

# EXPERIMENTAL ROBOTICS: FROM RESULTS TO POLICIES

## AI and Children's Rights

**Vicky Charisi**

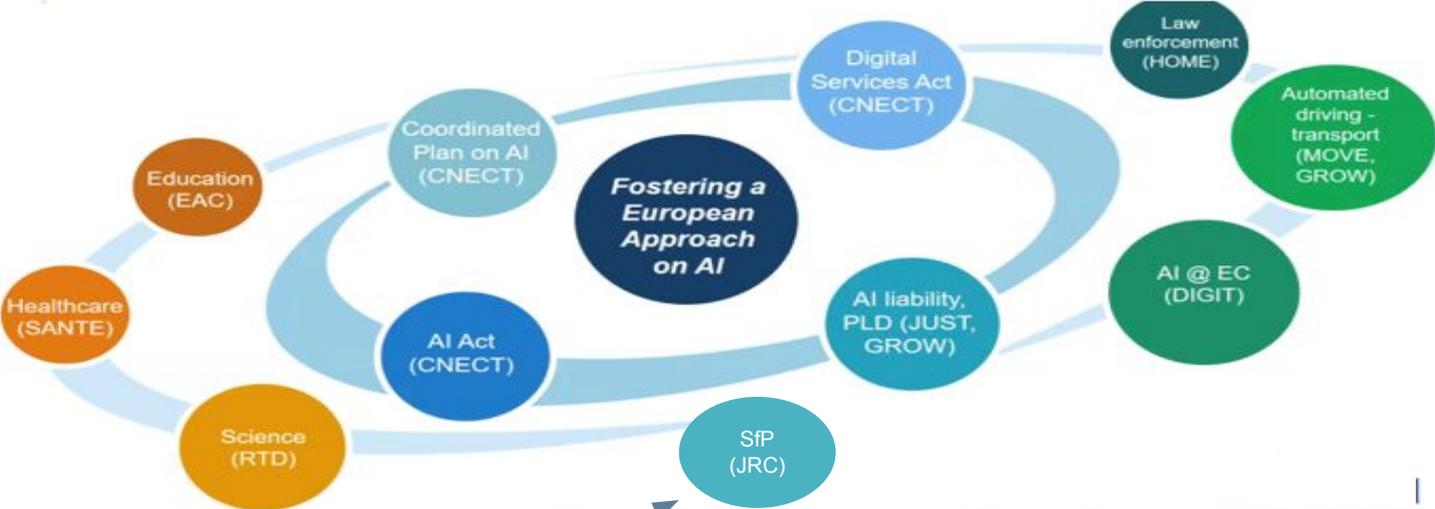
UCL, Institute of Education, UK

**Social Robotics, Artificial Intelligence and Multimedia (SoRAIM)**

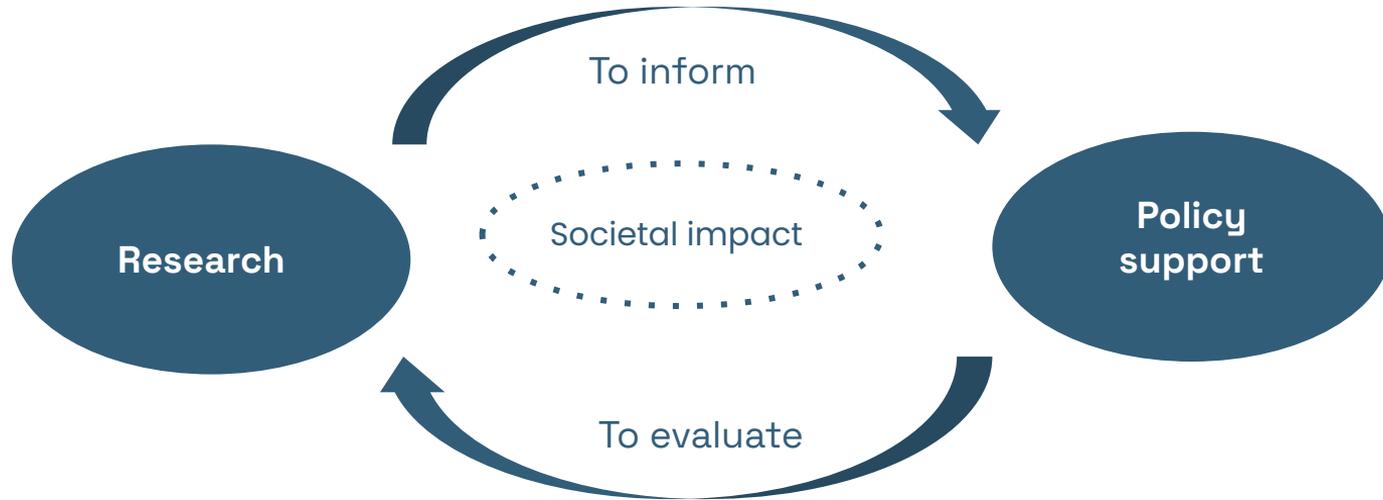
**Winter School**

February 20, 2024 | Grenoble, France

# The European Commission Ecosystem



## The scope of the talk



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Vision, values, existing work,  
policy, regulations

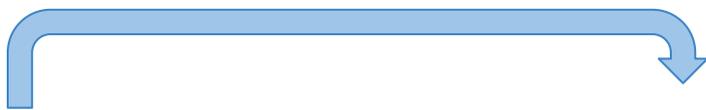


Technology / Novel systems  
Stakeholders involvement



**Designing for a better society**

**Understanding the impact of AI and robotic  
systems on humans**



**Design methods**



Evaluation methods  
Scientific evidence



## **Research**

**What is the impact of Social Robots on Children's  
Behaviour and Development?**

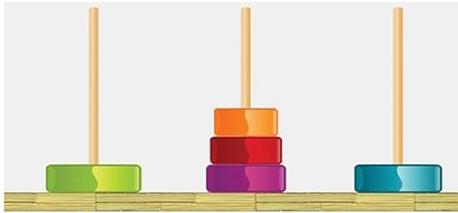
# Empirical studies



# Experimental study

**Aim:** Understanding the impact of robot behaviour on children's problem-solving and social dynamics

## Tower of Hanoi

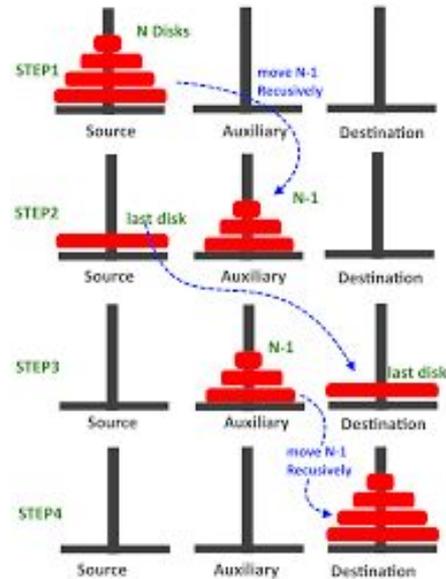
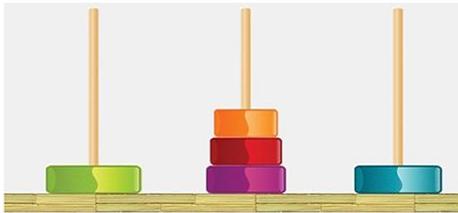


