

# On the Critical Role of Conventions in Adaptive Human-AI Collaboration

Andy Shih, Arjun Sawhney, Jovana Kondic, Stefano Ermon, Dorsa Sadigh





WYATT

1

Wilson





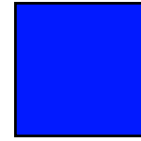
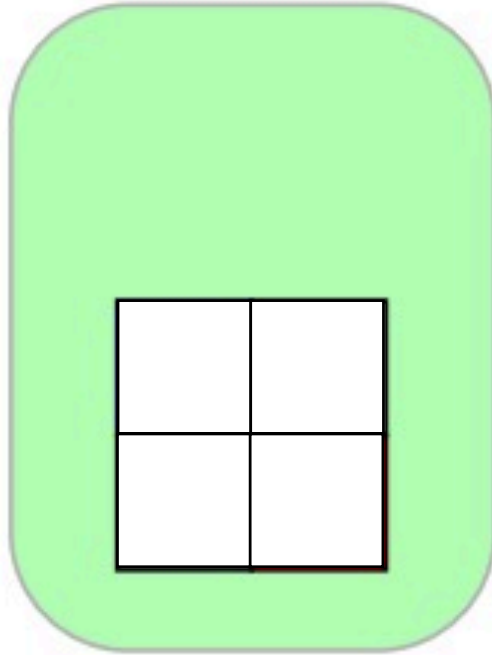
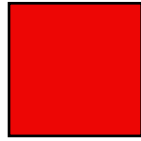




Multiagent collaboration requires knowing 2 things:

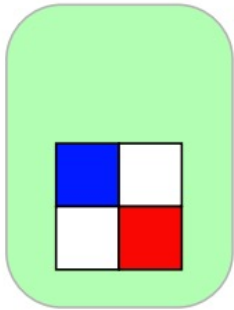
1. How to **be good at the task**
2. How to **coordinate with partners**

# Goal

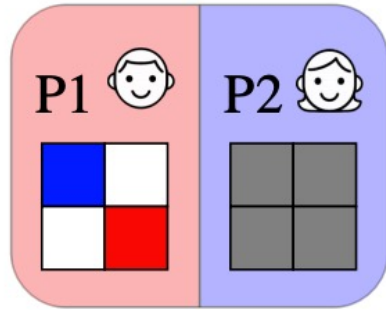


# Collaborative Block Placing

Goal



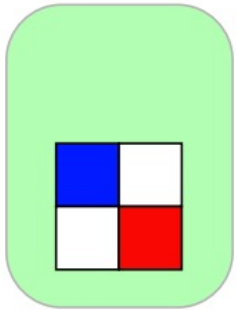
Visibility



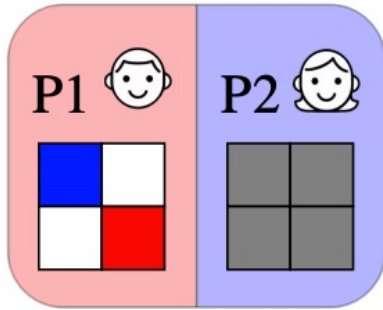


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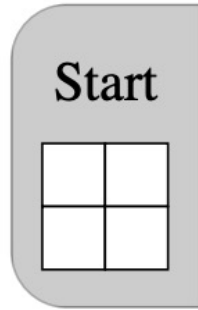
Goal



Visibility



Start

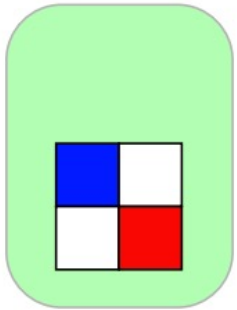


Working Grid

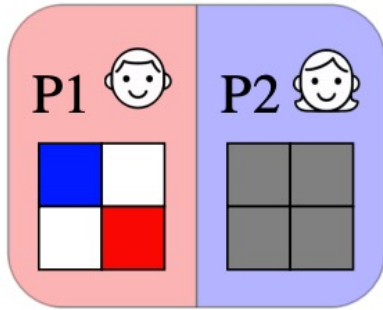


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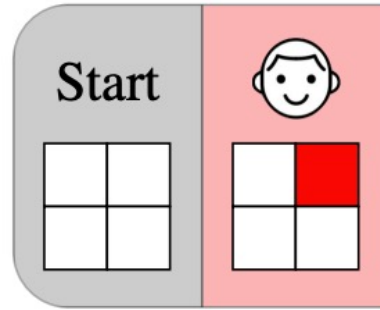
Goal



