

Object-Centric Debugging

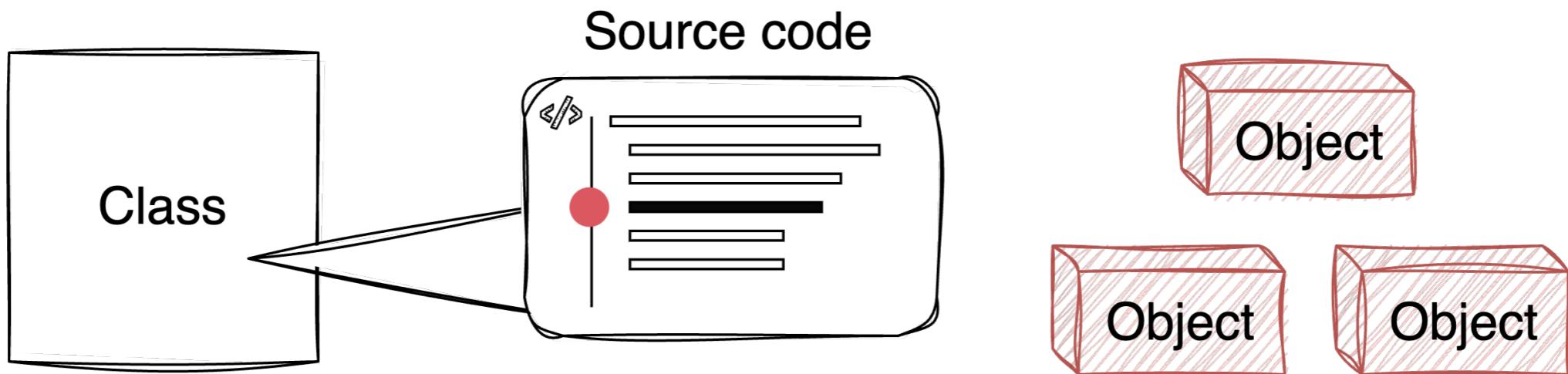
Empirical experiment - preliminary results

Valentin Bourcier, Steven Costiou, Pooja Rani, Alberto Bacchelli

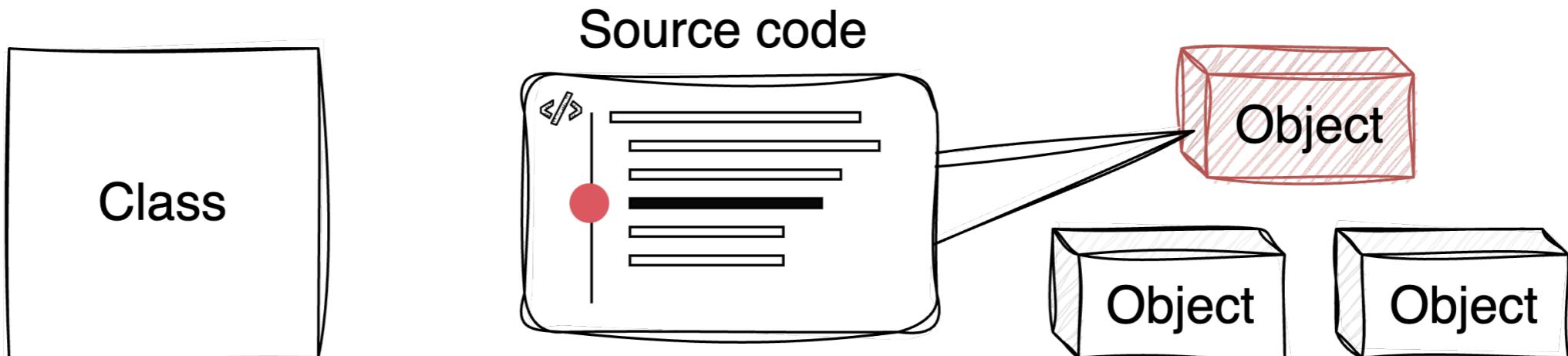
ESUG - 11 July 2024

What is object-centric debugging?

Traditional breakpoint

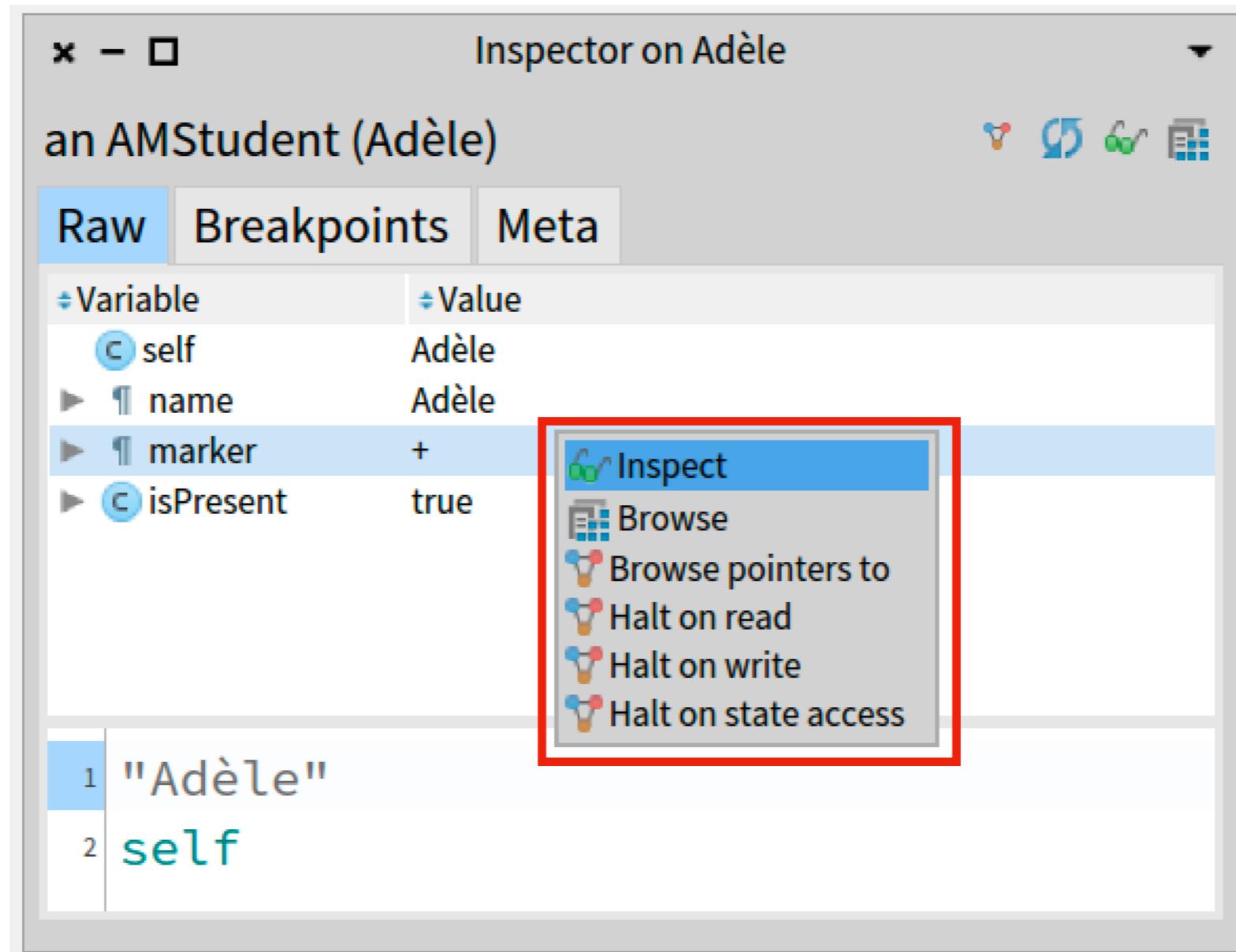


Object-centric breakpoint



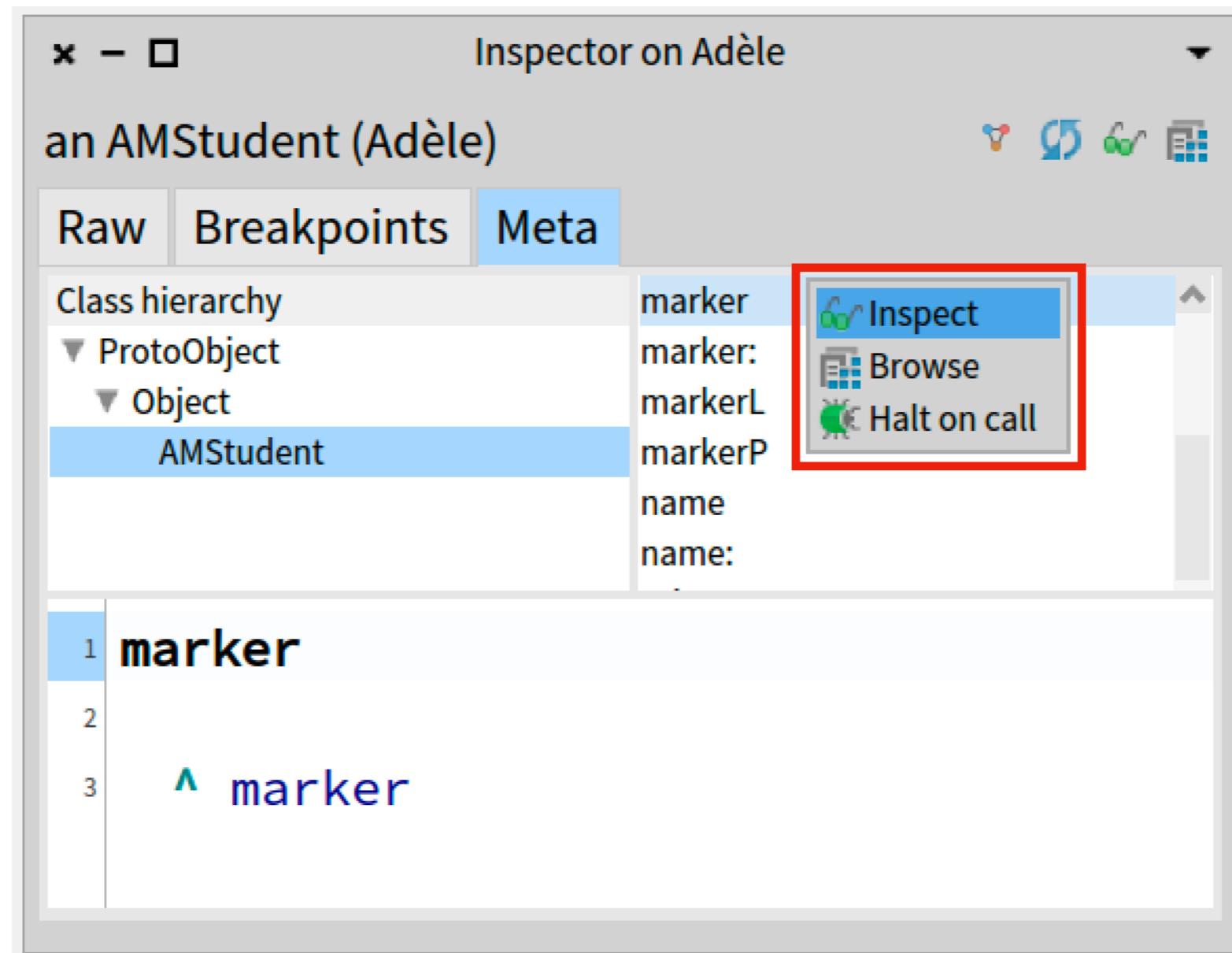
What is object-centric debugging?

Object-centric breakpoints in Pharo



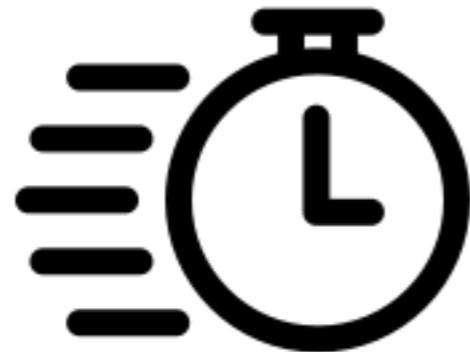
What is object-centric debugging?