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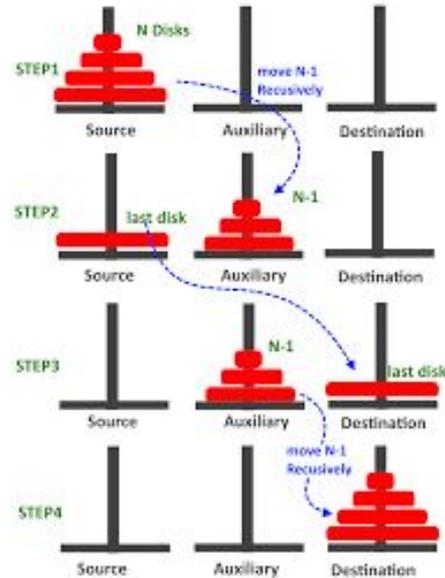
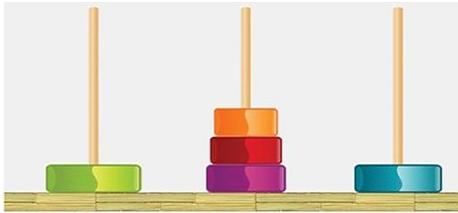


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# Experimental study

Aim: Understanding the impact of robot behaviour on children's problem-solving and social dynamics

## Tower of Hanoi



## The Haru Robot

(Honda Research Institute, JP)



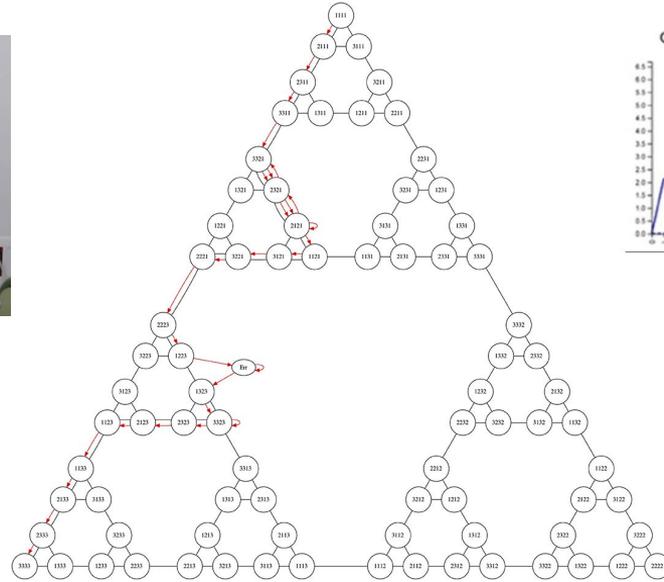
5 degrees of freedom

base rotation, neck leaning, eye stroke, eye rotation and eyes tilt.

Charisi et al. (2021) The Effects of Robot Cognitive Reliability and Social Positioning on Child-Robot Team Dynamics. International Conference on Robotics and Automation (ICRA).

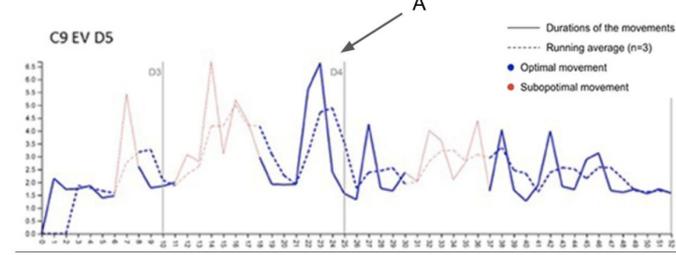
# Child-robot problem-solving

## Turn-taking vs voluntary interaction in problem-solving task



Patterns of deviation from optimal solution

### Temporal elements



### Types of movement

- Optimal
- Suboptimal
- Relatively fast
- Relatively slow

N = 20 children  
5-7yo

# Experimental study

2X2 repeated-measures between-subjects factorial design

**Participants: N=84 children 5-8yo ( $\mu = 6.71, \sigma = 0.99$ )**



Condition	Teams (n)
OE	11
SE	11
ON	10
SN	10

## Hypotheses:

H1: Robots that intentionally make mistakes elicit more child-child social interaction and negotiations

H2: Robots that intentionally make mistakes negatively affect children's trust

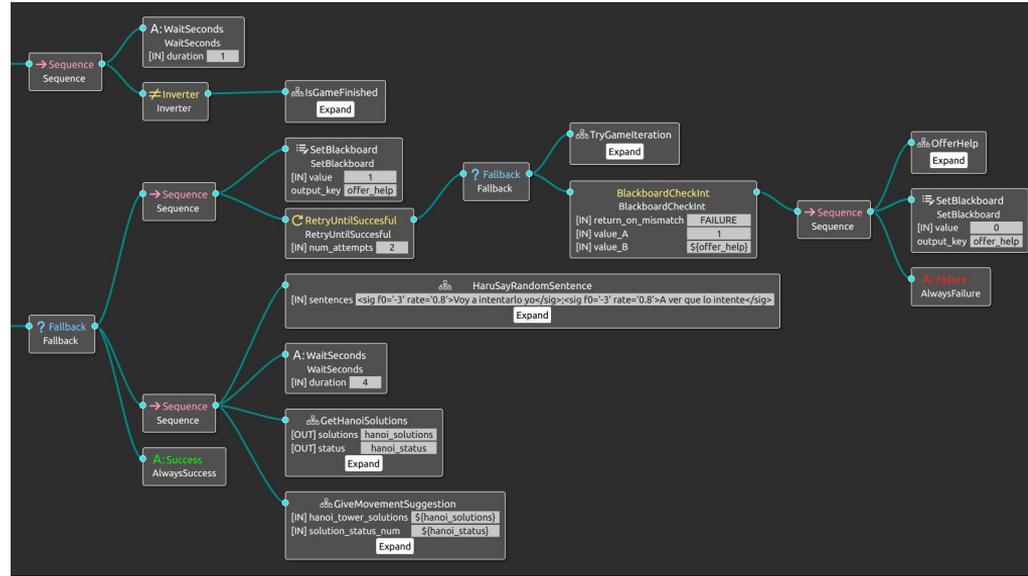
# The control module

Top-level Behaviour Tree (BT) that implements complex close-loop behaviours for the ToH children-robot interaction behaviour.