Visibility



Start

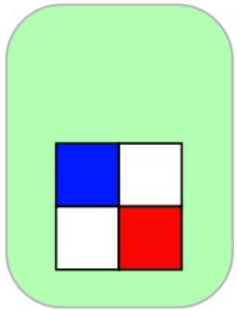


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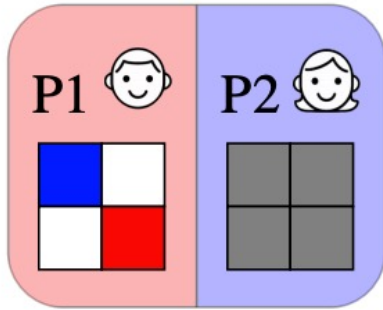


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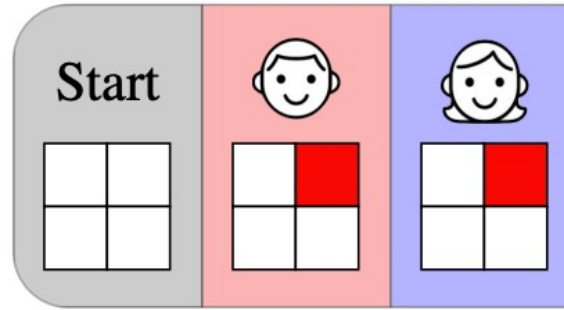
Goal



Visibility

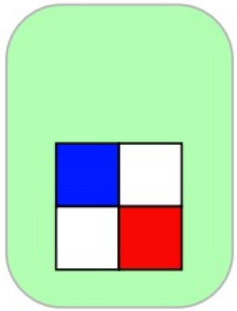


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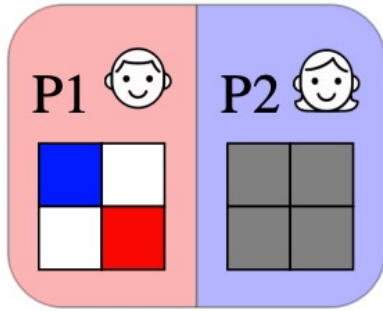


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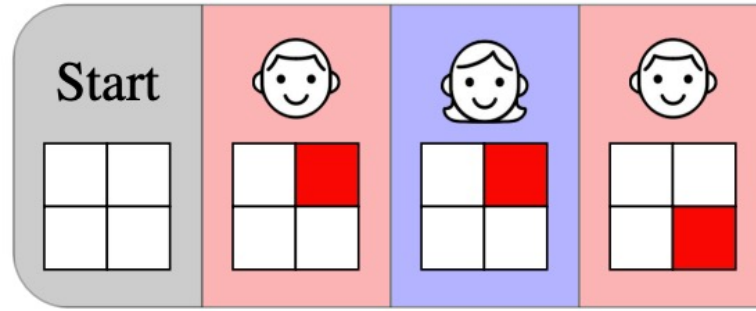
Goal



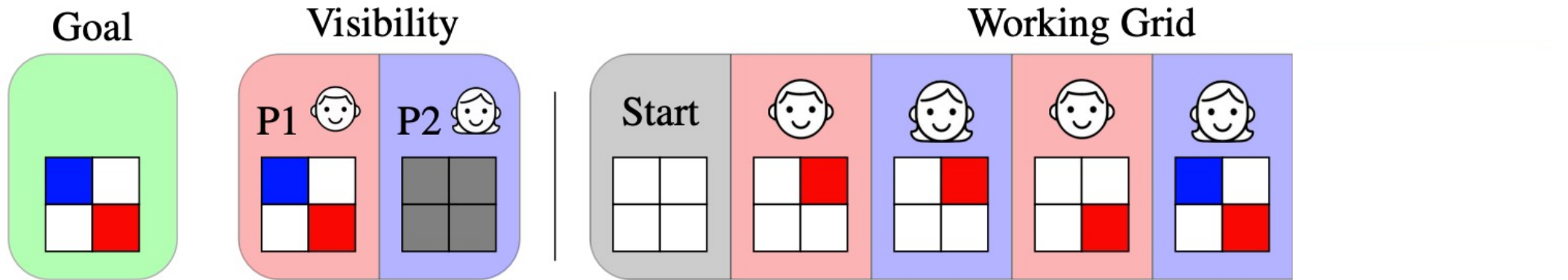
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Working Grid



