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TOWARD ROBOTS FOR DAILY LIFE

ECOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE
FNSNF SWISS NATIONAL SCIENCE FOUNDATION
robotics Swiss National Centre of Competence in Research

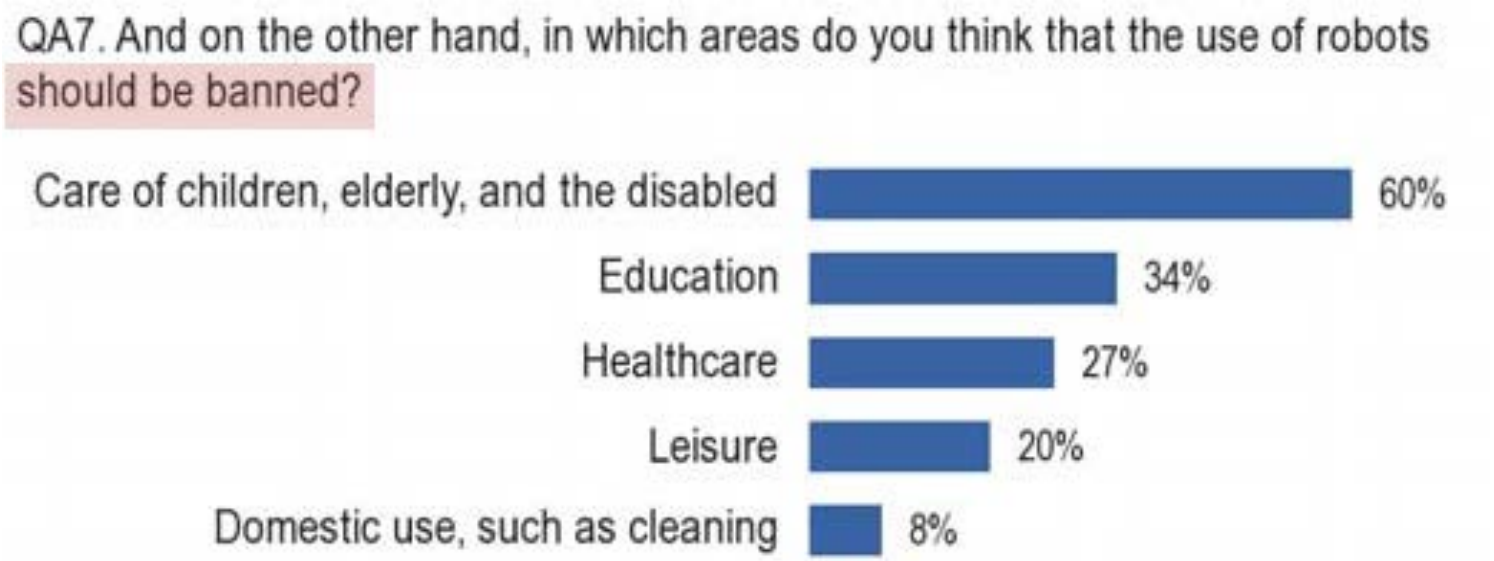
Motivation

Do you believe (like me) that robots will massively enter in our lifes?

