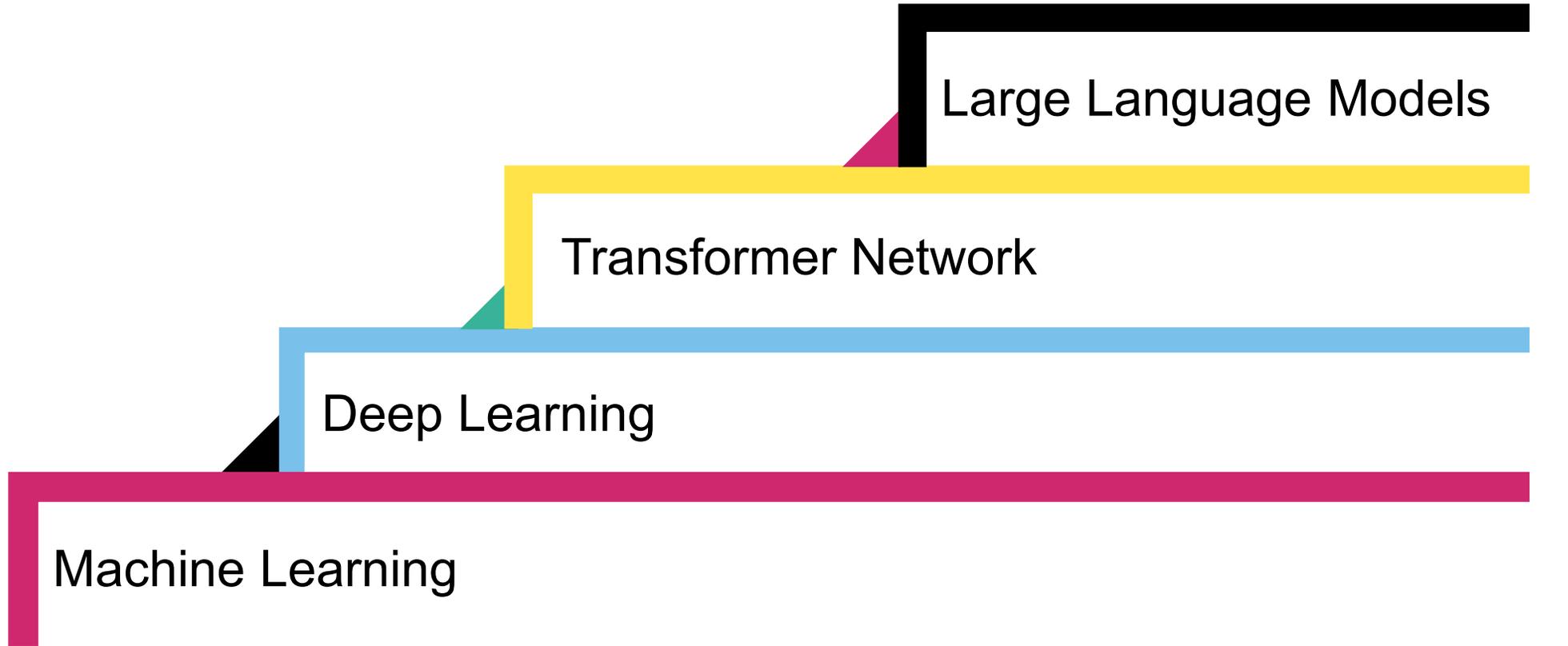
Multiple facets, reduce burden, support revocation

End of Part 1

Questions?



AI Development



Evolution of Artificial Intelligence

What's New? AI and Home

Modern AI Changes Smart Homes

OLD: Rule-based automation

"IF motion detected THEN turn on lights"

→ *You set the rules*

NEW: AI agents that learn

"Understand what you want and optimize for it"