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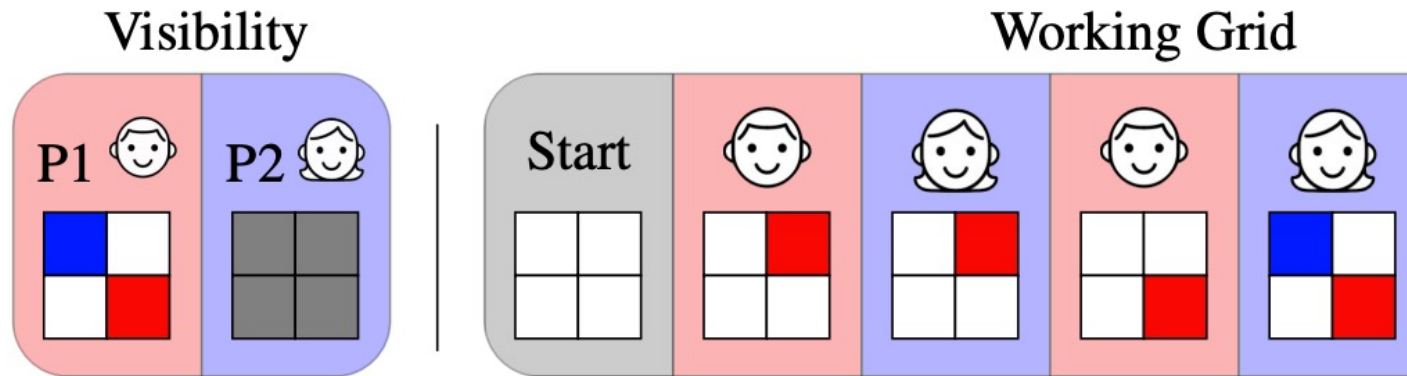
# For Player 1

**Rule:**

Placing red block correctly

**Convention:**

Signaling location of blue block



Multiagent collaboration requires knowing 2 things:

1. How to be good at the task

**Rules**

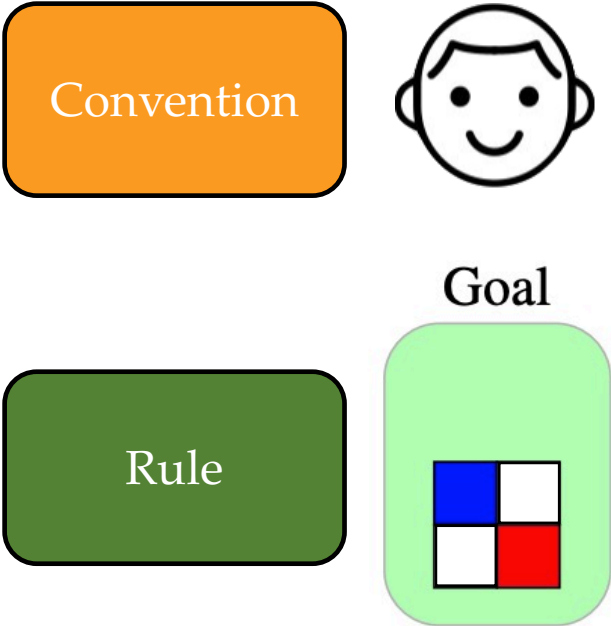
2. How to coordinate with partners

**Conventions**

**Conventions:** Shared representation that  
*breaks symmetry* between equally optimal strategies  
(developed over repeated interactions)



# Generalization: New Partner (Fixed Task)



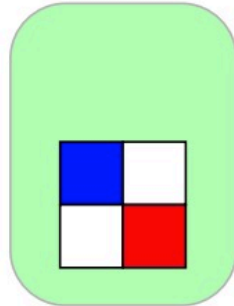
# Generalization: New Partner (Fixed Task)

Convention

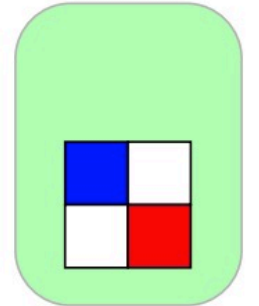


Goal

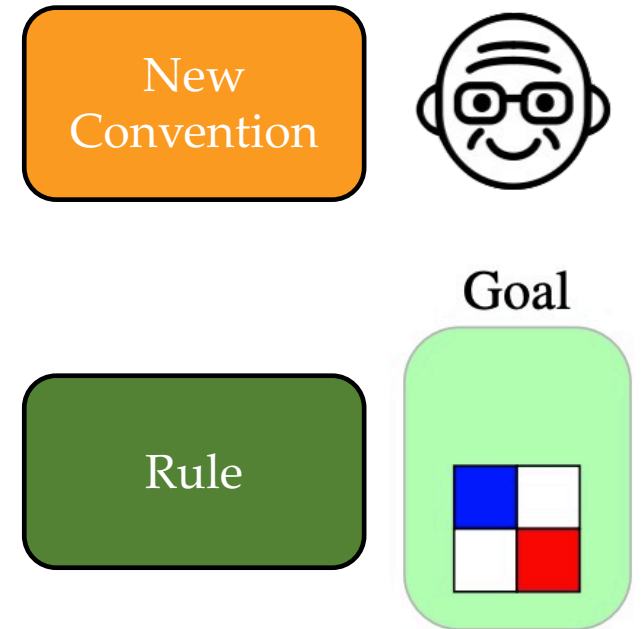
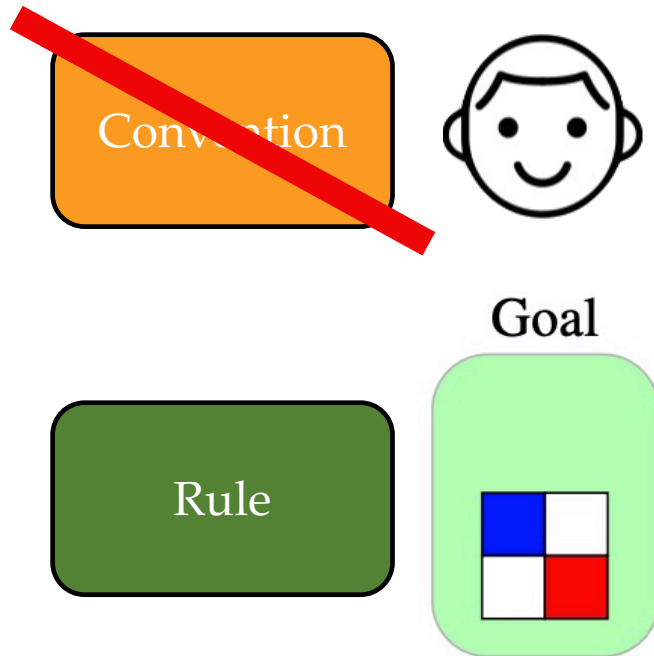
Rule