Manipulation of robot's behaviour

Cognitive reliability

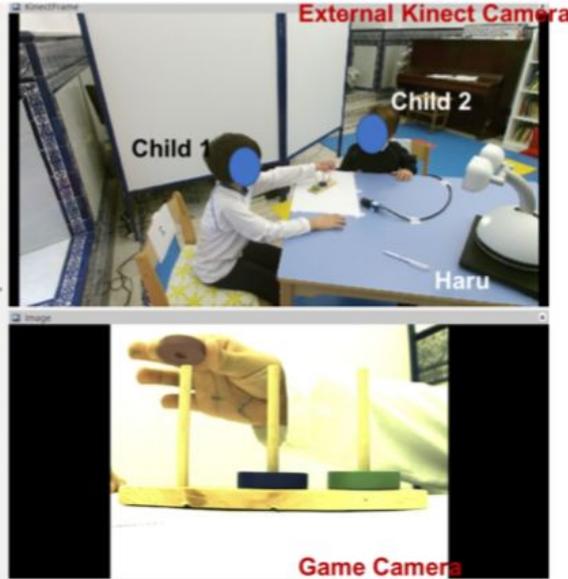
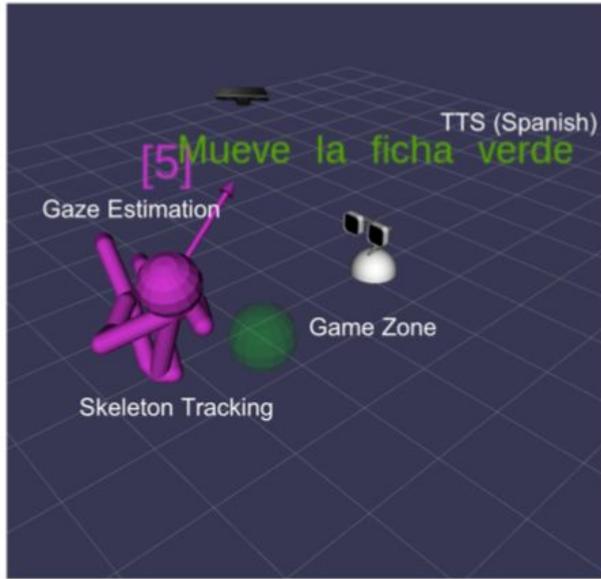
Social positioning



Condition	Cognitive Reliability	Social Positioning
OE	Optimal	Expressive
SE	Sub-optimal	Expressive
ON	Optimal	Neutral
SN	Sub-optimal	Neutral

## The perception module

The relative position/orientation of the children with respect to the game and the robot.

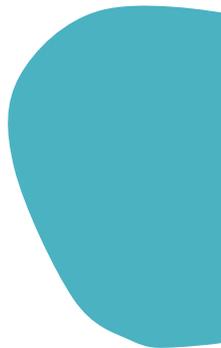
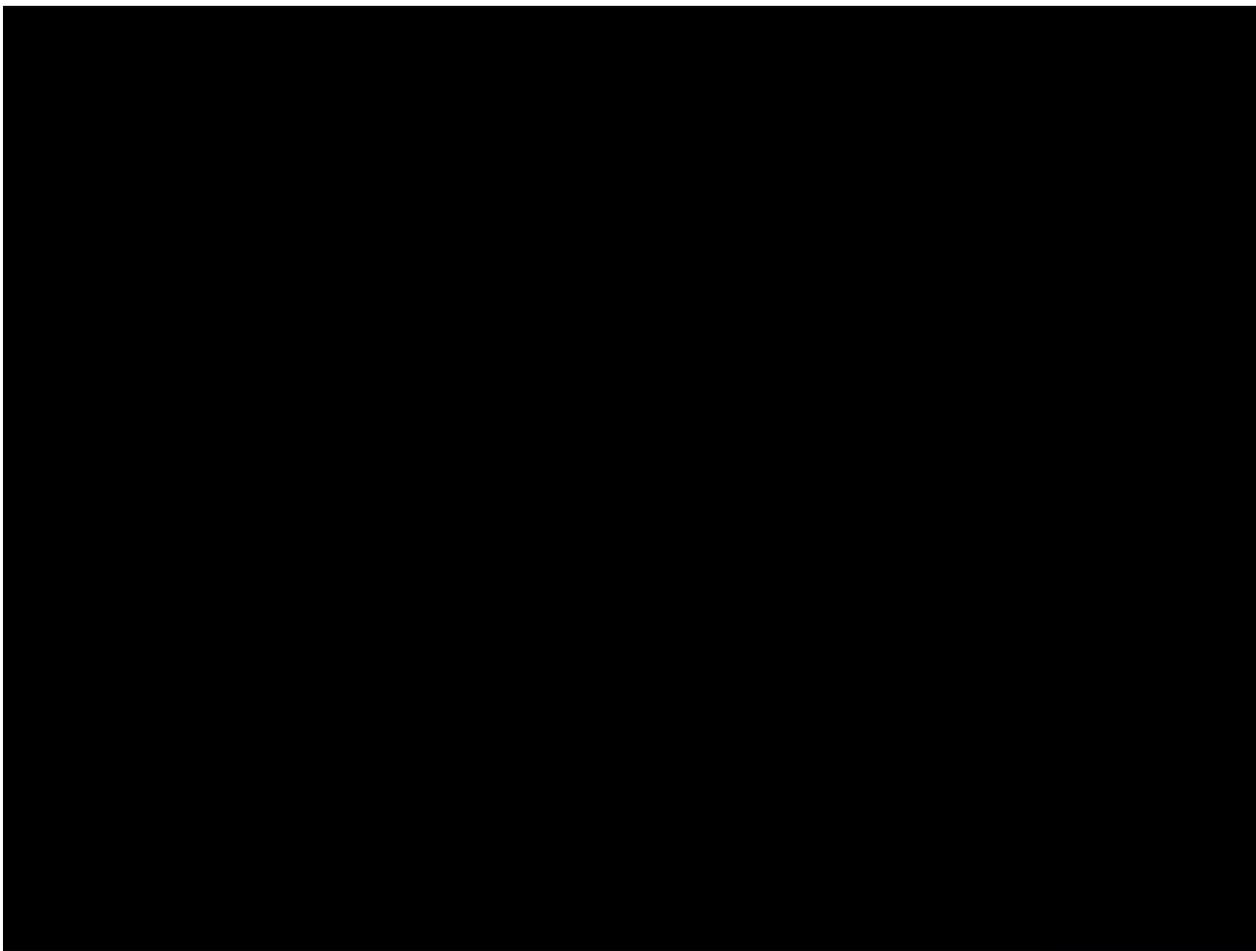


### RGBD camera

Children interaction with the game: which child is playing at a given time.