→ AI learns patterns and decides

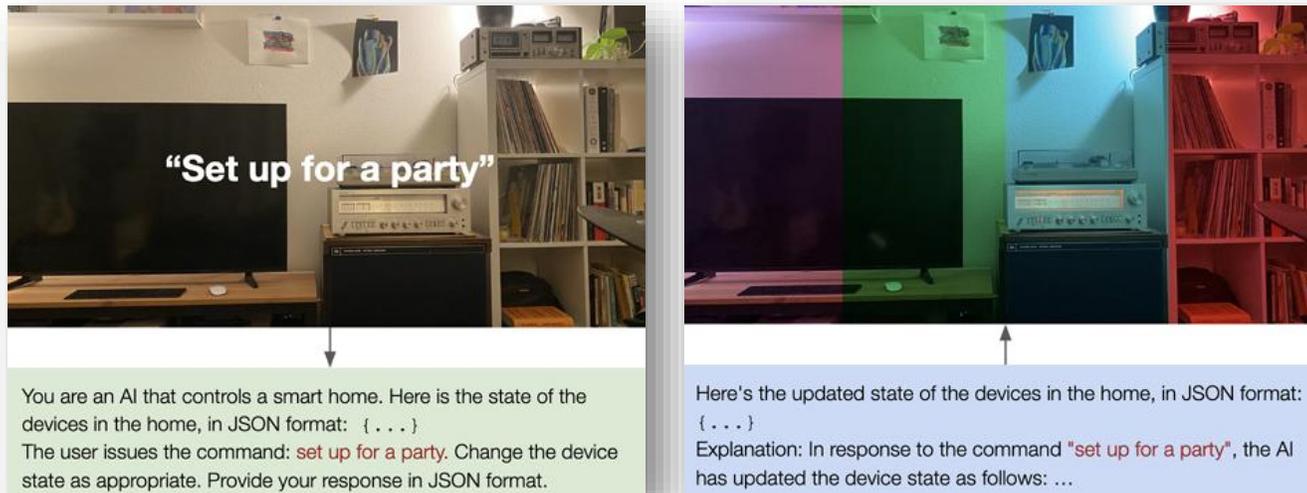
Examples in Your Home:

- Voice:** "I'm cold" → AI adjusts temperature to your preference
- Pattern:** Usually leave at 8am → Preheats car automatically
- Prediction:** High energy prices → Delays running appliances

This creates new questions about HOME autonomy and control

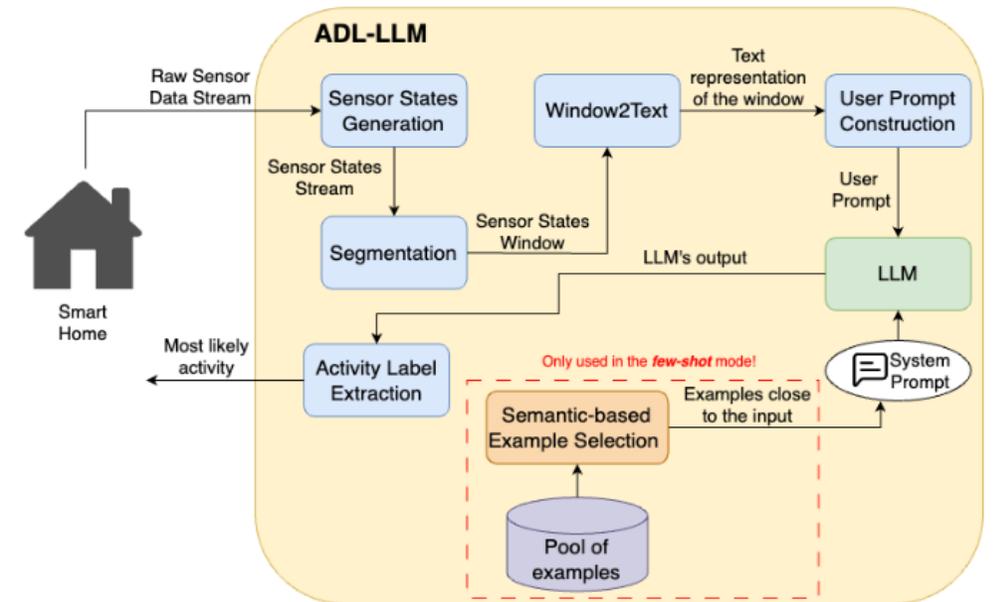
LLM Applications – ChatGPT

Converting natural language commands into actions



King, E., Yu, H., Lee, S., & Julien, C. (2023). "Get ready for a party": Exploring smarter smart spaces with help from large language models. *arXiv preprint arXiv:2303.14143*.