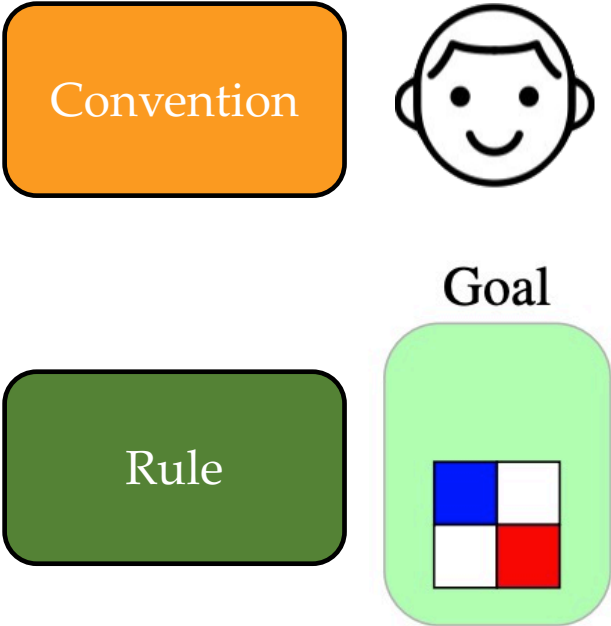
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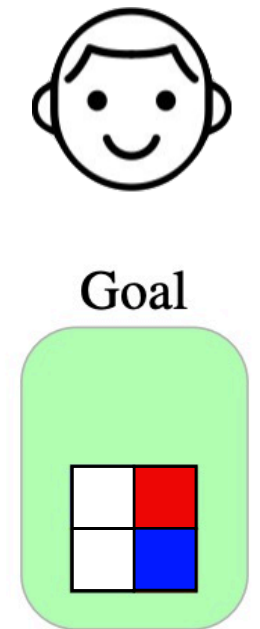
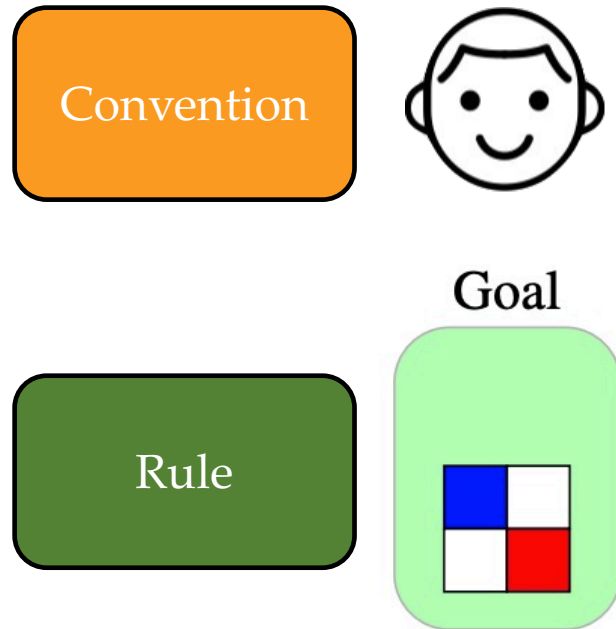