Object-centric breakpoints in Pharo



Object-centric debugging

The hypotheses



- **Faster** debugging
- **Fewer** actions

Ressia. *Object-centric debugging*



Insights, examples



Empirical evaluations

Empirical evaluation: object-centric debugging

The design



Ammolite



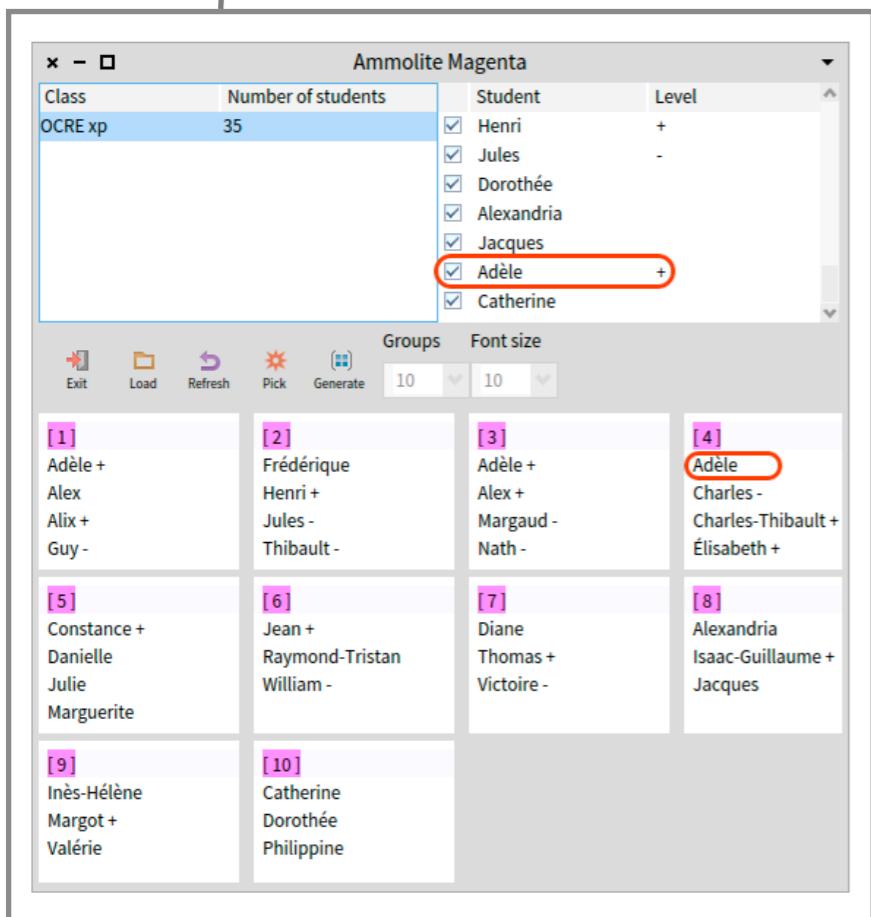
Lights Out

Empirical evaluation: object-centric debugging

The design



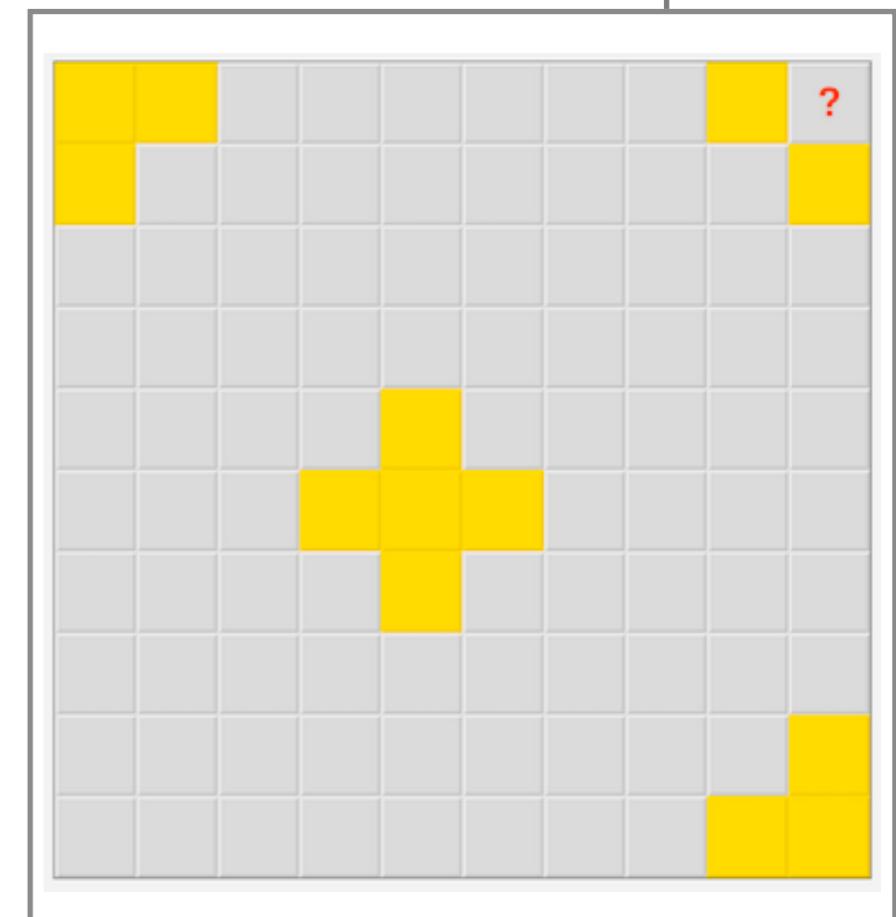
Ammolite



Class	Number of students	Student	Level
OCRE xp	35	Henri	+
		Jules	-
		Dorothée	
		Alexandria	
		Jacques	
		Adèle	+
		Catherine	



Lights Out



Empirical evaluation: object-centric debugging

The design



Ammolite



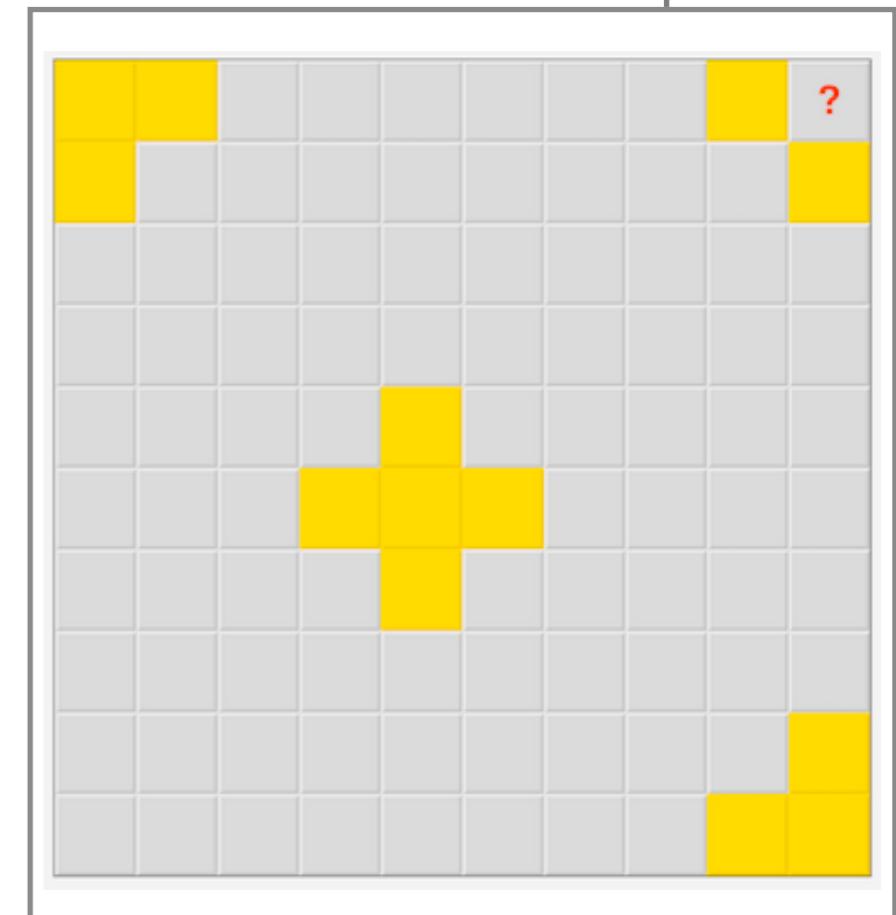
Lights Out

Ammolite Magenta

Class	Number of students	Student	Level
OCRE xp	35	Henri	+
		Jules	-
		Dorothée	
		Alexandria	
		Jacques	
		Adèle	+
		Catherine	

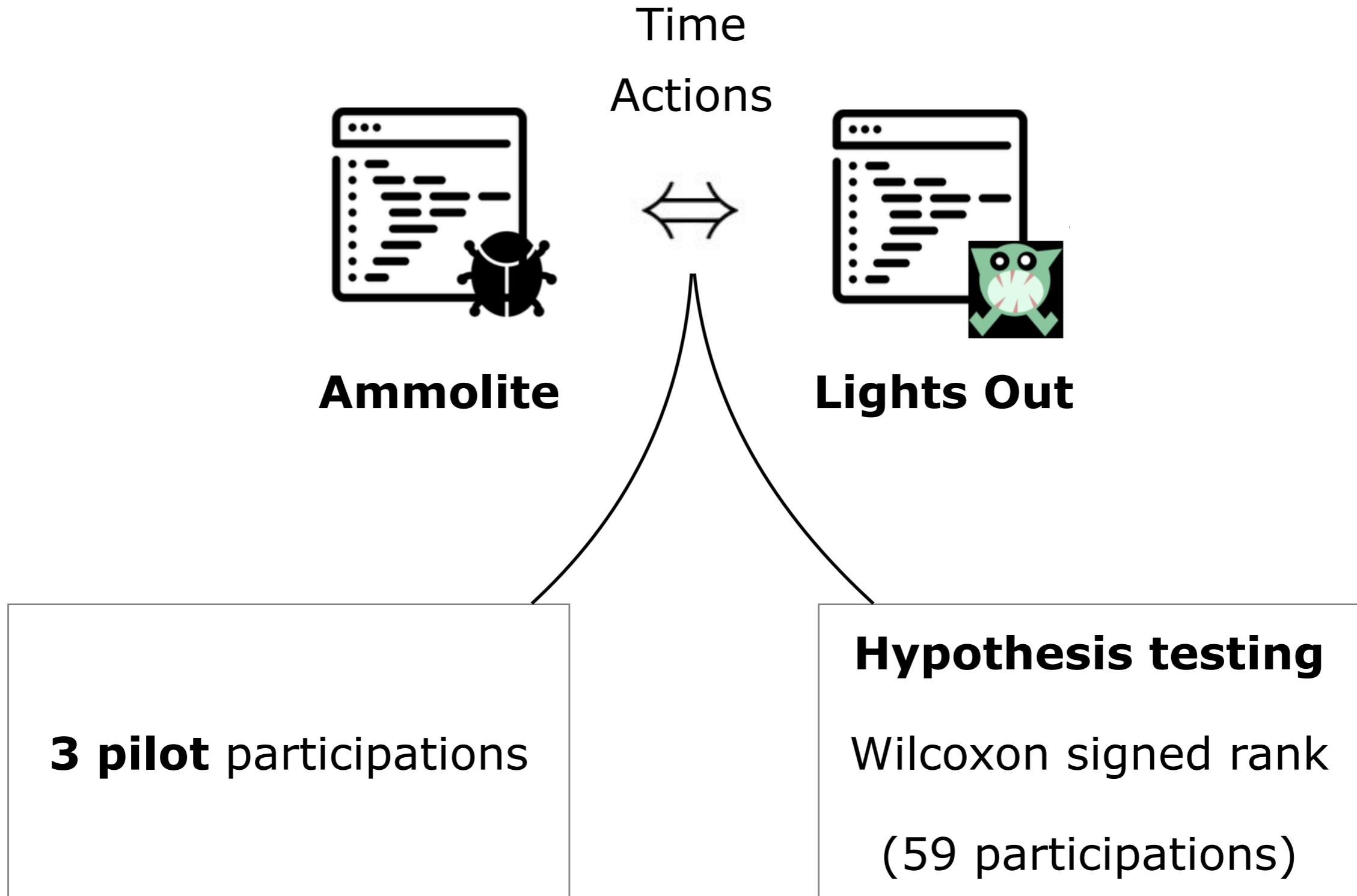
Groups Font size
Exit Load Refresh Pick Generate 10 10

[1] Adèle + Alex Alix + Guy -	[2] Frédérique Henri + Jules - Thibault -	[3] Adèle + Alex + Margaud - Nath -	[4] Adèle Charles - Charles-Thibault + Élisabeth +
[5] Constance + Danielle Julie Marguerite	[6] Jean + Raymond-Tristan William -	[7] Diane Thomas + Victoire -	[8] Alexandria Isaac-Guillaume + Jacques
[9] Inès-Hélène Margot + Valérie	[10] Catherine Dorothée Philipine		