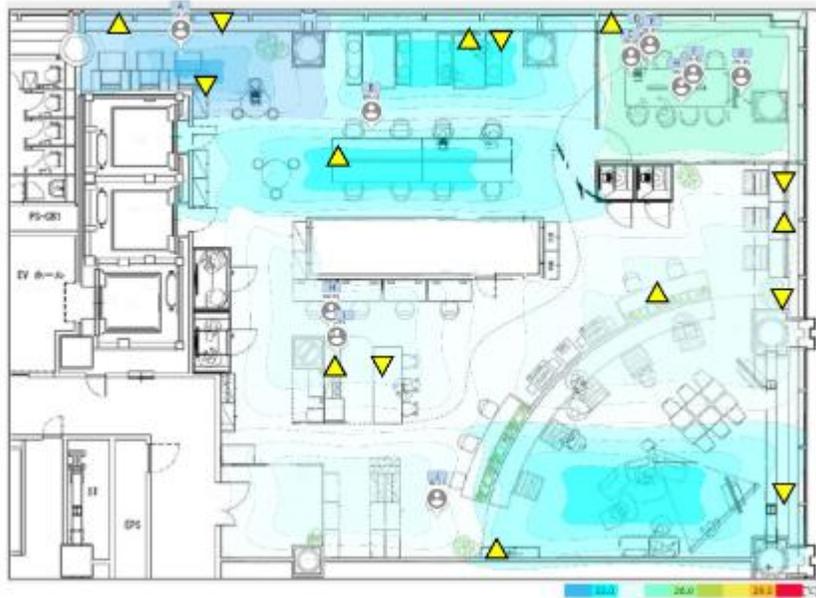
Activity classification



Civitaresse, G., Fiori, M., Choudhary, P., & Bettini, C. (2024). Large Language Models are Zero-Shot Recognizers for Activities of Daily Living. *arXiv preprint arXiv:2407.01238*.

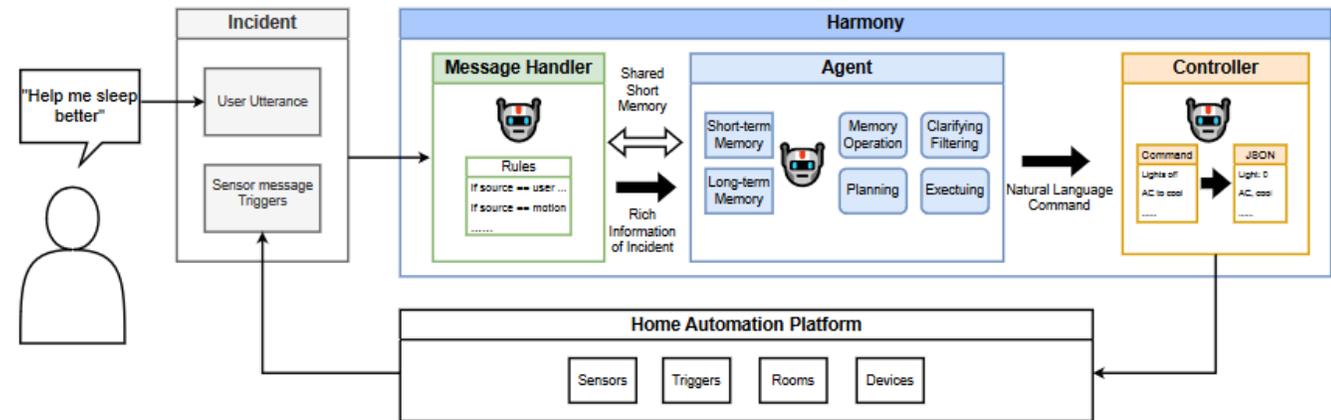
LLM Applications – Gemini & Llama

HVAC control for energy management



T. Sawada, T. Hasegawa, K. Yokoyama, and M. Mizuno, "Office-in-the-loop for building hvac control with multimodal foundation models," in Proceedings of the 11th ACM International Conference on Systems for Energy-Efficient Buildings, Cities, and Transportation, 2024, pp. 110–120.

