DOCTORAL CONSORTIUM · ASSETS 2026

*Designing **Autonomy-Preserving** Cognitive Support*

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Why autonomy matters

Autonomy is a basic psychological need, essential for well-being.

Technology can support memory, attention and planning at scale. But most of it **does the task for** people instead of **supporting** them to do it. This undermines autonomy.

People who rely on this support the most are the most affected.

Who does the task?

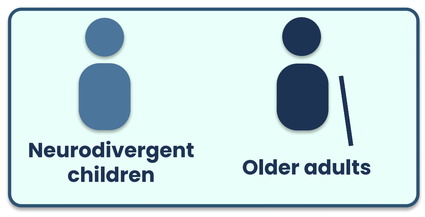
Doing for

Technology does it

Supporting

Help | **The person does it**

Who relies on cognitive support the most?



Autonomy support in prior work

1 How much [1]



Fits what the person can still do, compensating for what they cannot.

2 How [2]

"The answer is river."

"I think it is something that flows."

"Take your time. Tell me if you want a hint."

Collaborative, not imposed.

3 For whom



Designed for their own goals, not assumptions.

The gap. These considerations come from small studies in different domains and almost none directly measured the user's sense of autonomy. How to design for autonomy is still unclear.

To our knowledge, no published work has deployed a robot for cognitive support with autonomy as an explicit goal.

[1] Scaffolding theory: Wood, Bruner & Ross (1976). [2] Self-Determination Theory: Ryan & Deci (2000).

How should **cognitive support be designed** to preserve users' sense of **autonomy**, and how can **assistive robots** contribute?

RQ1. How to estimate cognitive state in real time from what users do in a cognitive task?

Expected contribution: behavioral indicators of cognitive state.

RQ2. How can robot behaviors provide cognitive support while preserving autonomy?

Expected contribution: a repertoire of autonomy-preserving robot behaviors.

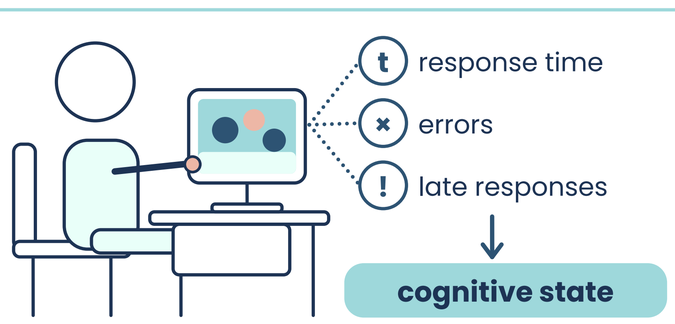
RQ3. How can a robot provide adaptive cognitive support, and what is the impact on their autonomy and task performance?

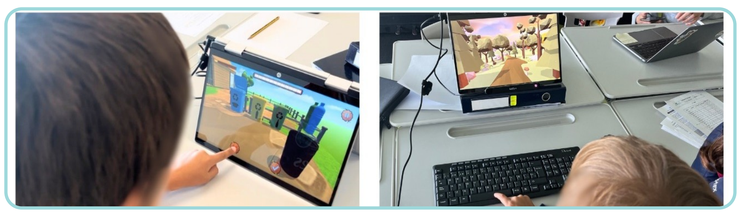
Expected contribution: a robot that provides adaptive cognitive support, and evidence on its effect on autonomy and performance.

Estimating cognitive state

Under review, CHI 2027

81 neurodivergent children, ages 7–14





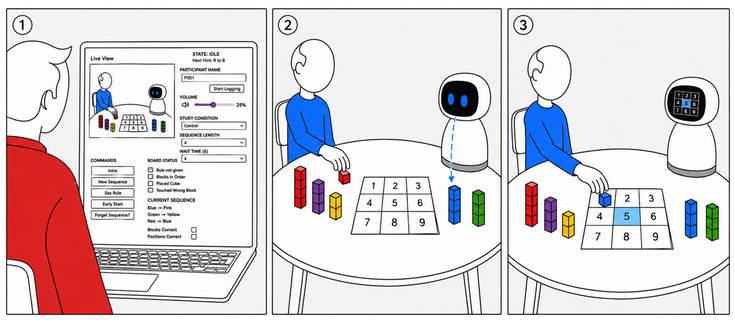
- Four games, each adapted from a standardized task for one cognitive skill: memory, attention, inhibitory control and cognitive flexibility.
- Three of four game scores aligned with their standardized task at some levels.
- Features beyond the score were meaningful indicators of cognitive skill.

- **Contribution**
- Behavioral indicators of cognitive state in these games.
- Validation methodology that can be reused for further indicators.

Autonomy-preserving behaviors

Under review, HRI 2027

35 older adults, ages 64–93



1 Dashboard **2** Implicit hint **3** Explicit hint

Perceived autonomy (single item): *"When the robot helped me, I still had to figure out the answer myself."*

4.61 Implicit hints

1.82 Explicit hints

- Memory task where the participants had to remember an increasing sequence of colored blocks and positions
- A robot gave hints, either Implicit (guiding to answer) or Explicit (directly stating answer).
- Implicit hints gave higher perceived autonomy, with no cost to performance.

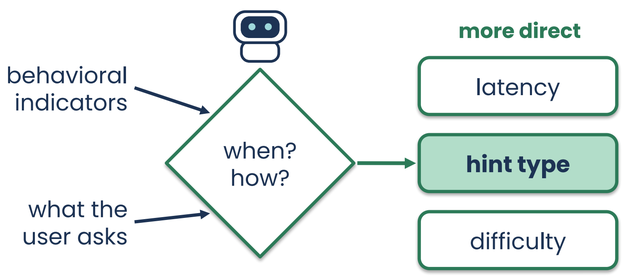
Contribution

- Early evidence of partial but coherent support that implicit support preserves autonomy.

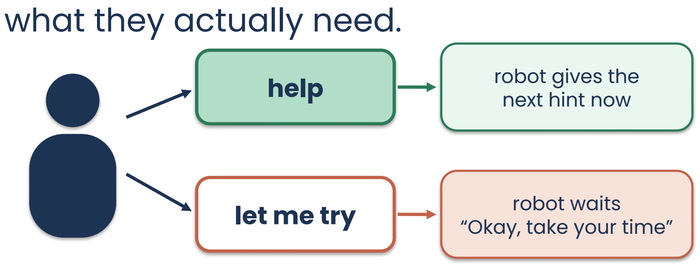
Adaptive support

Next steps

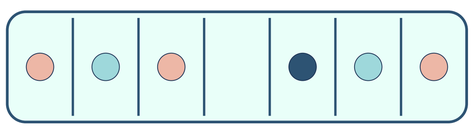
Adaptive robot. Tests whether adaptive support is better than fixed implicit support.



Offering choice. Tests whether the design assumptions about what people need match what they actually need.



Task. Real-world task, co-designed with older adults, carers and psychologists. For instance, medication management or grocery shopping.



Medication

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