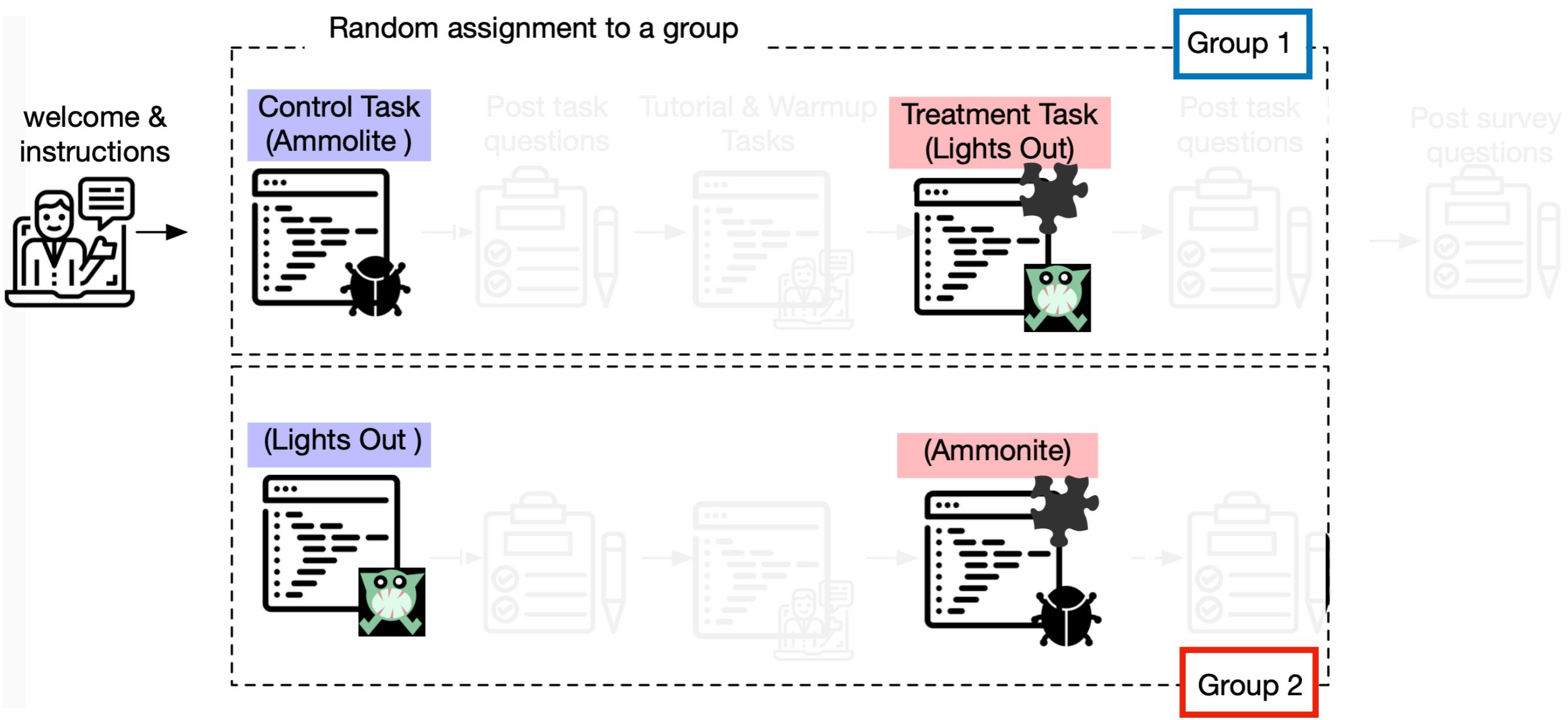
Empirical evaluation: object-centric debugging