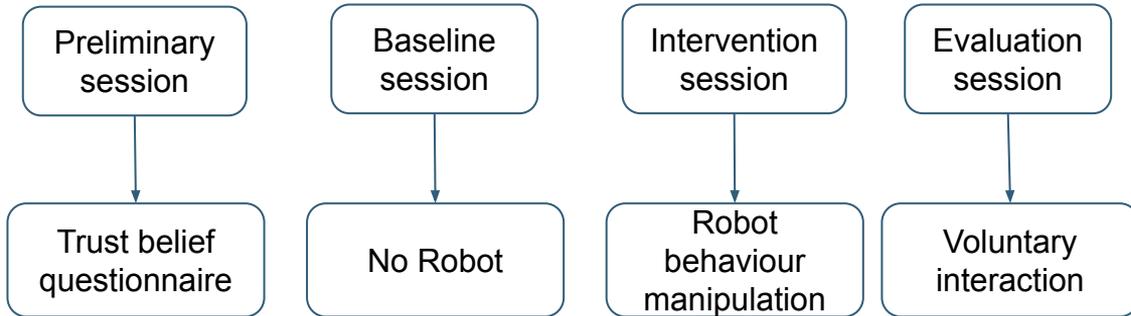
### Game Camera

Automatic estimation of the state of the ToH



# Experimental design

## Experimental procedure



## Metrics

A. Task performance  $K = (L - Op) / Op$

K: Task performance

L: Performed number of movements

Op: Optimal number of movements

B. Social interaction  $S = (S_1 + S_2) / L$

S: Social interaction

Sn: Times of a child address the peer

C. Planning disparity  $D = |S_1 - S_2|$

D: Disparity in planning within the pair

D. Help seeking behaviour  $H = n_H / L$

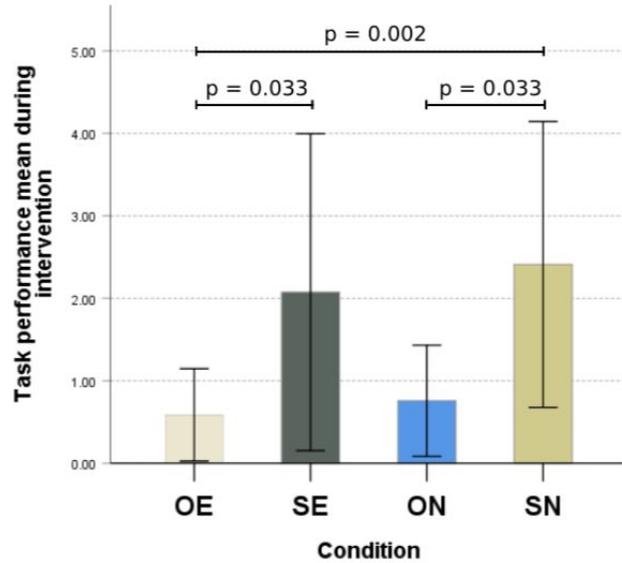
n<sub>H</sub>: Number of times a team asks for help

E. Trust belief questionnaire

F. Post-intervention interviews

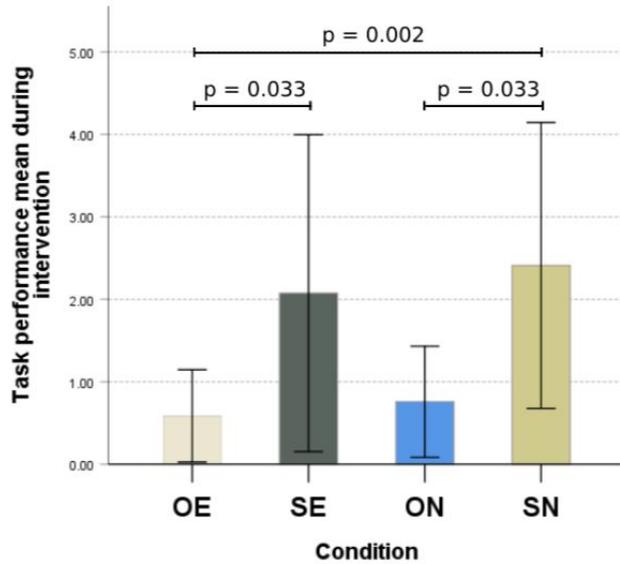
# Results

Collective task performance is better with the cogn. reliable robot in the intervention session

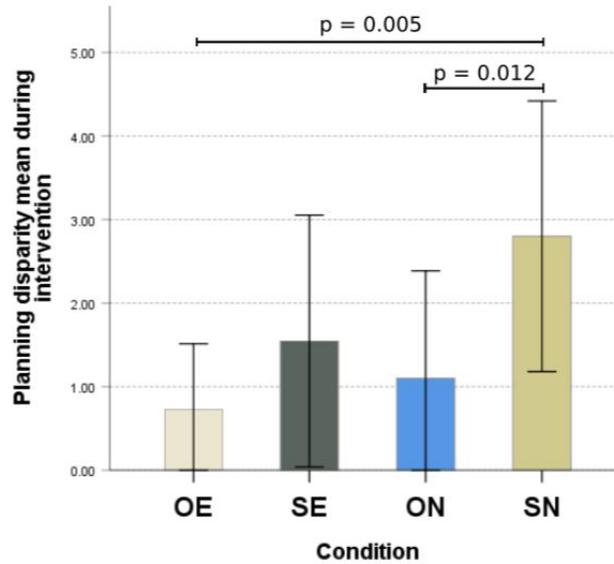


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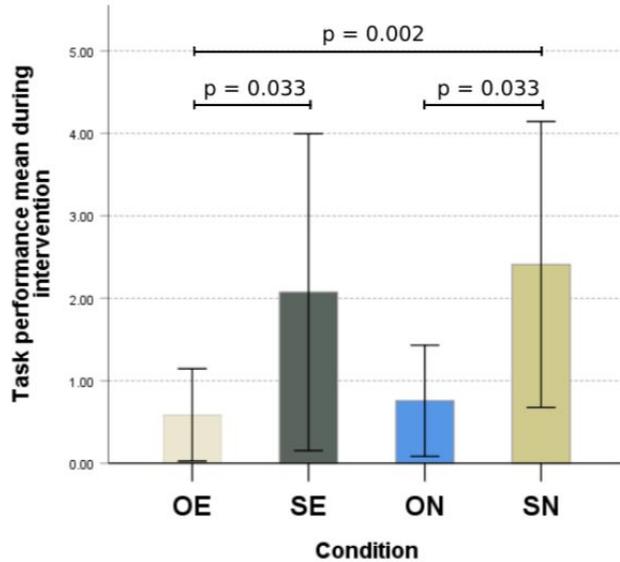