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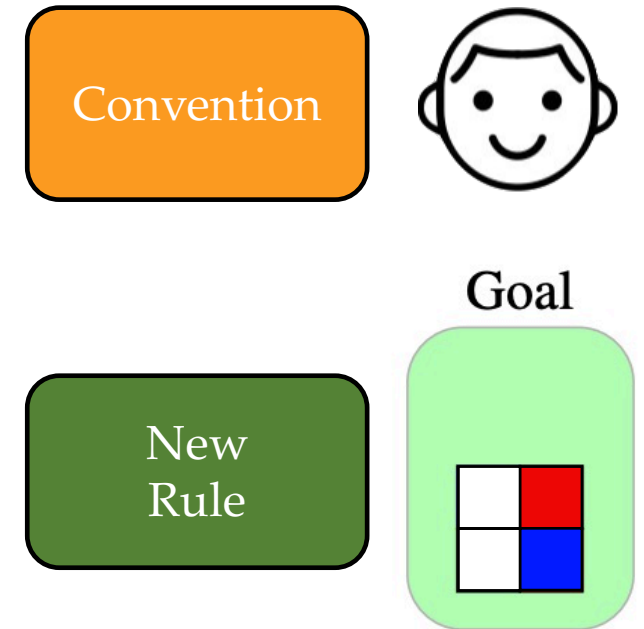
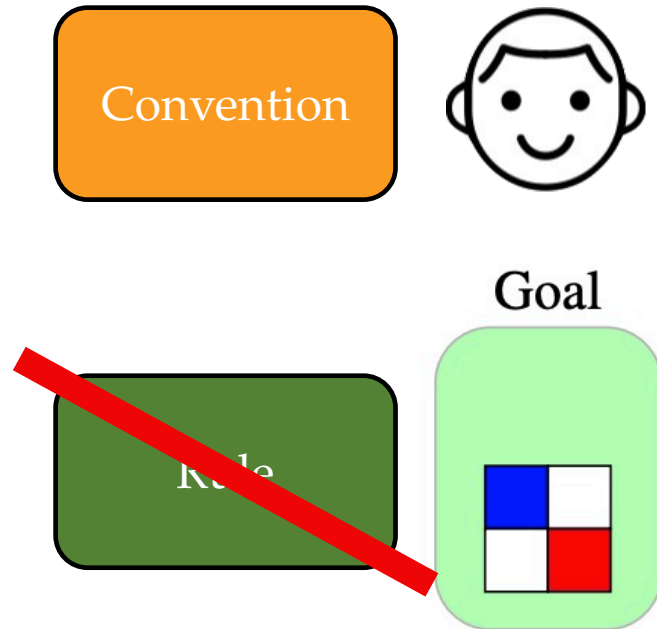
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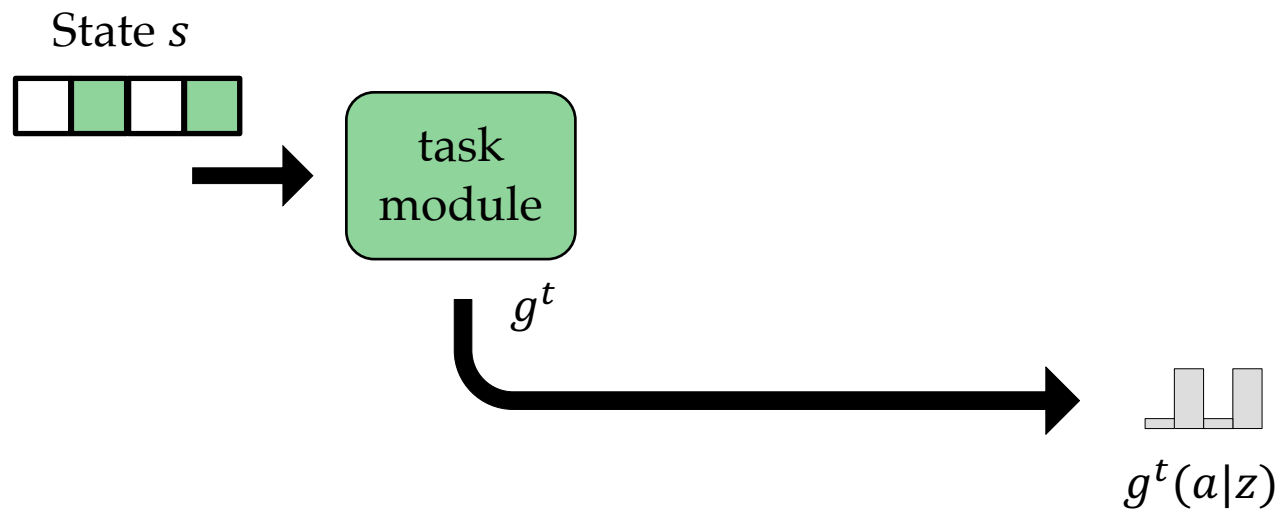