1stAveMachine

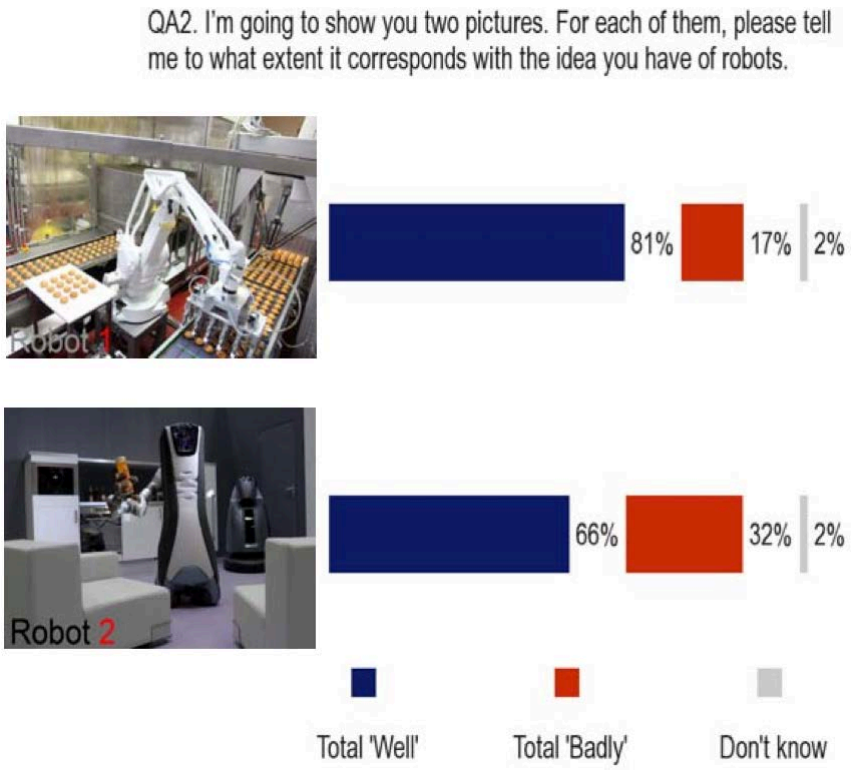
Motivation

- The general public has a **low acceptance for robotic assistance** in daily life (Eurobarometer "Public attitudes towards robots" 2012) :



Motivation

- Image of robots in large public:



PR1 cleaning under **teleoperation**. Designed and fabricated by Eric Berger and Keenan Wyrobek at the Salisbury Robotics Lab, Stanford University, 2007. **8x**

What should we do?

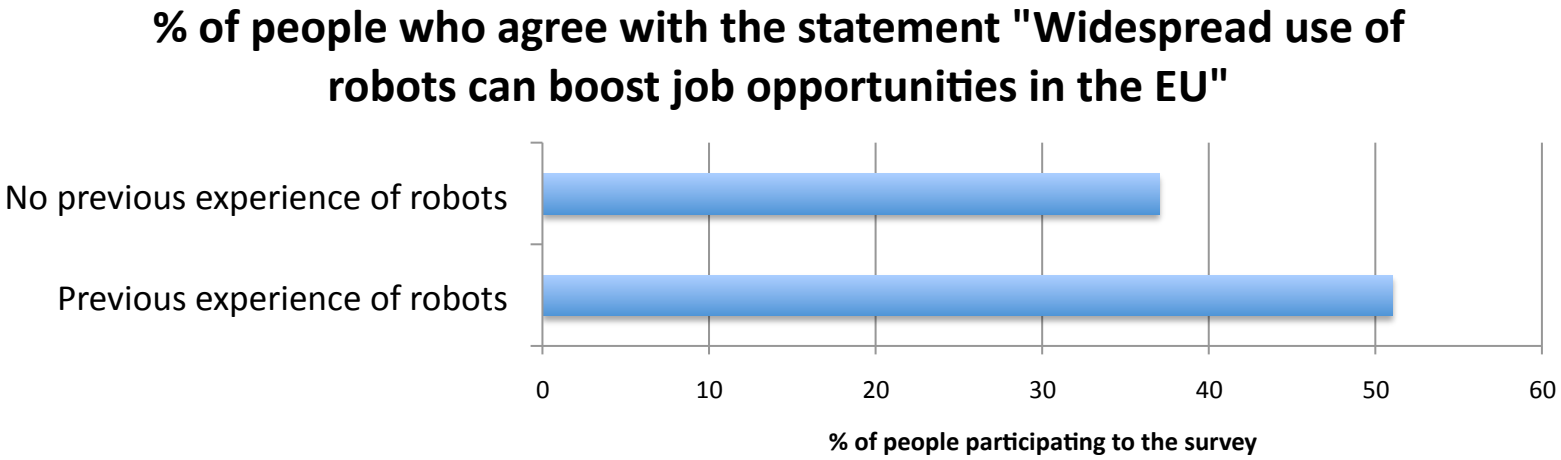
- Stop making research ?
- Wait that people better accept robots ?
- Force them economically ?
- Wait for a robotic iPad / iPhone ?

I prefer two constructive actions to improve acceptance:

- Reshape robotics to better fit into the existing ecosystem
- Educate people to better understand robotics (reshape humans)

Education

- People who already had a robot at home or at work have a better perception of robots (Eurobarometer 382)



- Manual workers who have already used robots at work are slightly less likely to consider that robots steal peoples' jobs compared with those who do not use robots at work (71% vs 75%, Eurobarometer 382).