More negotiations between children with the robot that makes mistakes

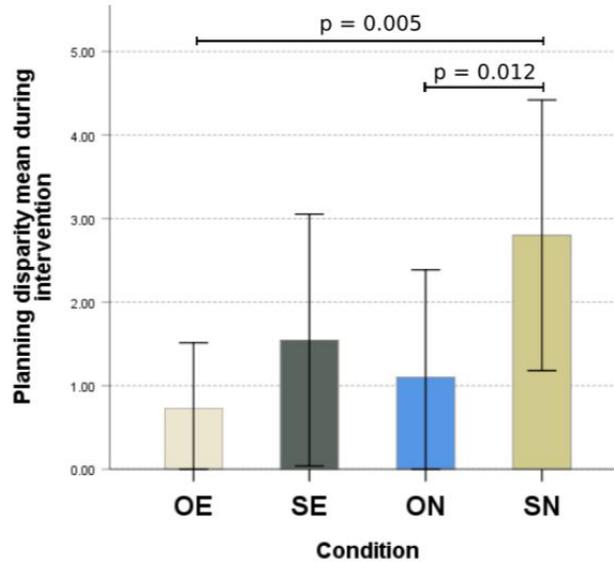


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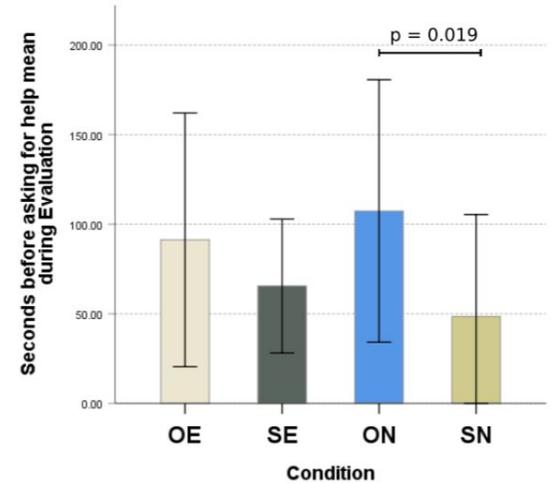
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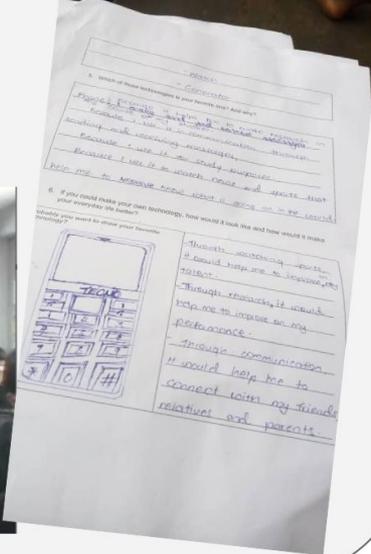


Children trust the robot when in need



# Fairness/ inclusion Participatory Action Research

ENSURE INCLUSION  
OF AND FOR  
CHILDREN



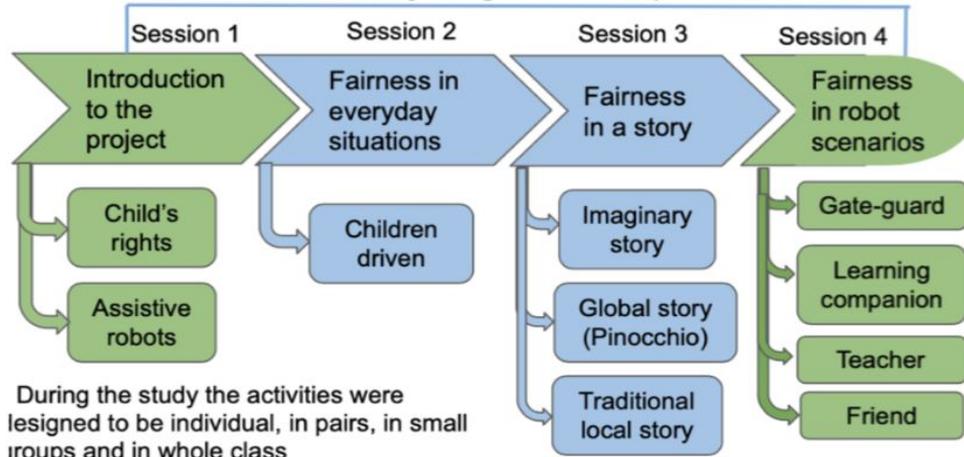
1 class in Tokyo N=24  
1 class in Bududa N=20

2 asynchronous sessions

# Research: Fairness

## Study 1

### Storytelling activities

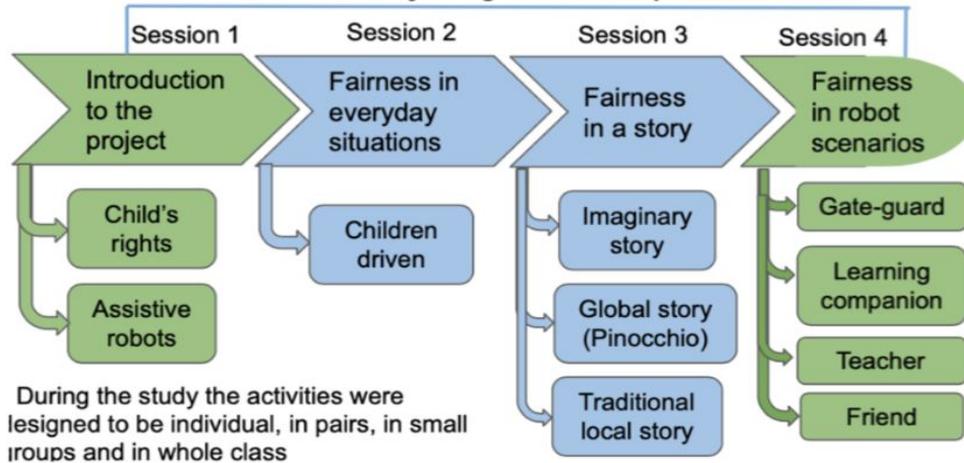


Charisi, V., Imai, T., Rinta, T., Nakhayenze, J., Gomez, R. (2021). Exploring the Concept of Fairness in Everyday, Imaginary and Robot Scenarios: A Cross-Cultural Study With Children in Japan and Uganda. In Interaction Design and Children (IDC '21). Association for Computing Machinery, New York, NY, USA.

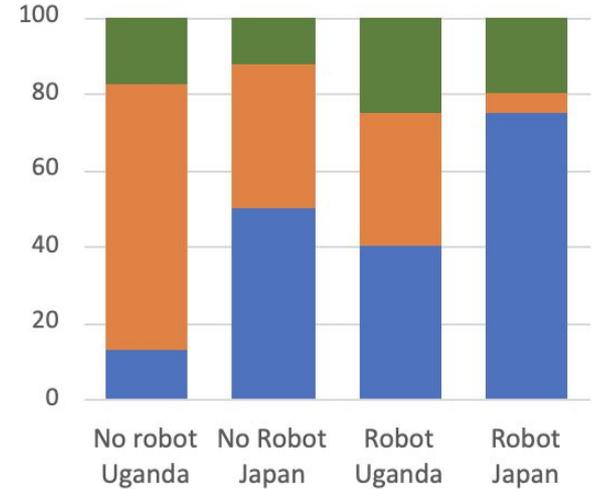
# Research: Fairness

## Study 1

### Storytelling activities



■ Mental ■ Material ■ Systemic



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# The impact of Generative AI on students' problem-solving and critical thinking

RQ1: What is the impact of the use of LLM-based tools on students critical thinking and problem-solving skills?