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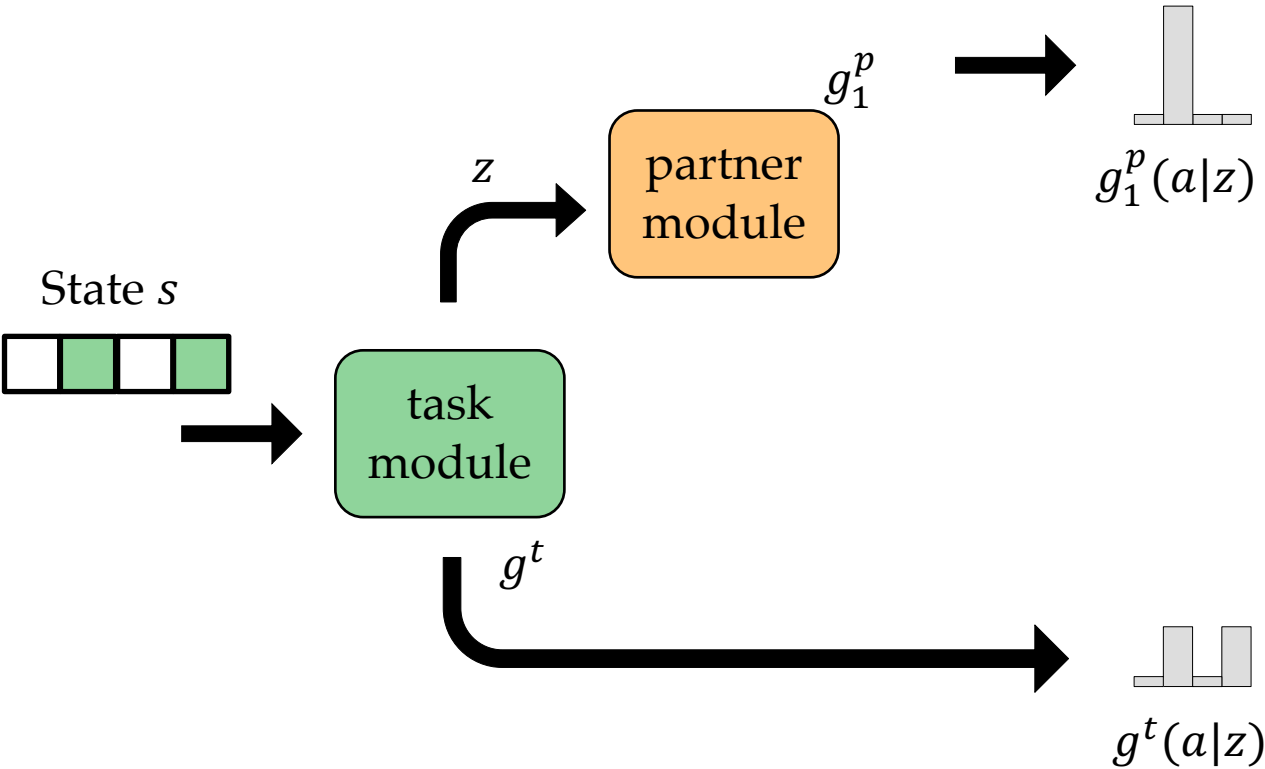
We need a modular architecture  
to work with new combinations of partners and tasks.