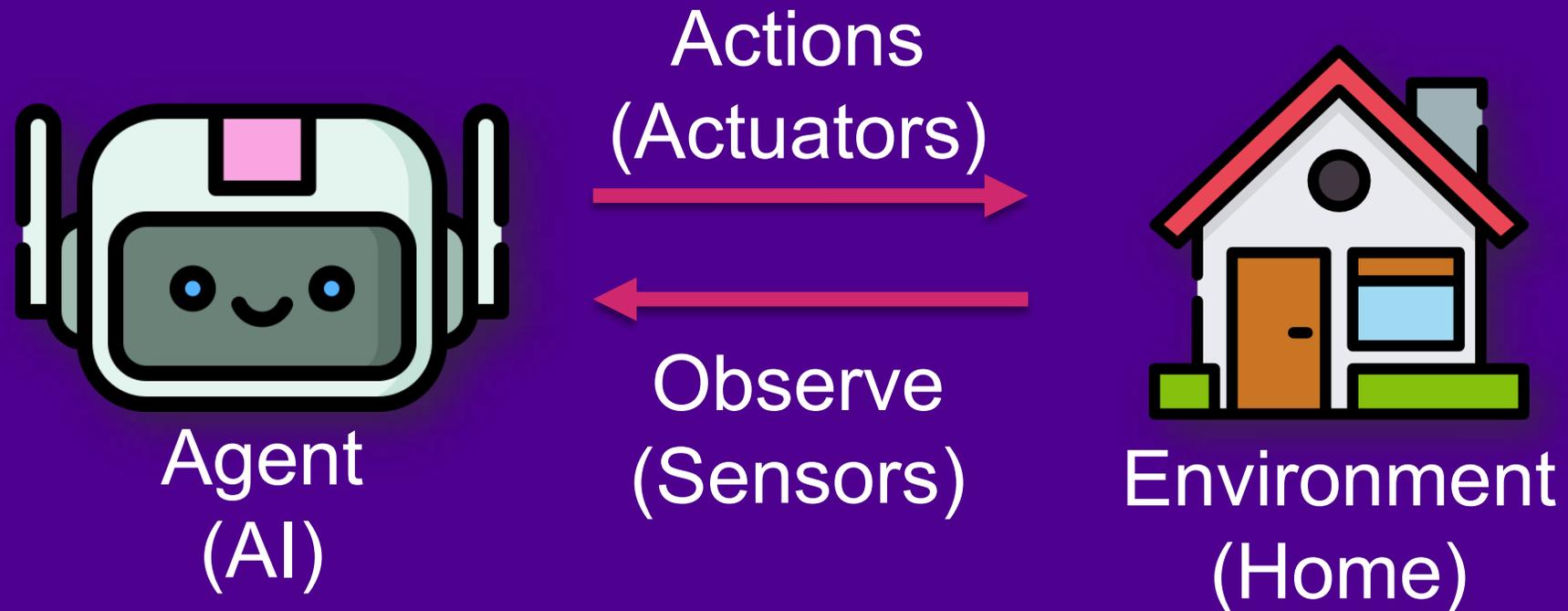
Converting natural language commands into actions



Yin, Z., Zhang, M., & Kawahara, D. (2024). Harmony: A Home Agent for Responsive Management and Action Optimization with a Locally Deployed Large Language Model. *arXiv preprint arXiv:2410.14252*.

The name's agent, “🕶️ AI Agent”

- An AI agent is a system that **observes** the **environment**, and **act** according to its **goal**.



Home AI Agents

Unlike a web chatbot, home AI agents can:



Observe you continuously

Sensors always on, learning your patterns



Control physical devices

Locks, cameras, appliances, HVAC systems



Affect multiple people

Family members, guests, neighbors, visitors



Learn intimate routines

When you sleep, eat, argue, shower, leave home

Question

What's ONE thing a home AI Agent should never do without asking, even if it would help you?