The design



Empirical evaluation: object-centric debugging

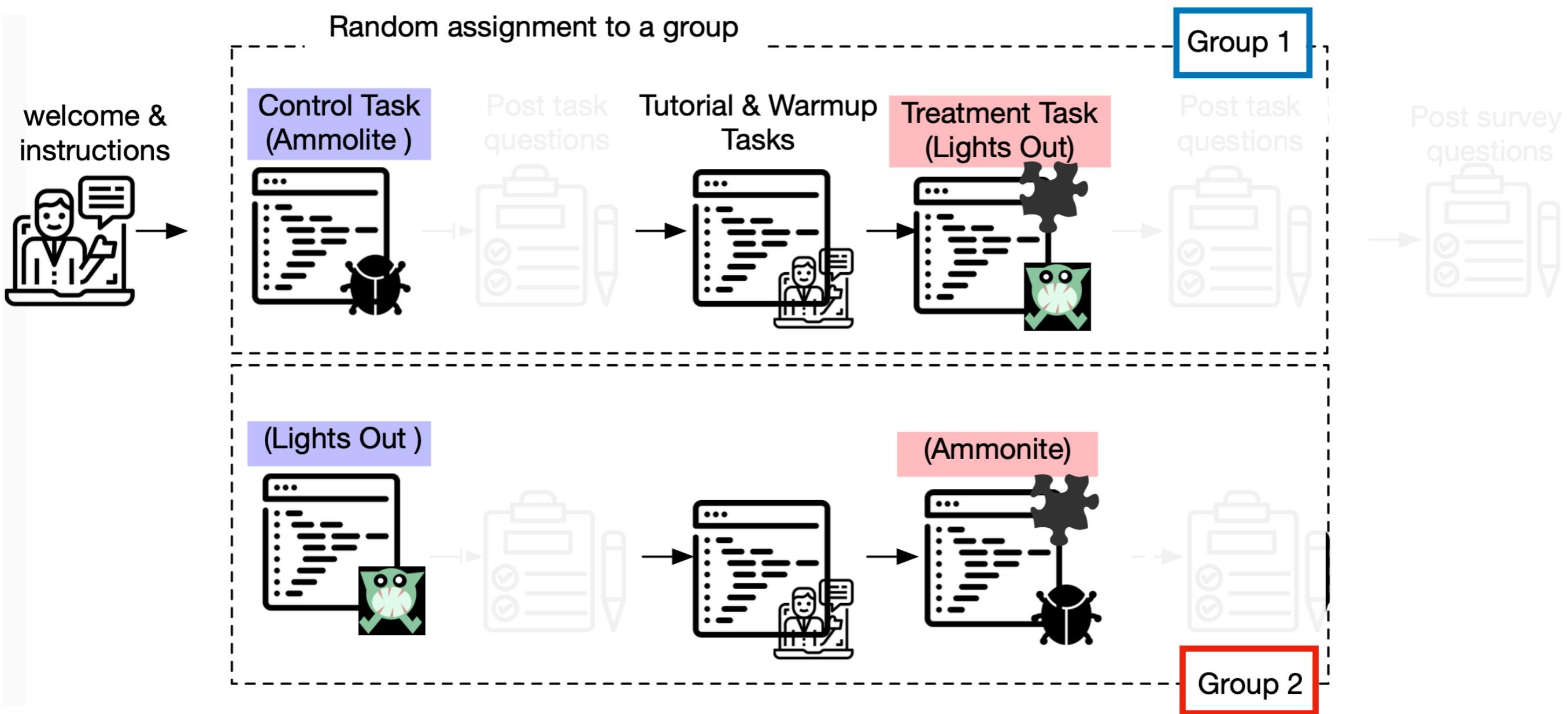
The design



Object-centric breakpoints

Empirical evaluation: object-centric debugging

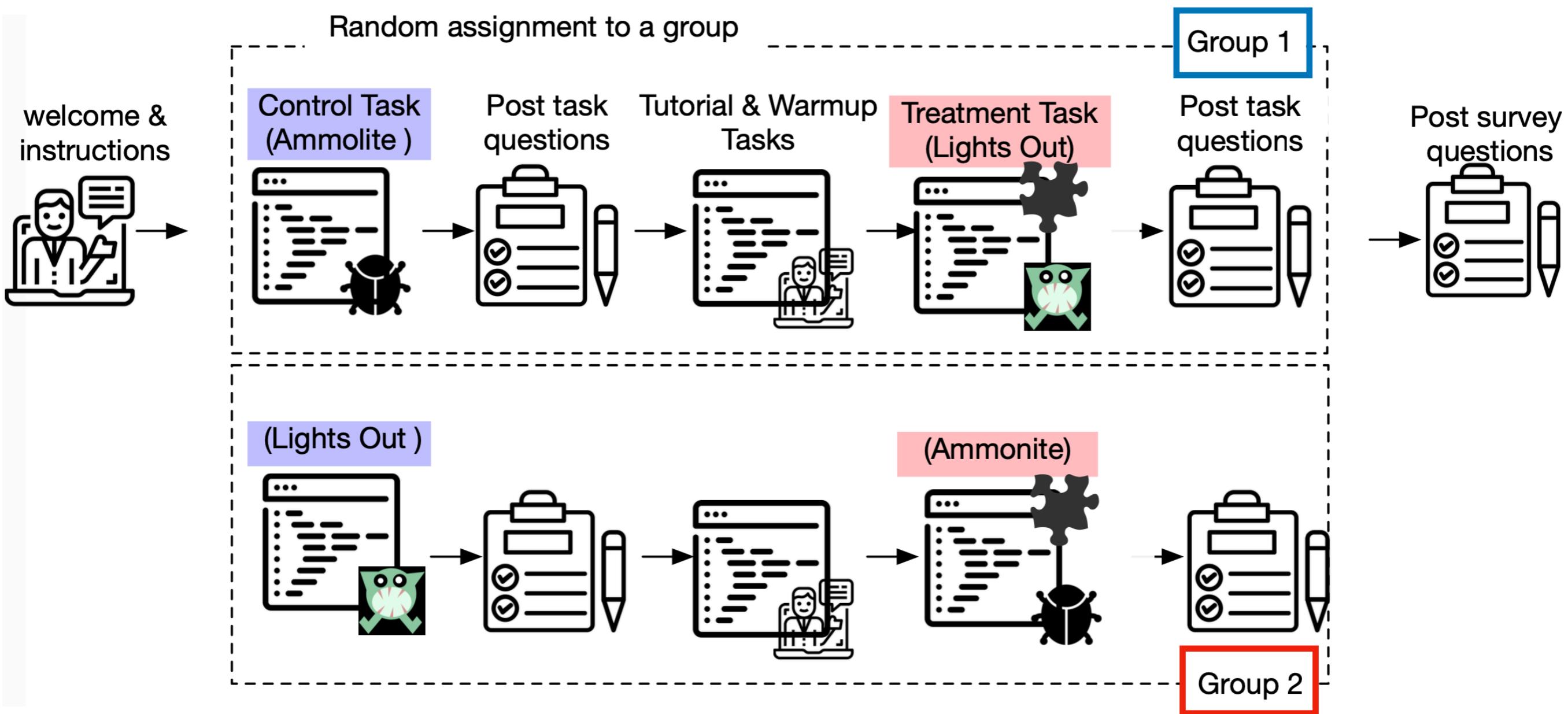
The design



 *Object-centric breakpoints*

Empirical evaluation: object-centric debugging

The design



Empirical evaluation: object-centric debugging

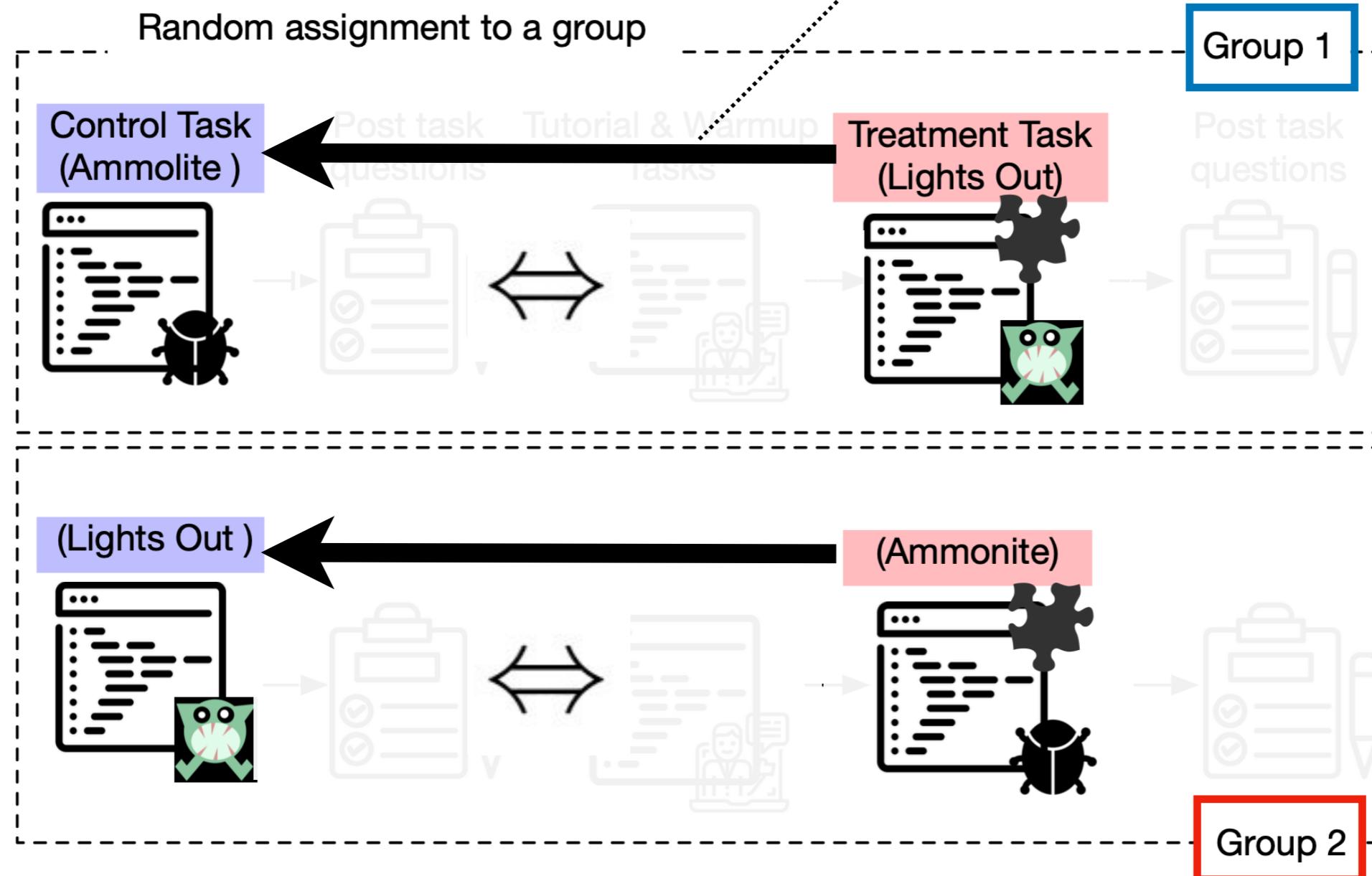
applause!



Empirical evaluation: object-centric debugging

The design

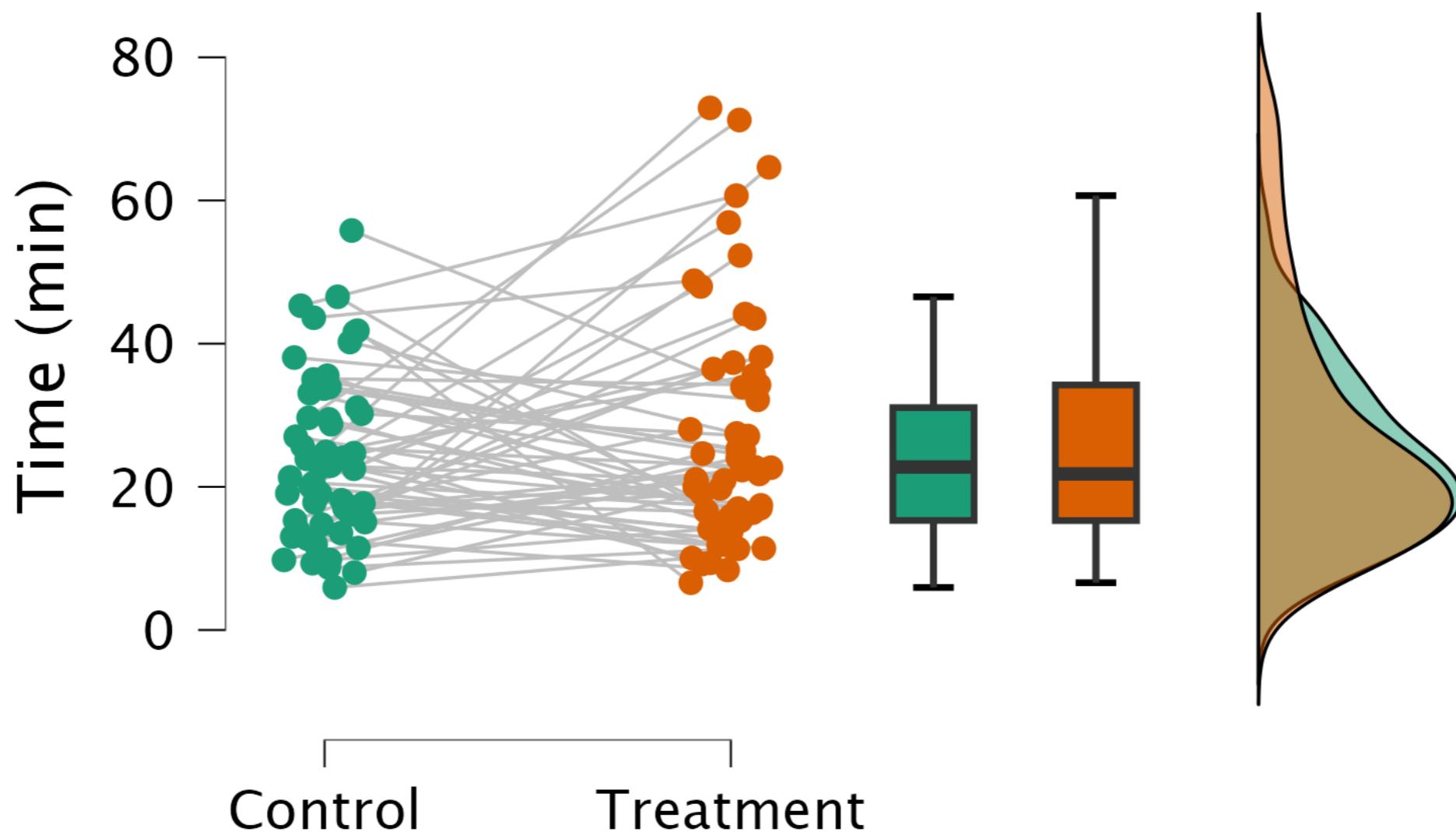
Per-participant analysis



Object-centric breakpoints

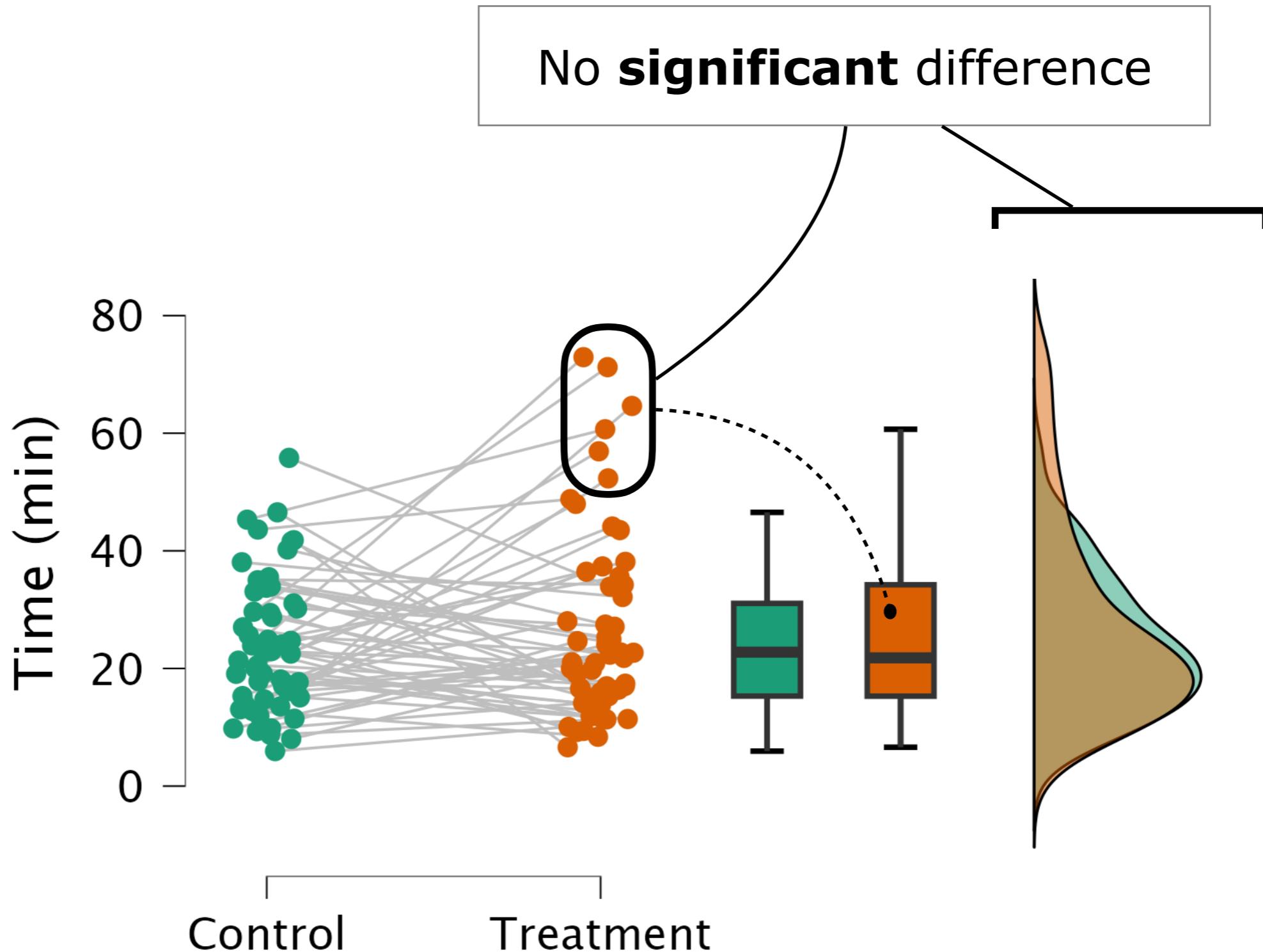
Empirical evaluation: object-centric debugging