# Modular Architecture

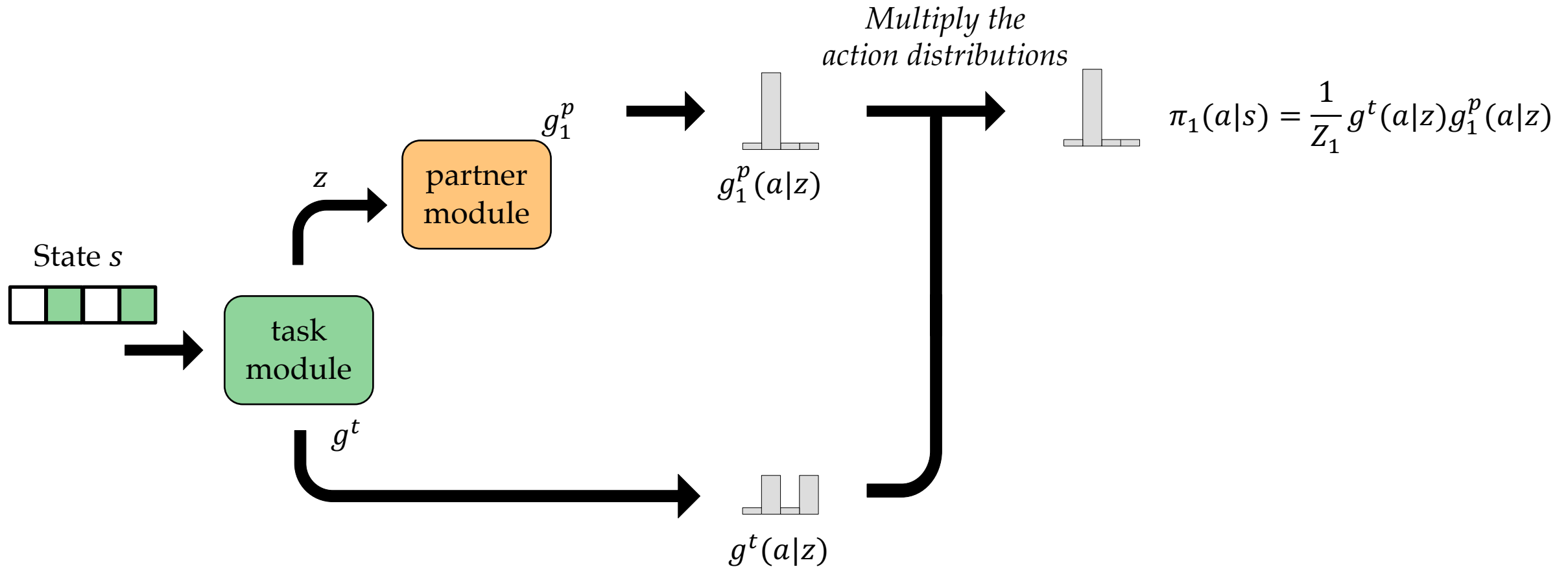




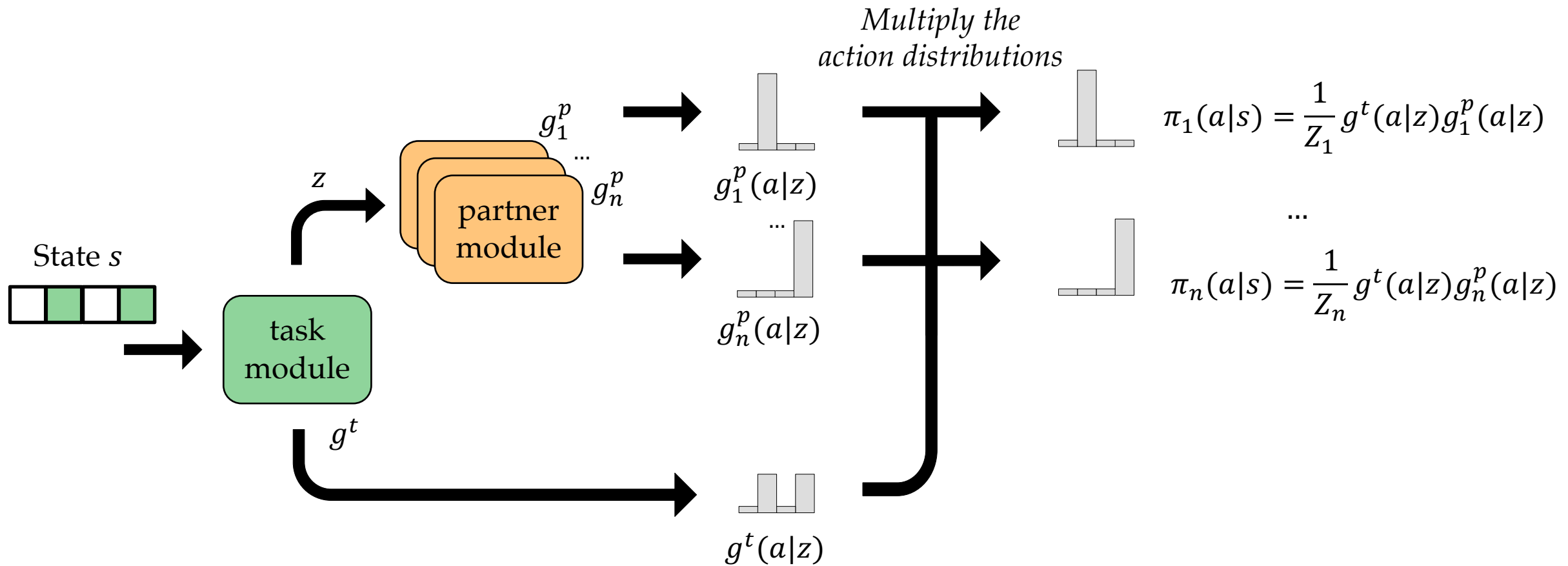
# Modular Architecture



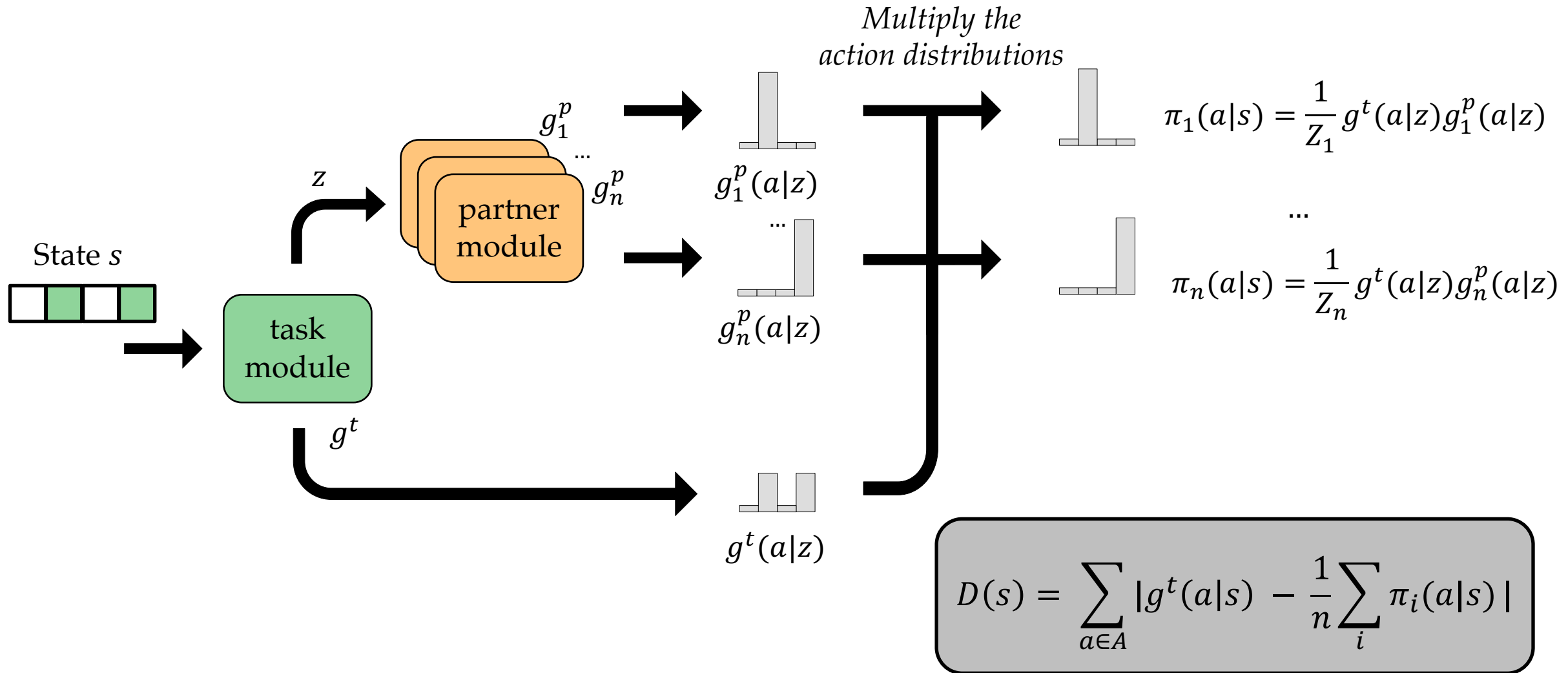