RQ2: What are the current practices of students and educators regarding LLM-based tools?

RQ3: What are the attitudes of students and educators pre and post the intervention with the LLM tool?

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Workshops  
with  
educators

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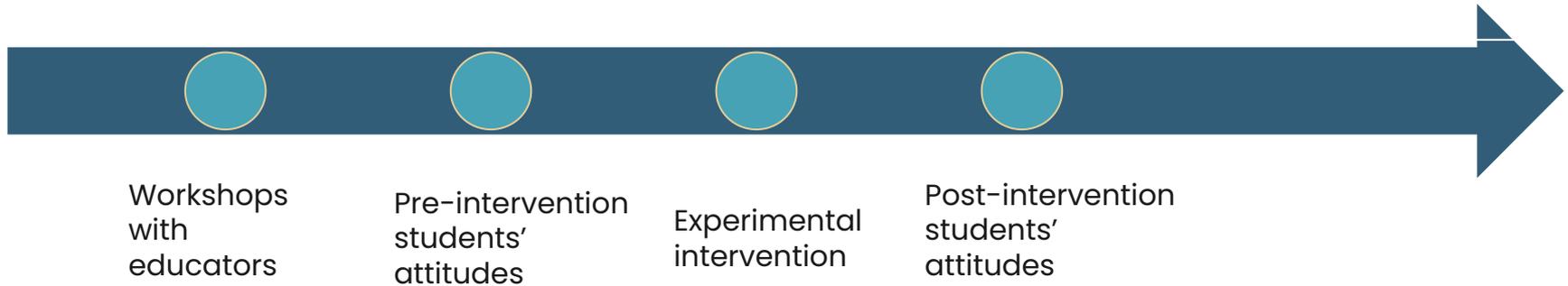


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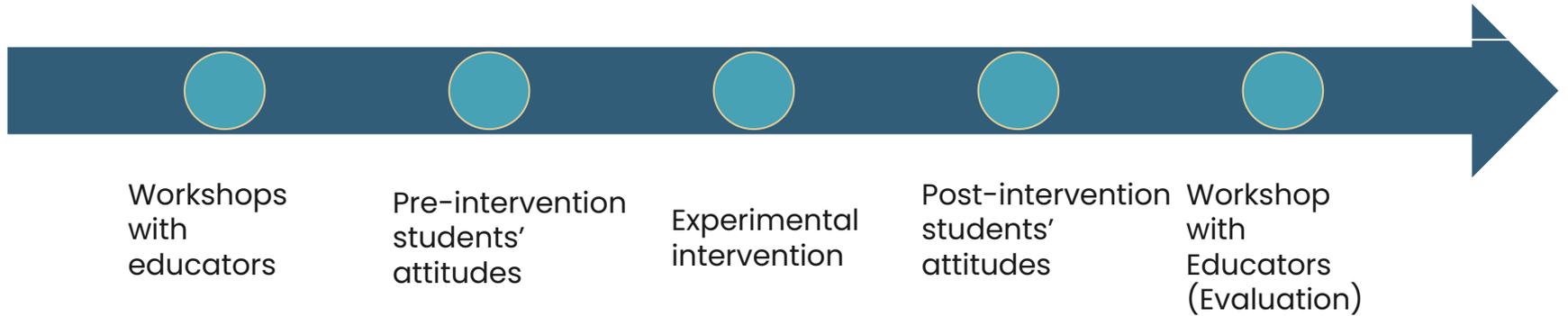


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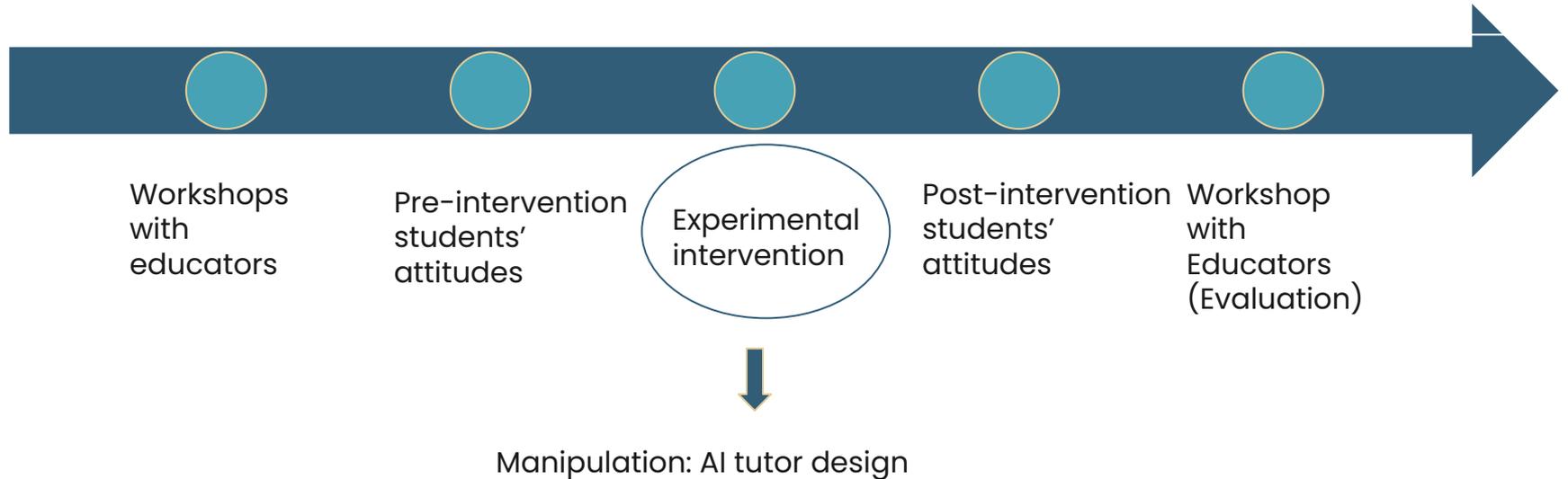


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# Research: The impact of Generative AI on students' problem-solving and critical thinking

- AI TUTOR 1: Solutions to a problem
- AI TUTOR 2: Solutions to a problem together with and explanation
- AI TUTOR 3 (Socratic): Guiding questions to facilitate the user to think about the correct solutions



Students (14-16 yo) N = 180  
Educators N = 60  
Locations: Belgium and Spain

## Data include:

- Responses on the survey (Demographics, tasks, pre- and post-intervention attitudes);
- Logged data of the interaction of the subjects with the AI tutor
- Anonymous material collected during a co-design activity with the students and teachers (e.g., post-its)

# Research to Evaluate Policy



## The Convention of the Rights of the Child (General Assembly, 1989)

### Committee on the Rights of the Child

#### General comment No. 25 (2021) on children's rights in relation to the digital environment



Report

### Policy Guidance on AI for Children

Draft for consultation |  
Recommendations for building AI  
policies and systems that uphold  
child rights