Per-participant, N=59



Empirical evaluation: object-centric debugging

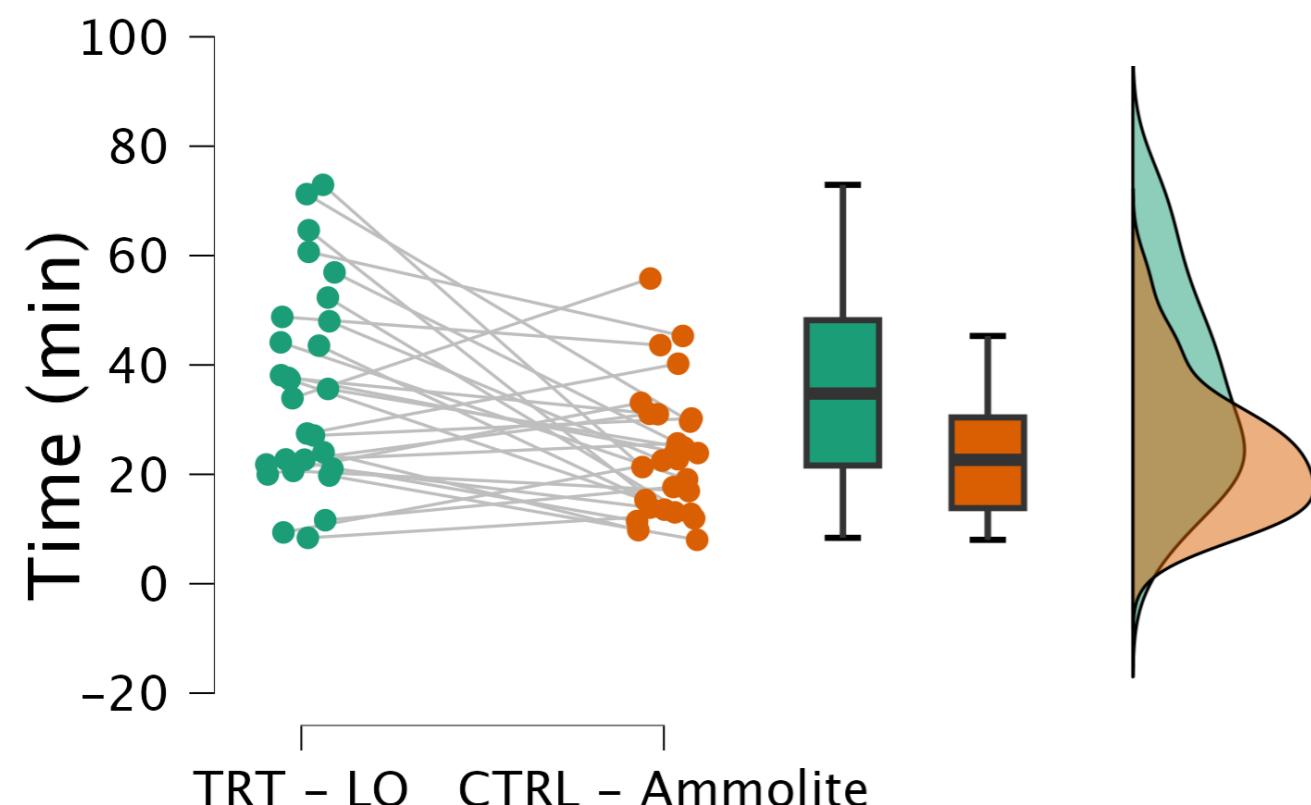
Per-participant, N=59



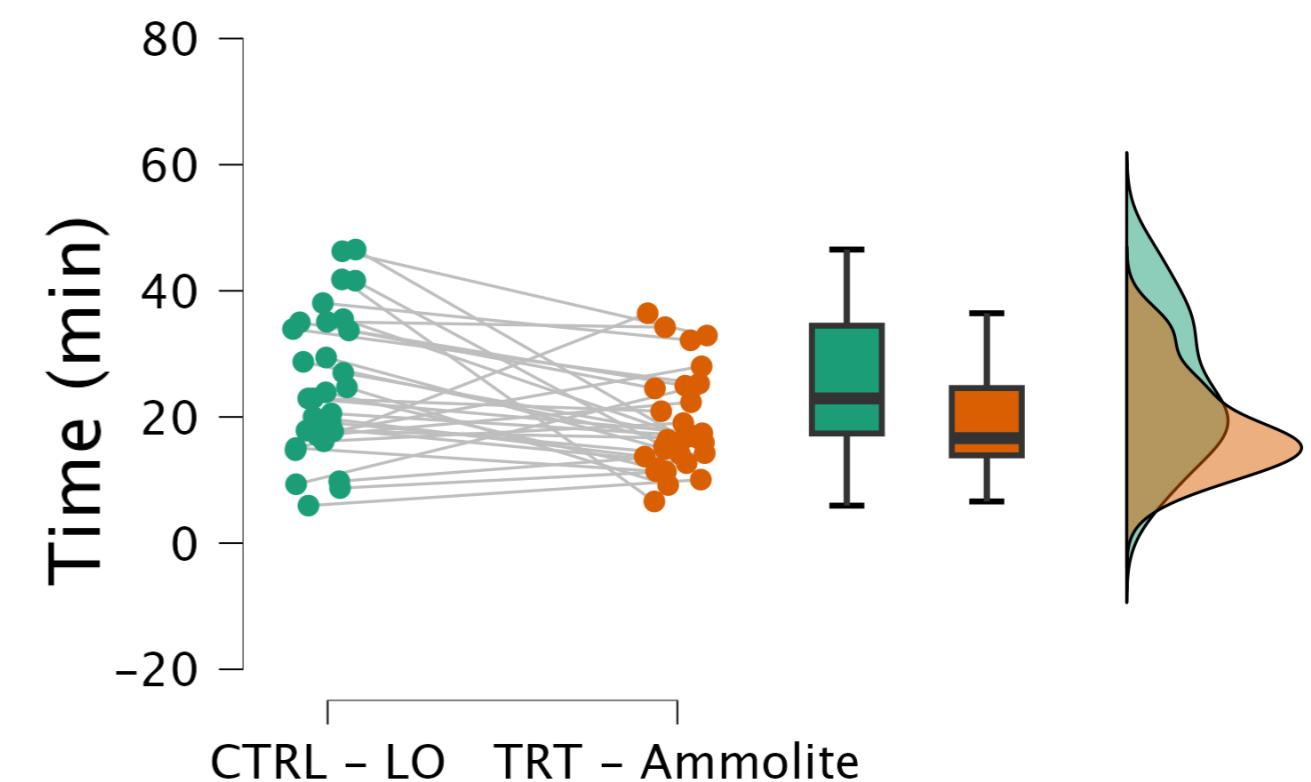
Empirical evaluation: object-centric debugging

Per-group, task-sequence analysis

GROUP 1



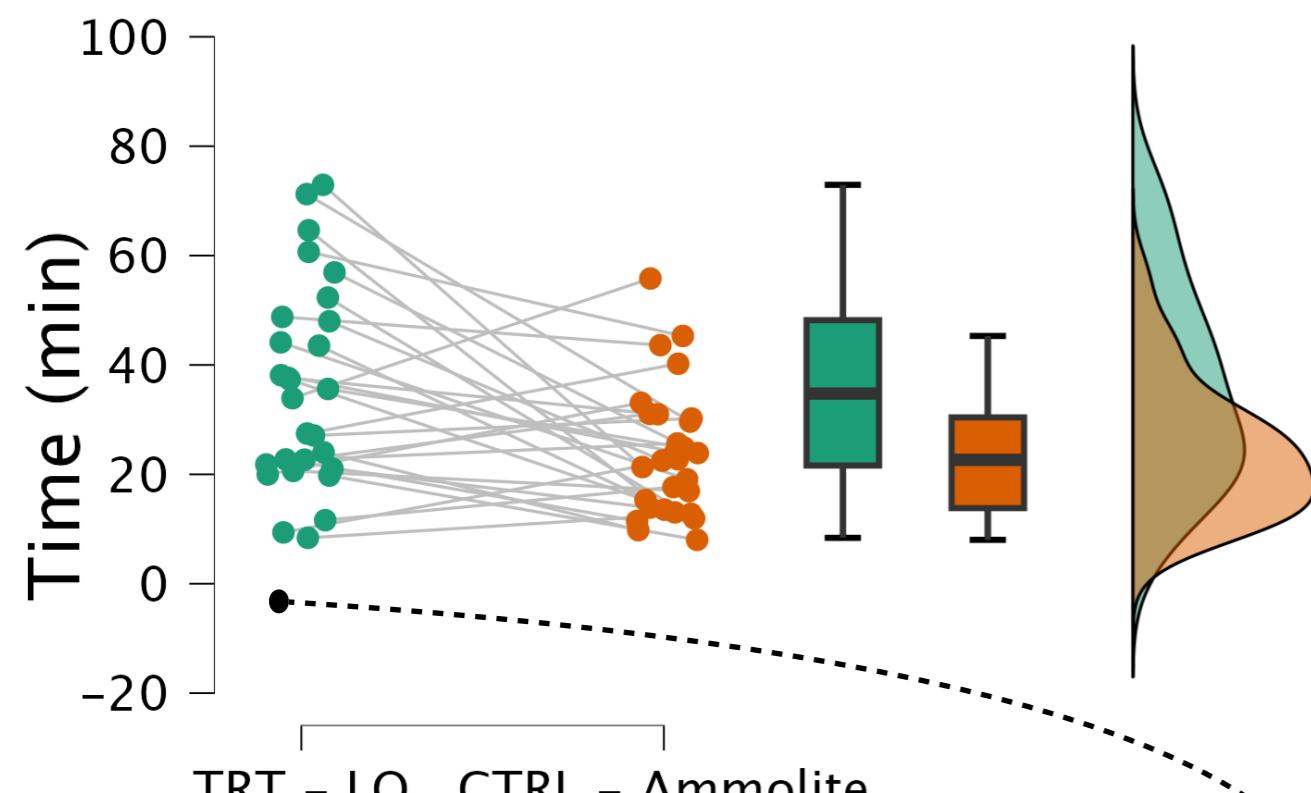
GROUP 2



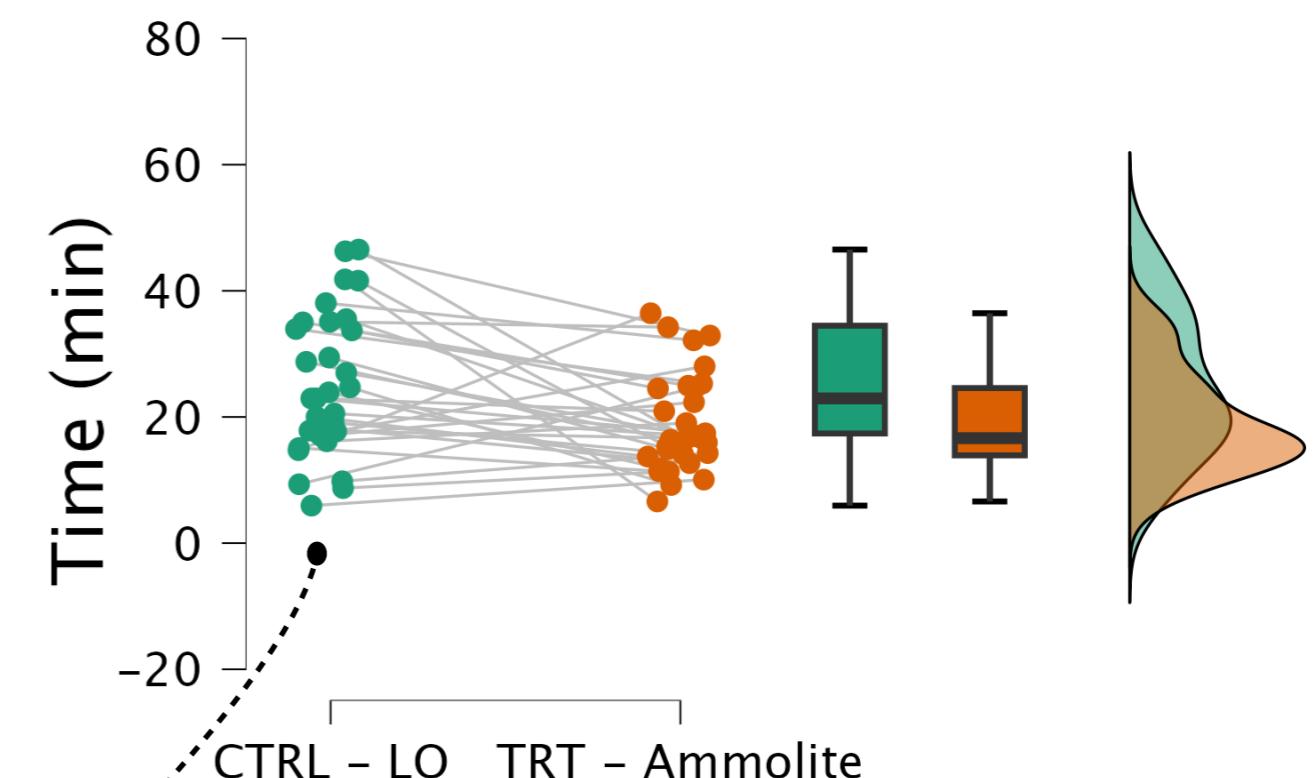
Empirical evaluation: object-centric debugging