Education

- **Educational robots are great but:**
  - Mostly for boys
  - No clear assessment of impact
  - Still not welcome in most schools
  - Expensive
- **We need robots that are:**
  - Cheap
  - Gender and age neutral
  - Flexible

Education

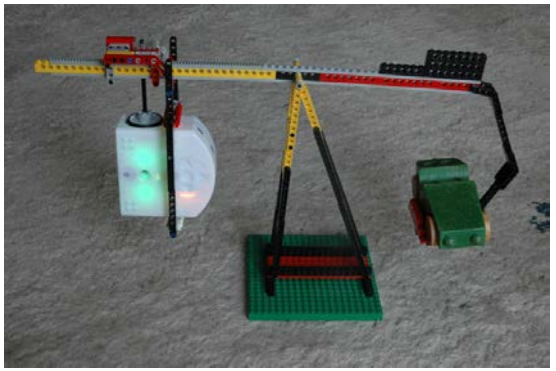
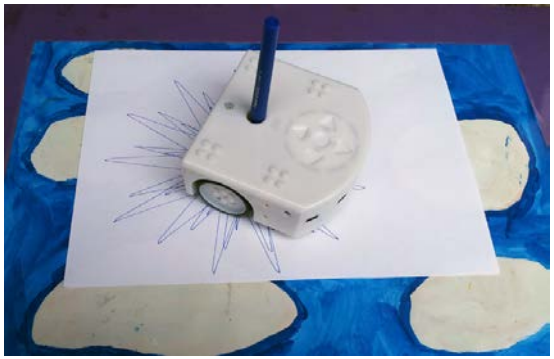
- **Thymio robot**
  - Cheap (<100$)
  - Open (hard and soft)
  - Gender neutral
  - Age neutral
  - Programmable
  - Flexible

Education

Education

- Thymio robot



Education

A key aspect:

- Explanation by embodiment

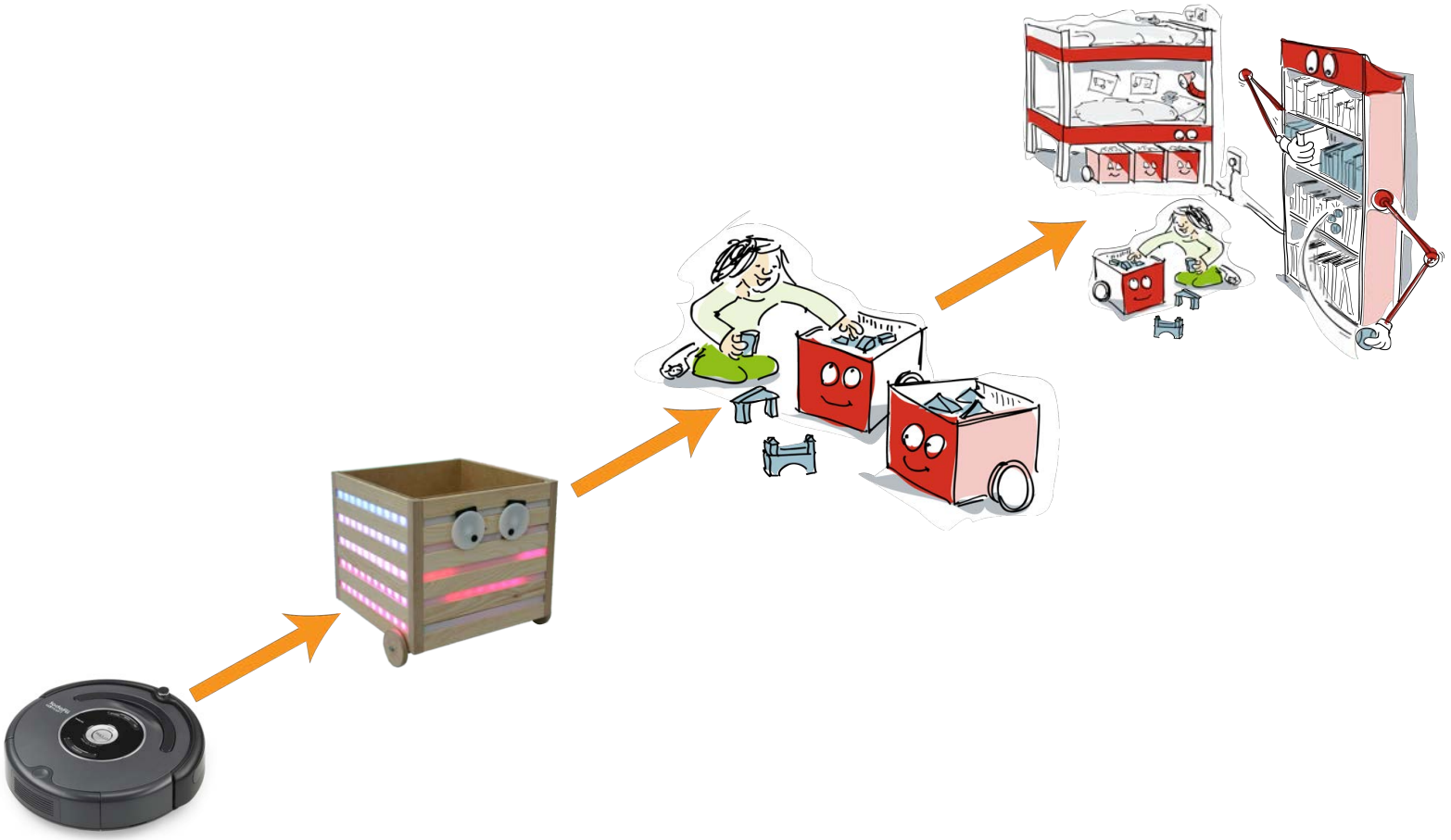
  as for example of morphological computation, tangible experiments,…