[See the full report](#)

# UNICEF's Framework

## Foundation = { uphold children's rights }

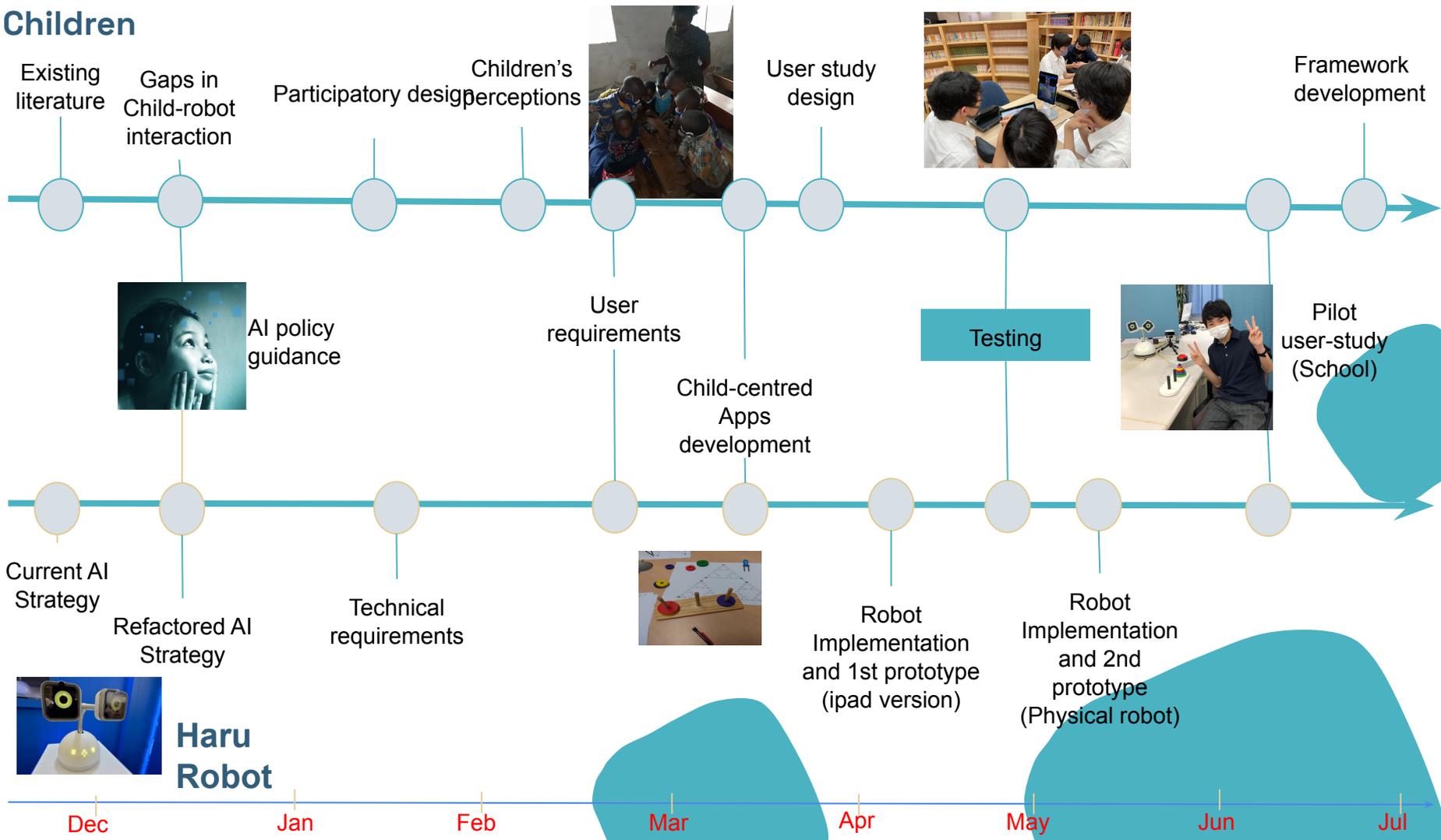
*Through the lenses of protection, provision and participation*

- 1 Support children's development and well-being**  
*Let AI help me develop to my full potential.*
- 2 Ensure inclusion of and for children**  
*Include me and those around me.*
- 3 Prioritize fairness and non-discrimination for children**  
*AI must be for all children.*
- 4 Protect children's data and privacy**  
*Ensure my privacy in an AI world.*
- 5 Ensure safety for children**  
*I need to be safe in the AI world.*
- 6 Provide transparency, explainability, and accountability for children**  
*I need to know how AI impacts me. You need to be accountable for that.*
- 7 Empower governments and businesses with knowledge of AI and children's rights**  
*You must know what my rights are and uphold them.*
- 8 Prepare children for present and future developments in AI**  
*If I am well prepared now, I can contribute to responsible AI for the future.*
- 9 Create an enabling environment**  
*Make it possible for all to contribute to child-centred AI.*

## { Examples of most used techniques found in common AI applications }

	Chatbots	Recommendation systems	Robots	Automated decision-making
Natural language processing	✓	×	✓	✓
Computer vision	×	×	✓	×
Rule-based models	✓	✓	✓	✓
Learning from examples	✓	✓	✓	✓
Planning techniques	✓	×	✓	×
Predictive analytics	✓	✓	×	✓
Reinforcement learning	×	✓	✓	×

# Children



# Evaluating policy recommendations with end-users (students)



# Contributions



**Honda Research Institute Japan & European Commission, Joint Research Centre**

Case study

**Name of initiative**  
Haru Robot

**Implementing organization**  
Honda Research Institute Japan (HRJI, JP)  
European Commission, Joint Research Centre (JRC)

**Geographical scope**  
Artificial intelligence (AI) system  
Japan, Europe and Global

**About the initiative**  
Haru is a prototype robot that aims to stimulate children's cognitive development, creativity, problem-solving and collaborative skills. Once fully developed, it is intended to be used in the home environment, as well as in educational settings, to address more diverse cultural backgrounds. Haru's design process involved children in Japan and Uganda to assess how they viewed concepts of fairness and explainability.