Per-group, task-sequence analysis

GROUP 1



GROUP 2



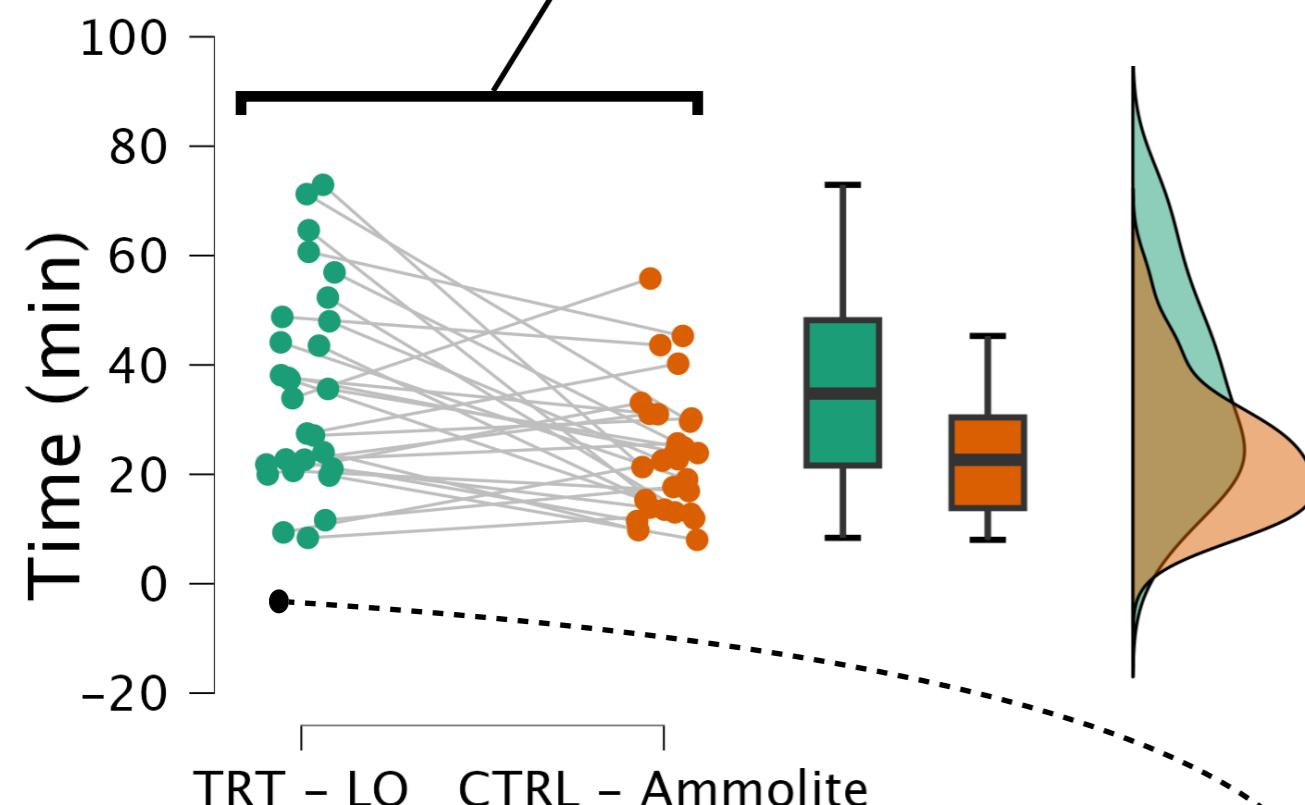
Higher values on the **left side**

Empirical evaluation: object-centric debugging

Per-group, task-sequence analysis

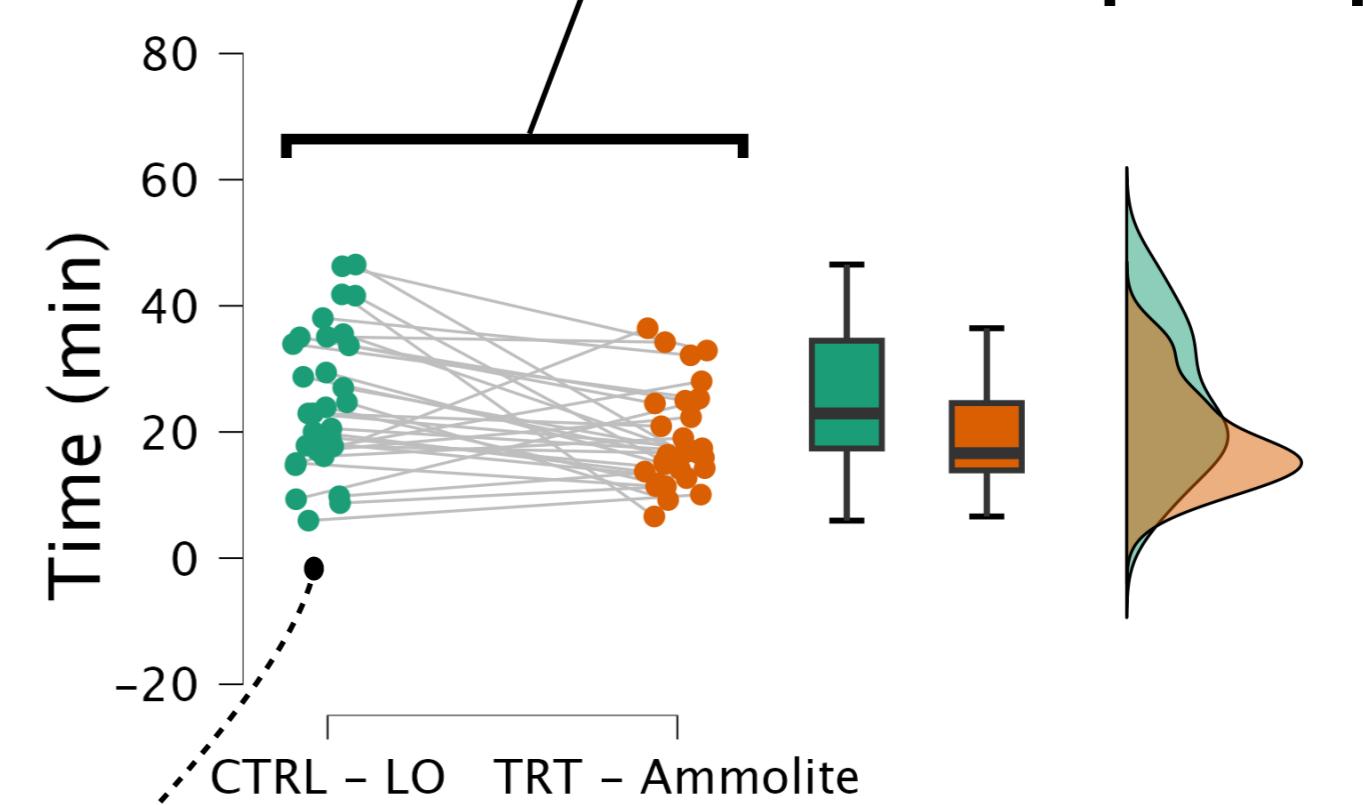
GROUP 1

Negative difference



GROUP 2

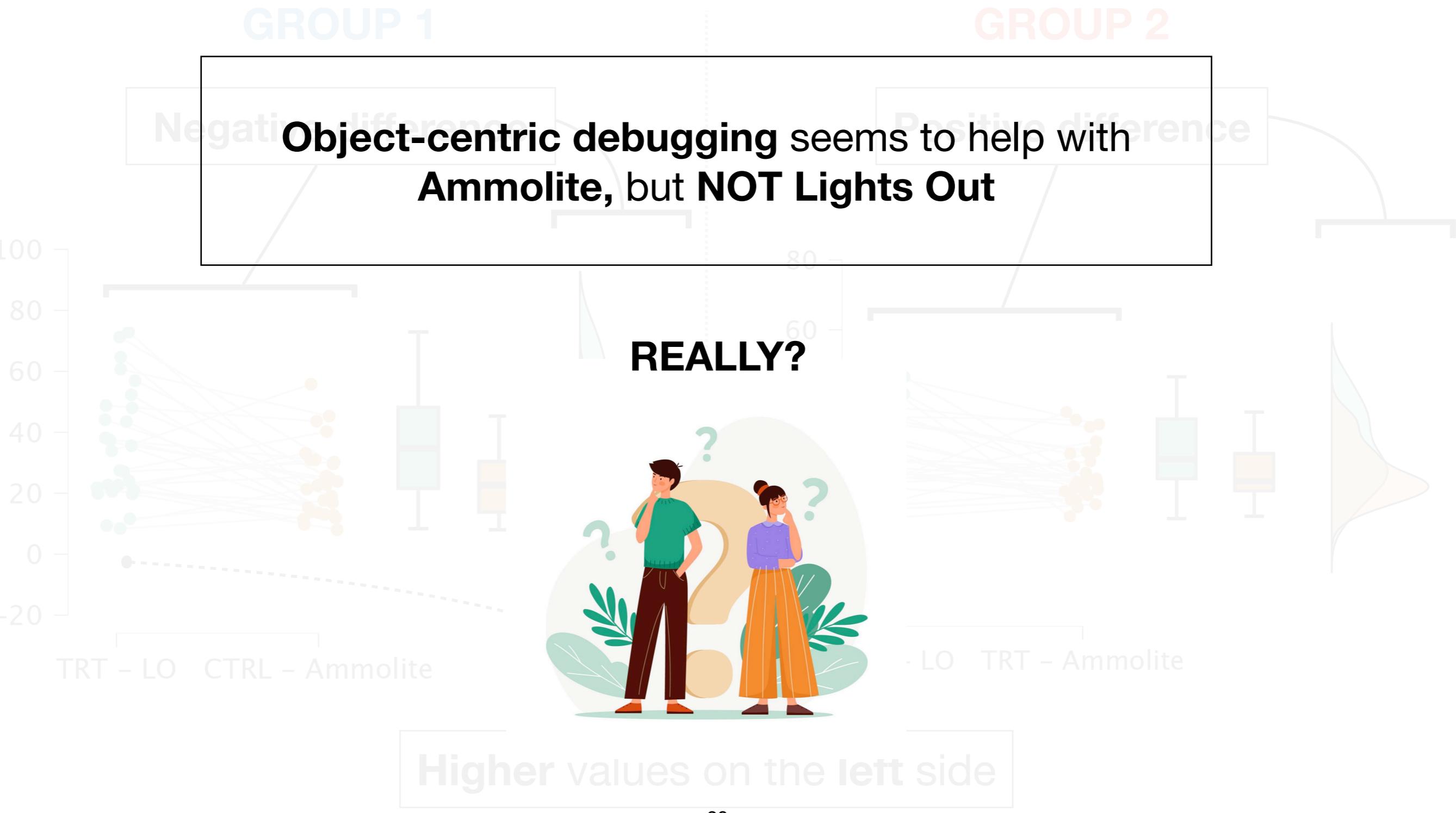
Positive difference



Higher values on the left side

Empirical evaluation: object-centric debugging

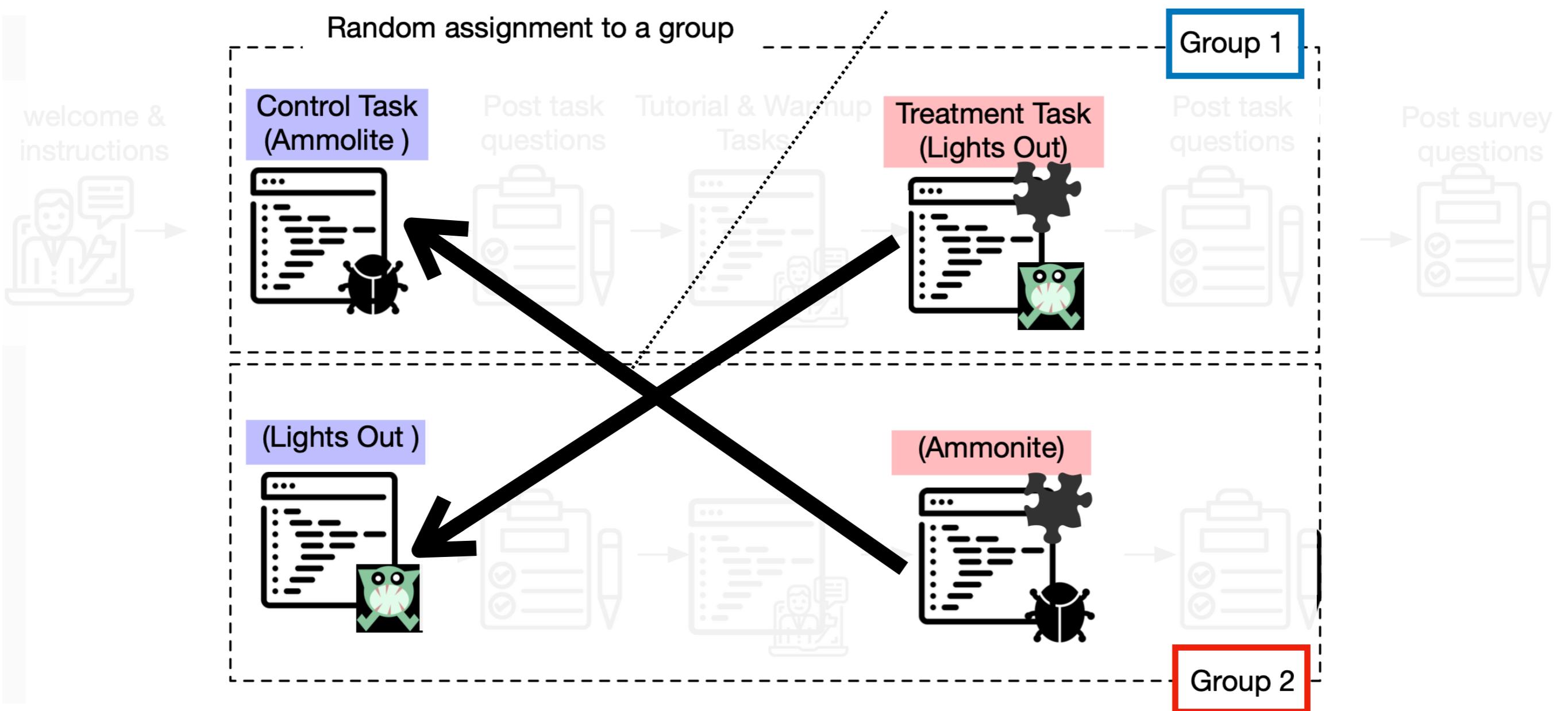