  visualisation of states

Reshaping robotics

- Focusing on **embodiment in everyday objects.**
- By taking advantage of this embodiment, enter smoothly into the **ecosystem** in a distributed way.
- Implementing a **natural interaction.**
- Targeting and validating a **better acceptance**.

Toward robots for daily life

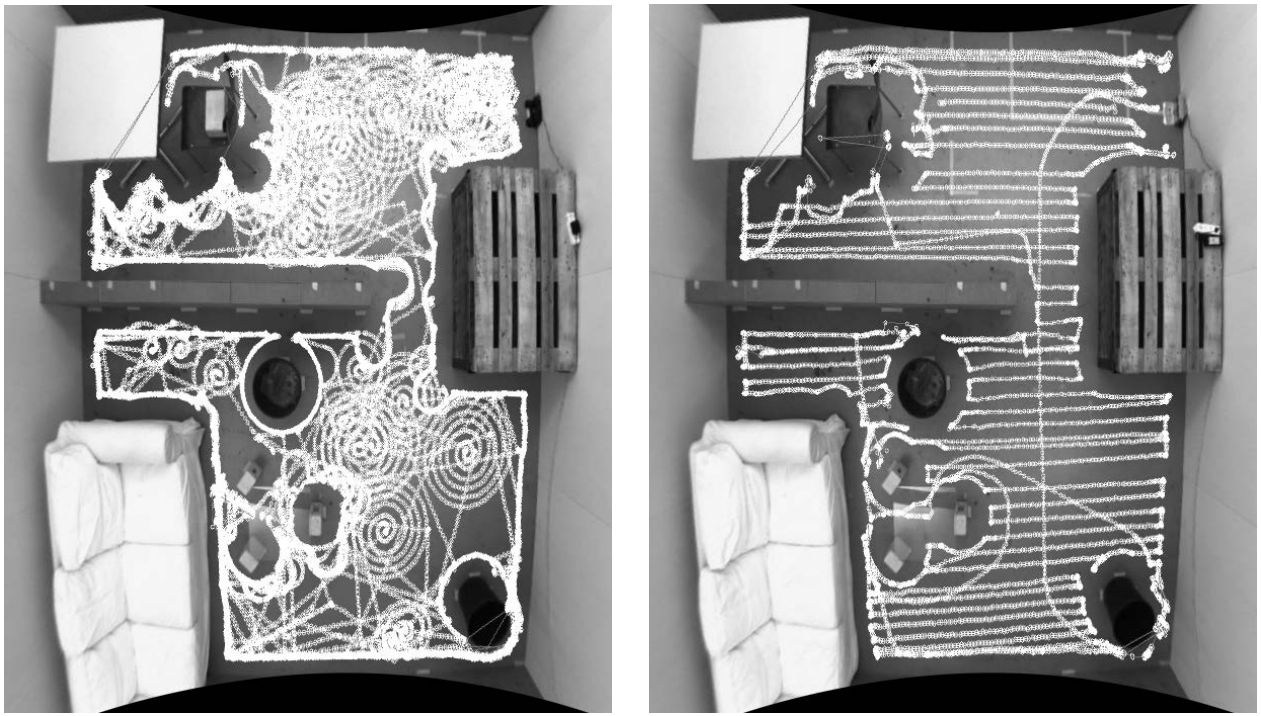


Roomba study

- **Purpose:** Understanding the factors impacting the introduction of existing robotics into the **ecosystem.**
- **Method:** Technical and user studies (ethnographers in houses and engineers on 6 vacuum cleaners)
- **Result examples:** **All nine households** where the tests took place considered energy as a key issue. SLAM techniques have a strong positive impact on energy in existing products: the required energy / m^2 is **reduced by a factor 2-3**.