**Alignment with UNICEF Policy Guidelines on AI for Children**  
The initiative has aligned to:  
+ Principle 10: Safety and non-discrimination for children  
+ Principle 11: Transparency, explainability and accountability for children

**Keywords**  
Japan, Europe and Global

**Launched**  
Prototype, 2021 released in 2020

unicef | for every child

IEEE

Presented by **IEEE SA**

APPLIED CASE STUDIES FOR DESIGNING TRUSTWORTHY EXPERIENCES FOR CHILDREN

## THE HARU ROBOT

A social robot companion for children

By Randy Gomez, Principal Scientist, HONDA Research Institute Japan  
Vicky Charvi, Research Scientist, European Commission, Joint Research Centre



IEEE

BE MENU

KIDS KNOW BEST x LEGO

DOWNLOAD

# KIDS INCLUDED

Enabling meaningful child and youth participation within companies in the digital era




## “Beyond the horizon: a new era for the rights of the child”

### High-level Launching Conference for the new Strategy for the Rights of the Child (2022-2027)

Draft programme

Update 17/02/22

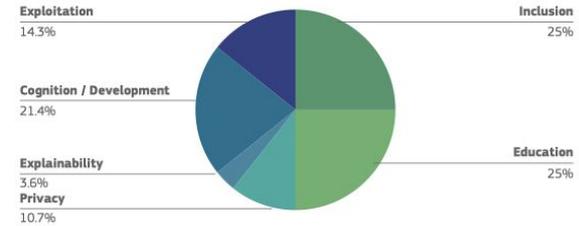


co-organised by  
the Council of Europe and the Italian Presidency of the Committee of Ministers  
at the Ergife Palace Hotel & Conference Center, Rome, 7-8 April 2022

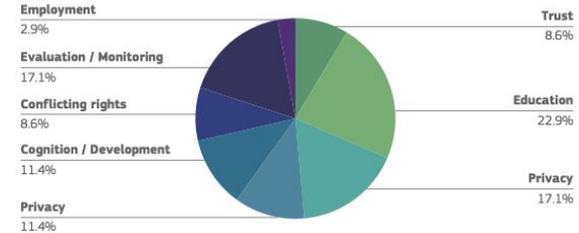
# Proposing evidence-based policy recommendations



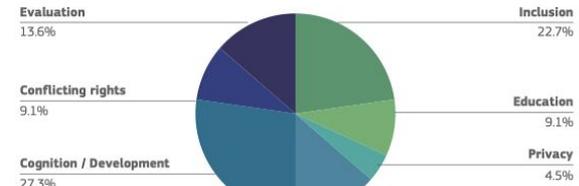
**FIGURE 7**  
Questions received from policymakers (N=28)  
Source: EC



**FIGURE 8**  
Questions emerged through the discussions with experts (N=22)  
Source: EC



**FIGURE 9**  
Topics posed by children and youth (N=35)  
Source: EC



Where are we now and what do we need for the future?

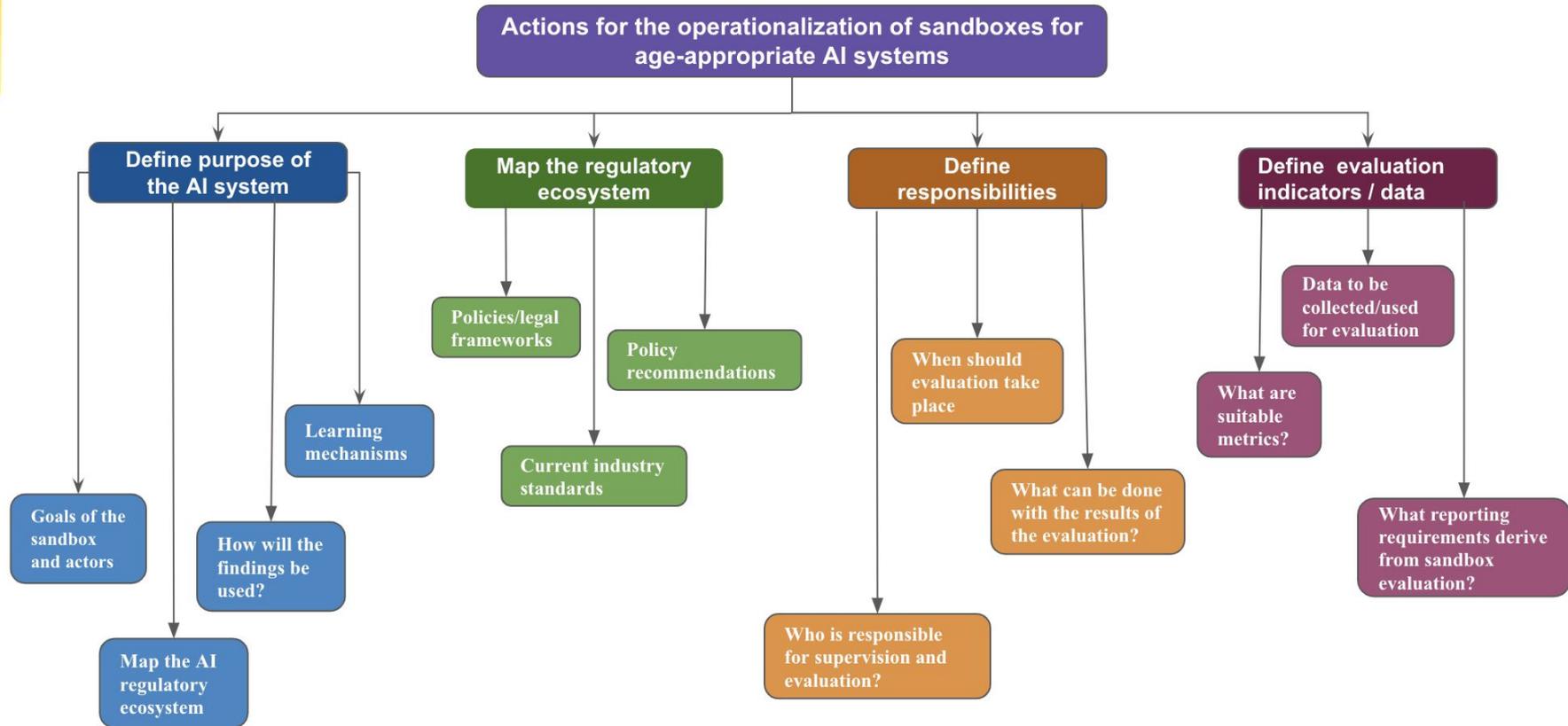
# Systematic literature review on HRI research in relation to children's rights

	Accountability	Explainability	Fairness	Inclusion	Privacy	Safety	Transparency
User Study		21, 35, 50	20, 36	11, 12, 13, 14, 18, 19, 23, 24, 25, 27, 29, 32, 39	4, 40, 42	5, 38, 43	41, 47
Position Paper	37				37, 52	1, 17, 22	26
Review Paper				10	2	33, 51	

# EU AI Act



# Operationalising AI Regulatory Sandboxes for Children's Rights and Well-being



Charisi, V. and Dignum, V. (2024). Operationalising AI Regulatory Sandboxes for Children's Rights and Well-being. In Axente, M., Denis, J. L., Kishimoto, A., Régis, C. (eds.). *Human-Centered AI: a Multidisciplinary Perspective for Policy-Makers, Auditors and Users*. Routledge's Chapman & Hall/CRC Artificial Intelligence and Robotics Series.

# Discussion

How can we ensure responsible design, development, deployment and use of social robots that would promote children's rights and possibly responsible social transformation?

Thank you for your attention

Vicky Charisi

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