Per-group, task-sequence analysis



Empirical evaluation: object-centric debugging

Work-in-progress

Per-task analysis

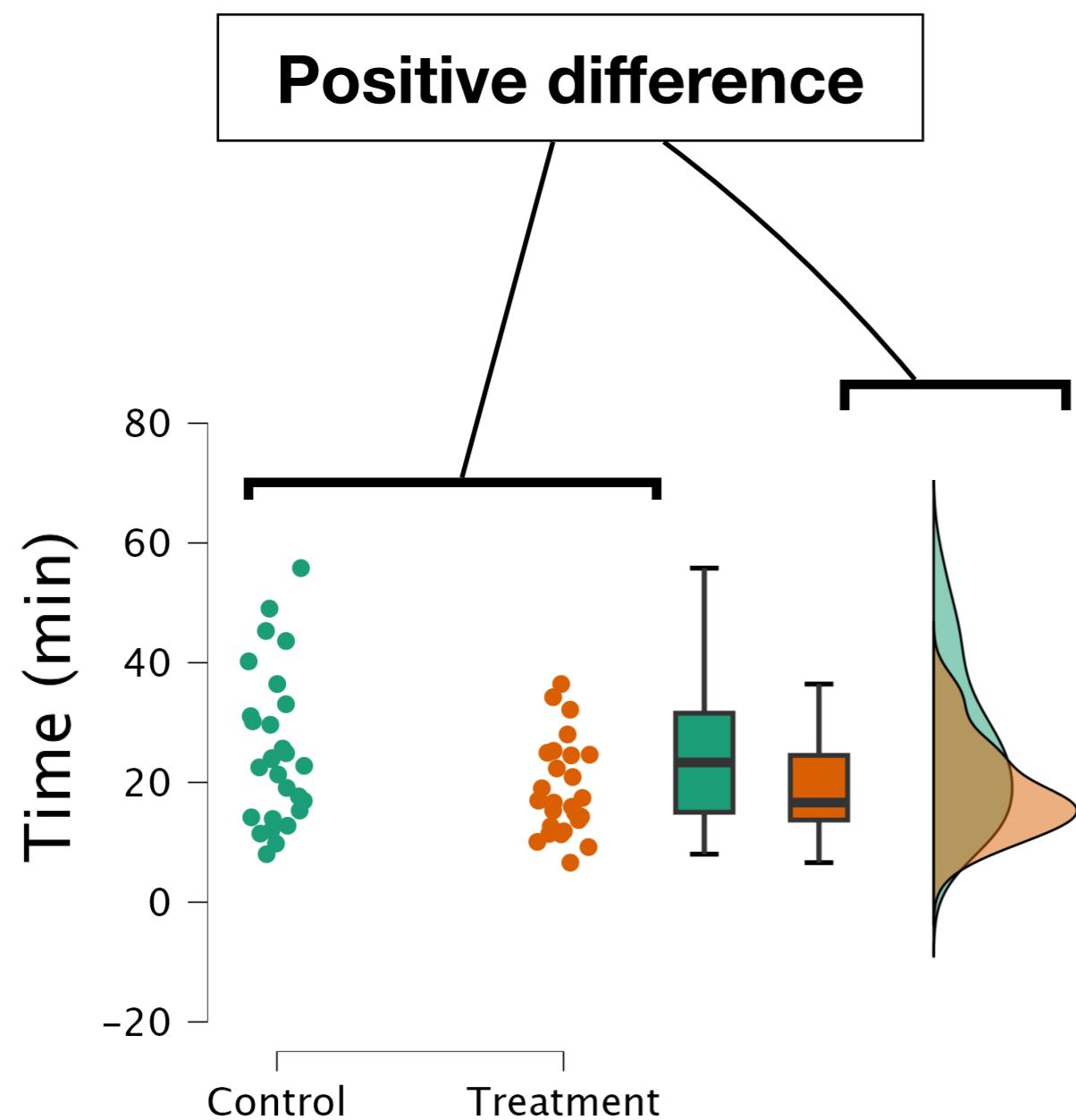


Object-centric breakpoints

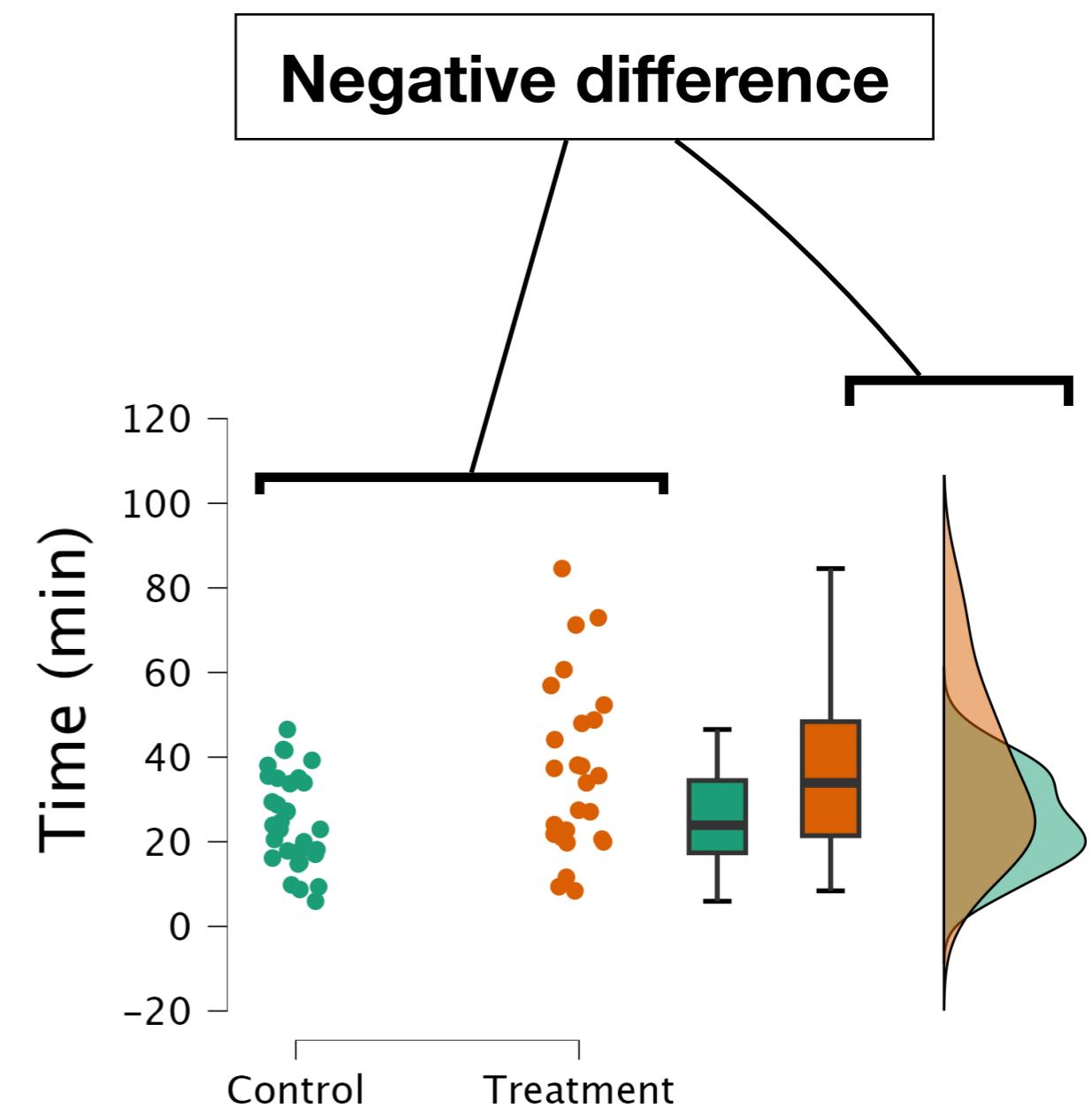
Empirical evaluation: object-centric debugging

Per-task analysis

AMMOLITE



LIGHTS OUT

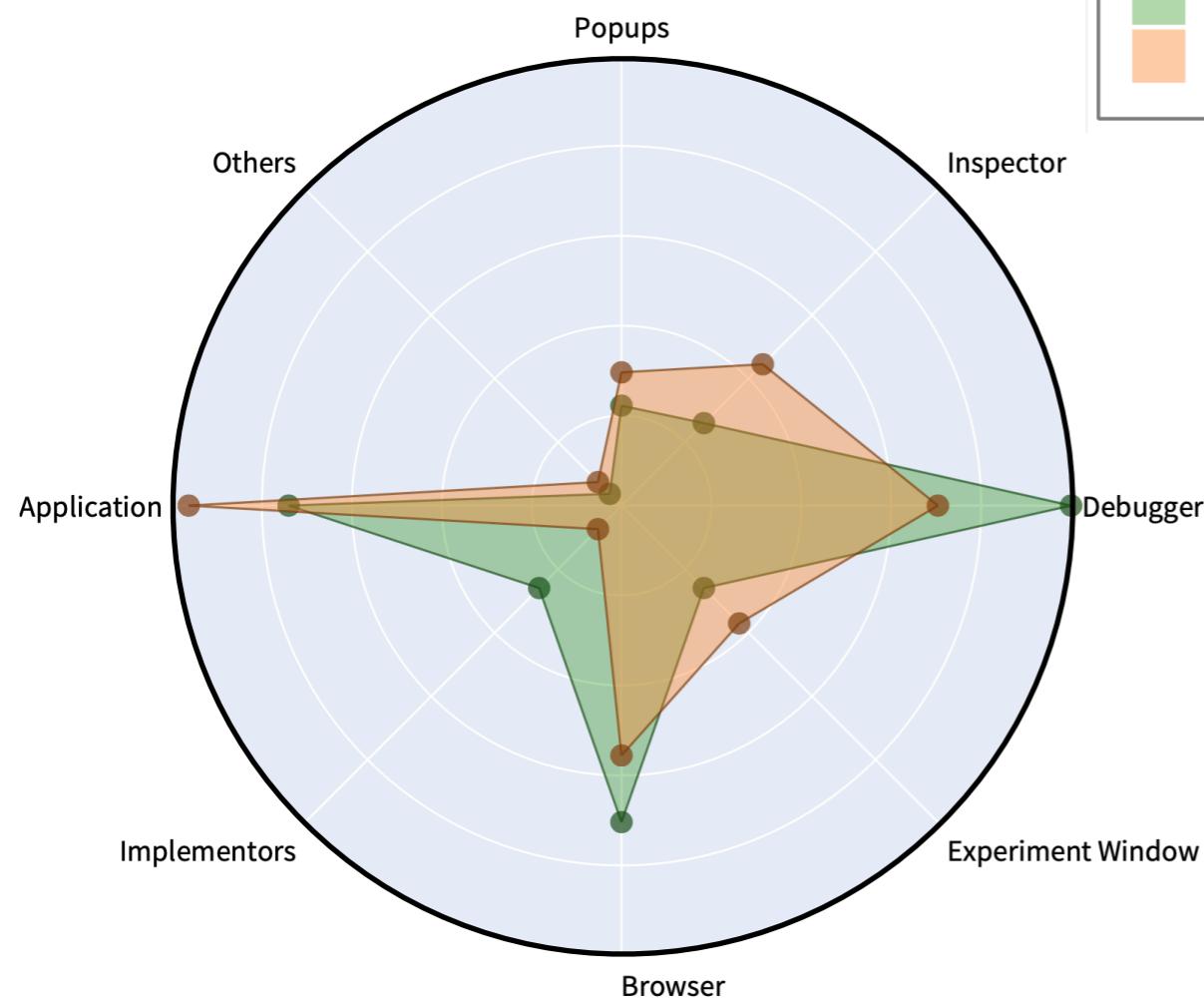


Empirical evaluation: object-centric debugging

What causes this difference?