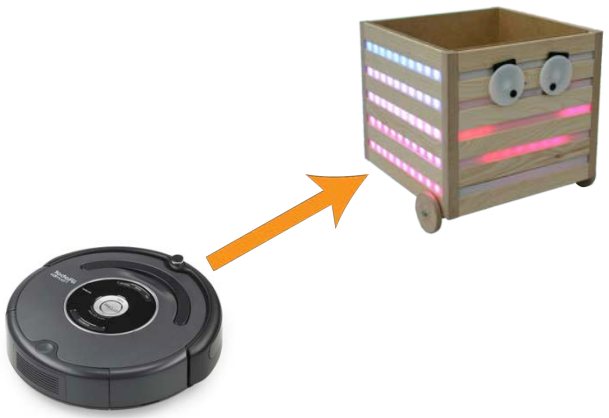
Roomba study

- **Results:** SLAM can also improve **acceptance**, as random-moving robots are considered “stupid” or “unpredictable”. Robots need to act transparently.



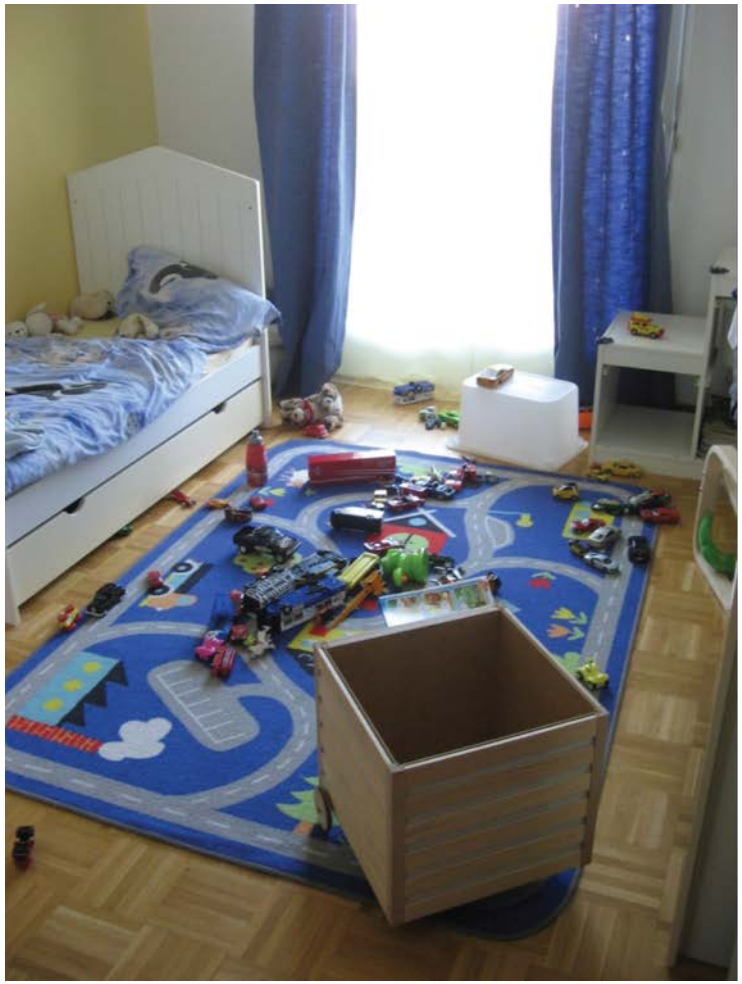
Ranger study

- **Purpose:** Analysing the impact of a **robotic object** introduced in the ecosystem**.**
- **Method:** User studies in 14 families (31 children (2-10 years), 17 parents) using “Wizard of Oz” experiments.



Two behaviors: active and passive.