Risks of Utilizing AI

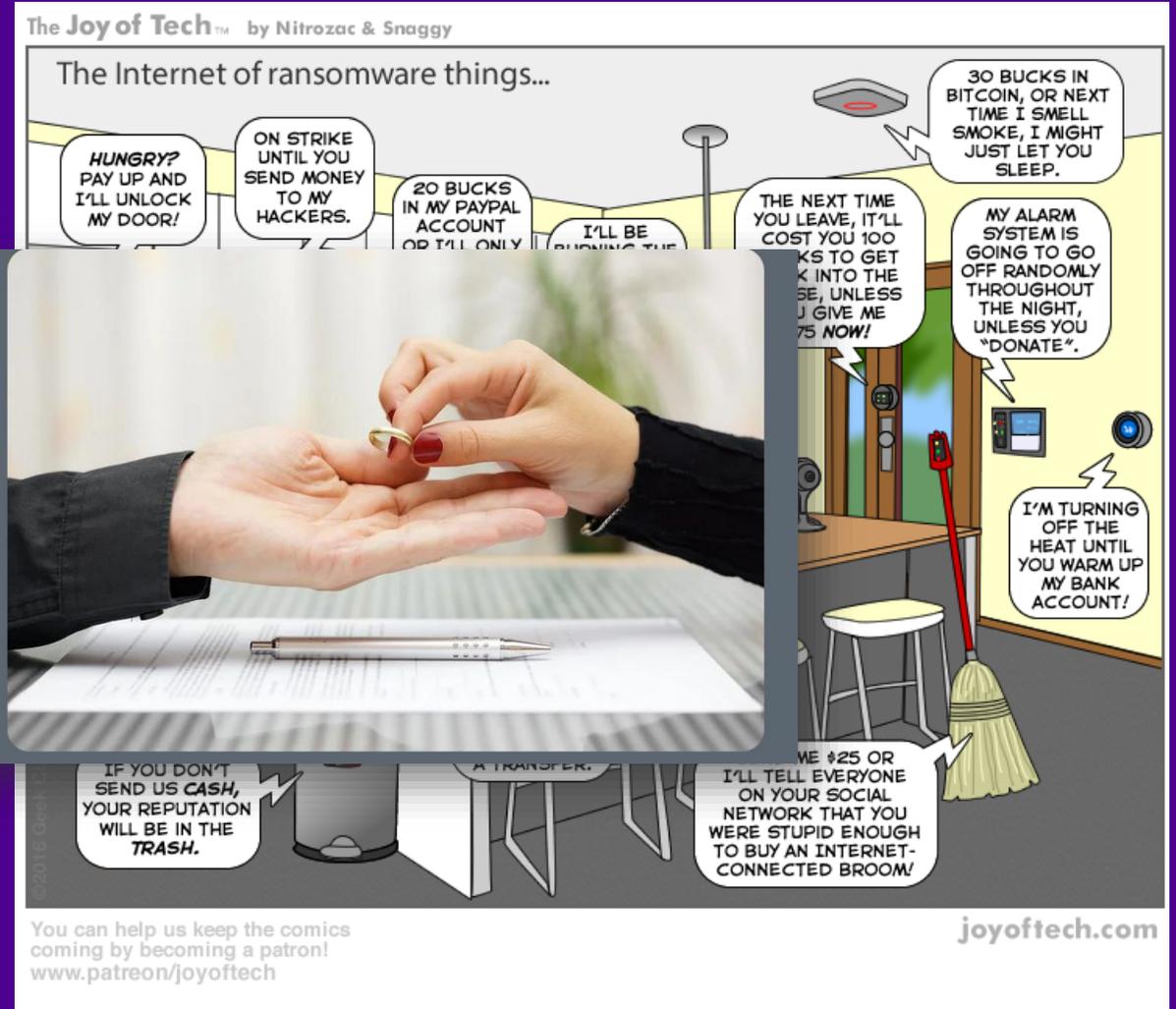
- ❑ Physical
- ❑ Intimate
- ❑ Breach
- ❑ Multi-U

Learning Center

How Modern Tech Is Changing Divorce Cases

WRITTEN BY:
Merel Family Law
September 19, 2025 | Divorce

Merel Family Law, September 19, 2025 | Divorce, How Modern Tech Is Changing Divorce Cases, <https://merelfamilylaw.com/blog/how-modern-tech-is-changing-divorce-cases/>



Design Principles for Home AI

Questions to always ask:

- Who benefits? Who might be harmed?
- What consent is needed from whom?
- Does it augment autonomy or reduce it?
- Can users understand and contest decisions?
- What happens when it fails?

“Ethics of AI is about considering the consequences of every decision we make in the ML system”

— Carlos Guestrin
Stanford University

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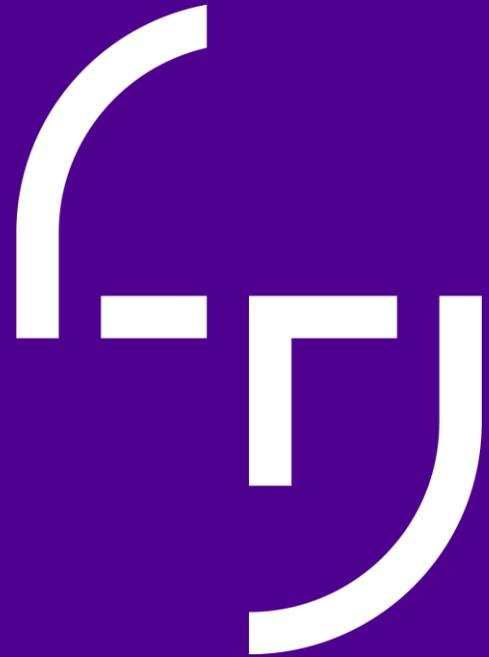
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Thank you!

Questions?

<https://bit.ly/av-tau>





**Human
Potential
Unlimited.**