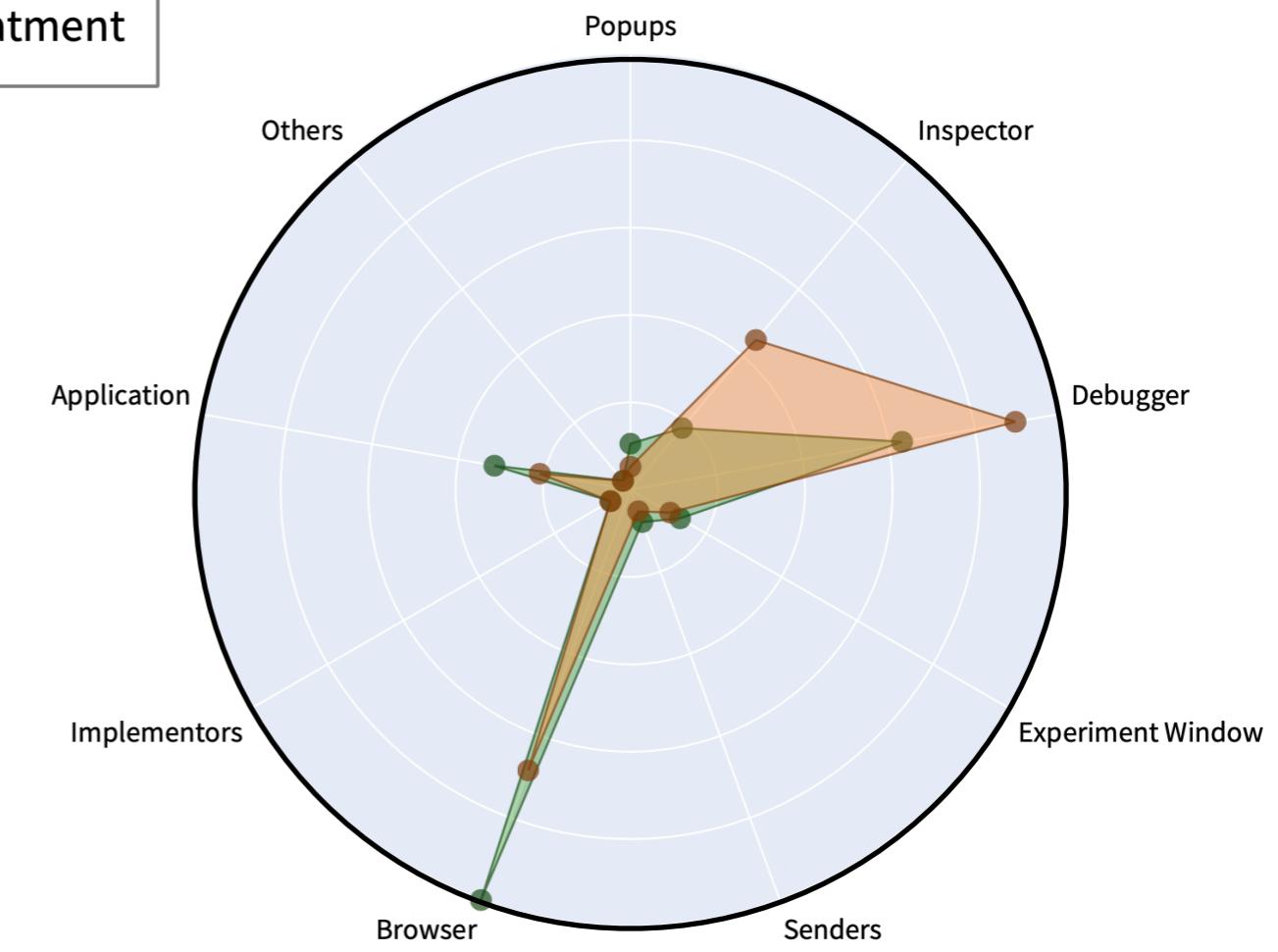
AMMOLITE

Positive difference



LIGHTS OUT

Negative difference

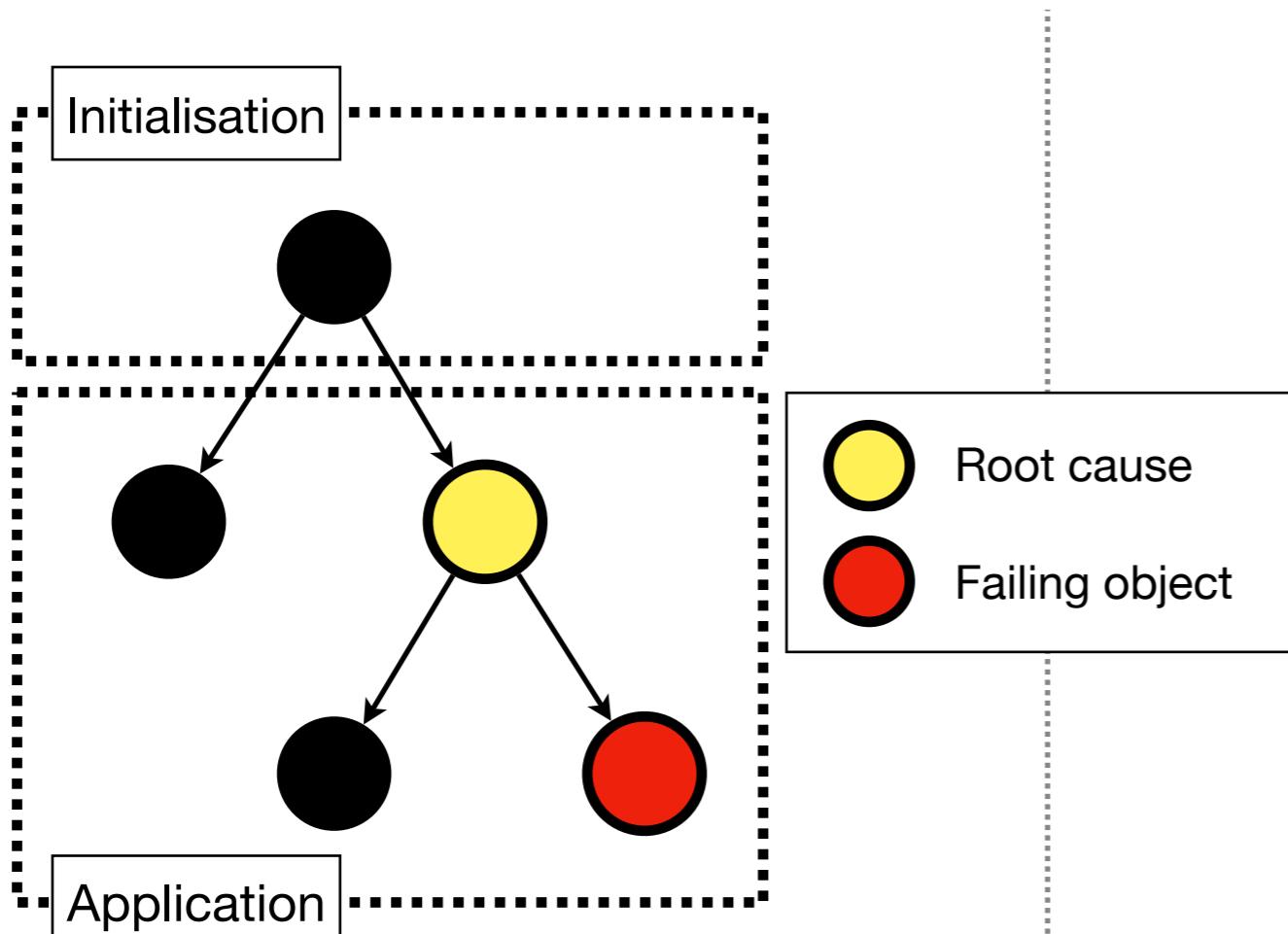


Code Browser more efficient than the debugger for Lights Out?

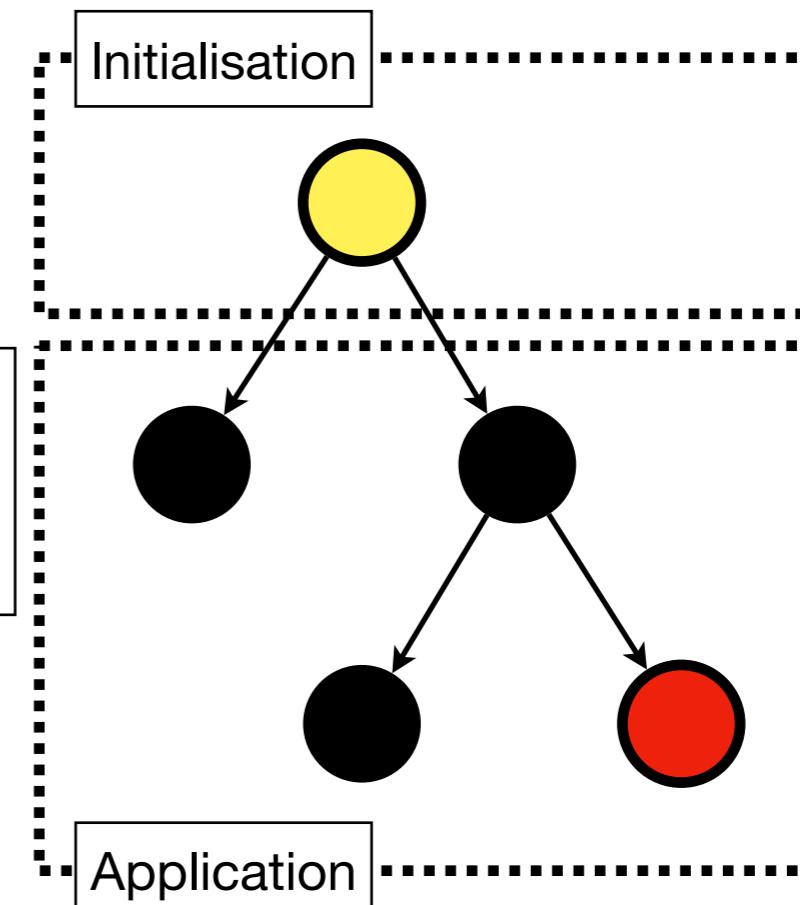
Empirical evaluation: object-centric debugging

What causes this difference?

AMMOLITE



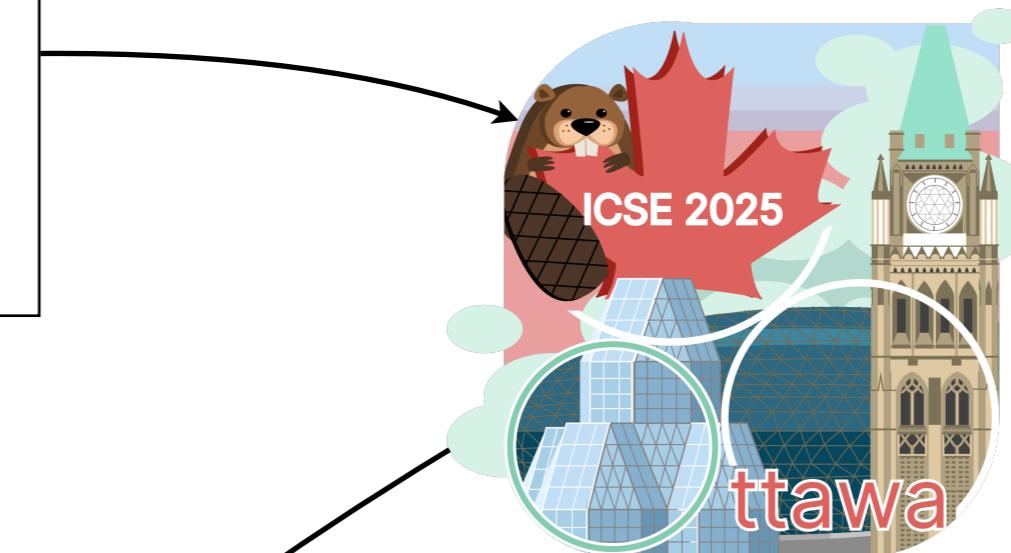
LIGHTS OUT



Bugs with a **different nature**
(reported by a dozen participants)

What's next?

A deep dive in the data:
• **Per-expertise** analysis
• **Robustness** analysis



International Conference
on
Software Engineering

New **object-centric** tools
&
New experiments

Object-Centric Debugging

Empirical experiment - preliminary results

Valentin Bourcier, Steven Costiou, Pooja Rani, Alberto Bacchelli

ESUG - 11 July 2024