Ranger study

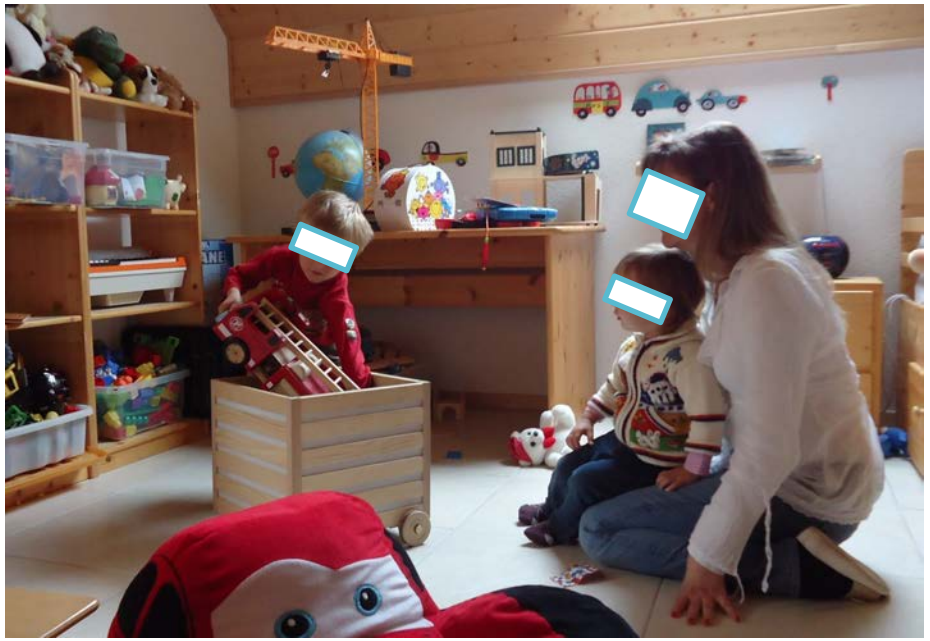


before

after

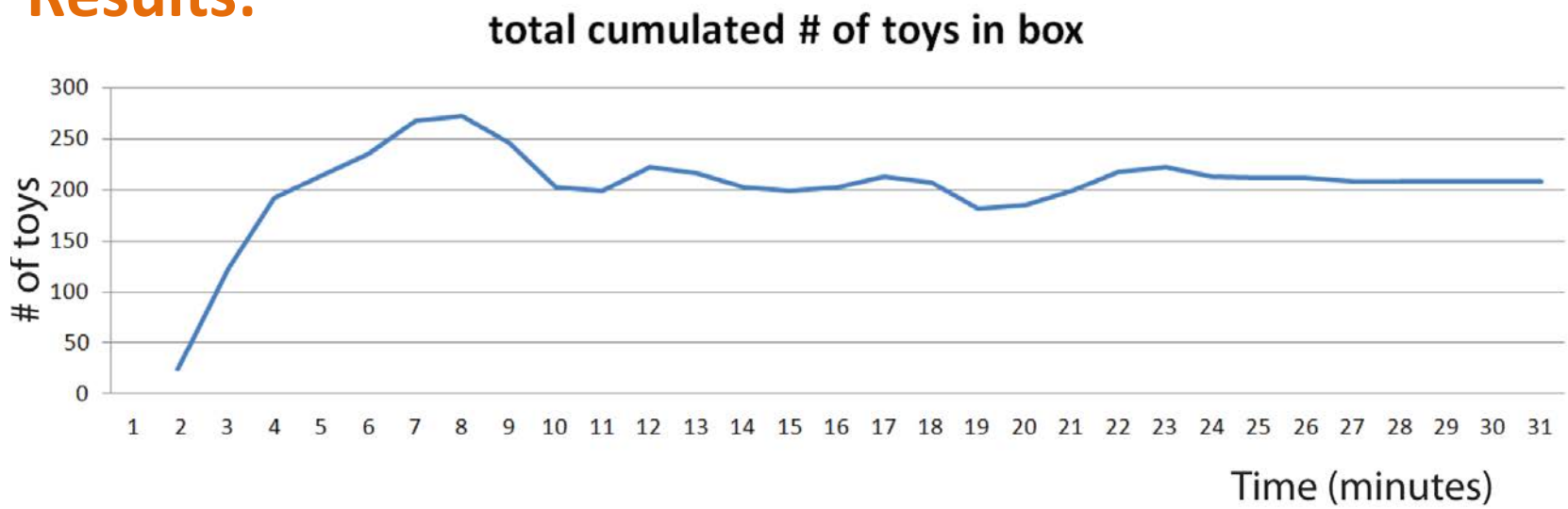
Ranger study

- **Feedback:**
  - Both children and parents like Ranger.
  - They find the design appealing (wood, colors, sounds, eyes).
  - They wish having several boxes.



Ranger study

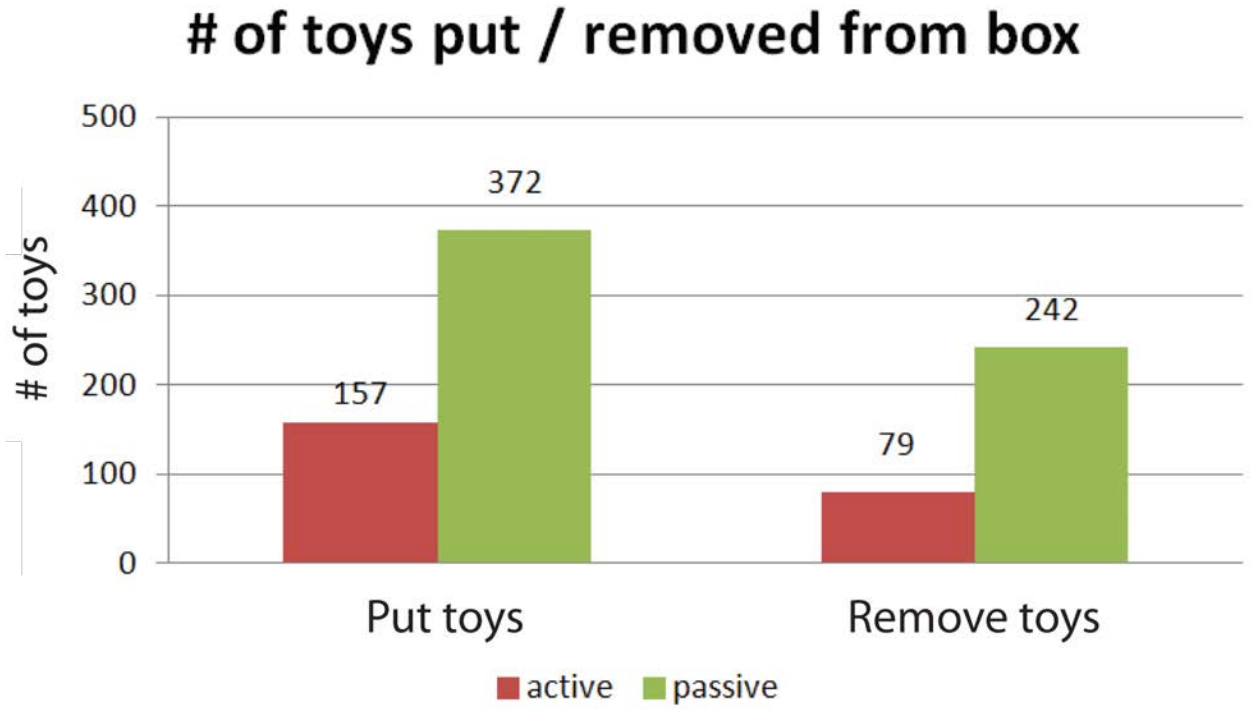
- **Results:**



  - Great fascination of putting toys in Ranger in the first 7 min. After having put ~20 toys some kids start removing them.

Ranger study

- **Results:**

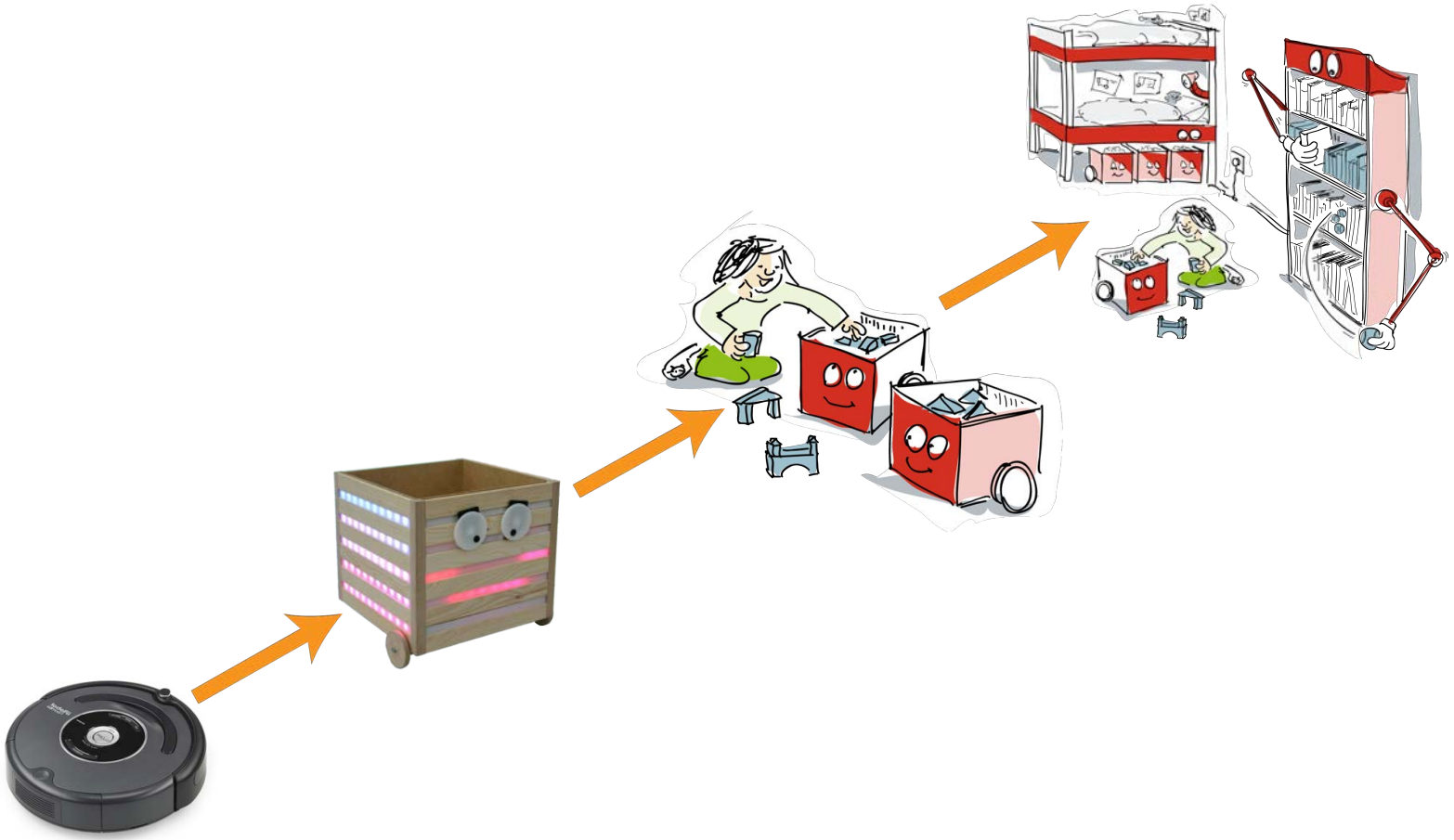


- "Put" and "remove" are the actions carried out most often. But clear difference of number of actions between active and passive (Put: F(1,29)=4.18, p=0.05)

Ranger study

- **Conclusions:**
  - Excellent acceptance, better than in the Roomba study.
  - A more interactive robot is more engaging and social but also distracts more, reaching a worse score in toys placed in the box.
  - The result can be due to a novelty effect, the design needs to enable sustainable interaction.
  - One box is not a solution for storage.

Toward an Active Environment



Toward an Active Environment

Conclusion (education)

- We have a new educational robot, Thymio II, which uses **embodiment** to support education.
- Thymio II has shown to be **age and gender neutral**, enabling creativity and promoting the exploration of science and technology.
- We distributed nearly **1500 Thymio II** in schools and private users.
- Several teachers have started developing **educational material** based on Thymio II, mainly in primary schools and baccalaureate schools.

Conclusion (robjects)

- The approach we have in integrating robotics in everyday objects is **radically different from the state of the art robotics** and can be an **answer to the skeptical perception** of robotics in the large public, reaching applications for many situations.
- We completed a **first iteration** loop integrating design, user studies, analysis and feedback to design of robotic objects.
- We **validated the positive attitude** toward robotic objects, much higher than to vacuum cleaners, for instance.

Thank you

- Work performed by:

  Fanny Riedo
  Luc Bergeron
  Laurent Soldini
  Julia Fink
  Philippe Rétornaz
  Florian Vaussard
  Alain Berthoud
  David Hamel
  …