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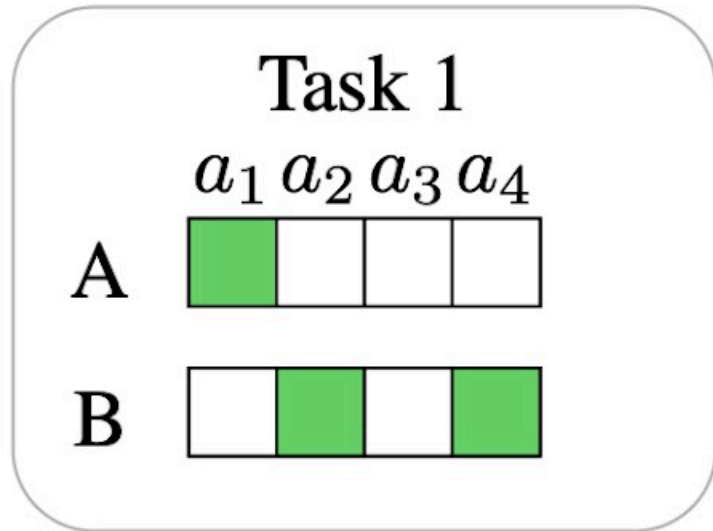


# Modular Architecture



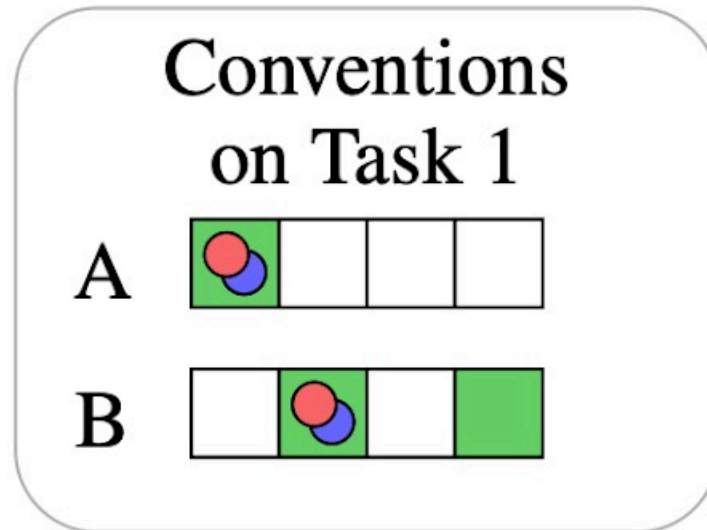
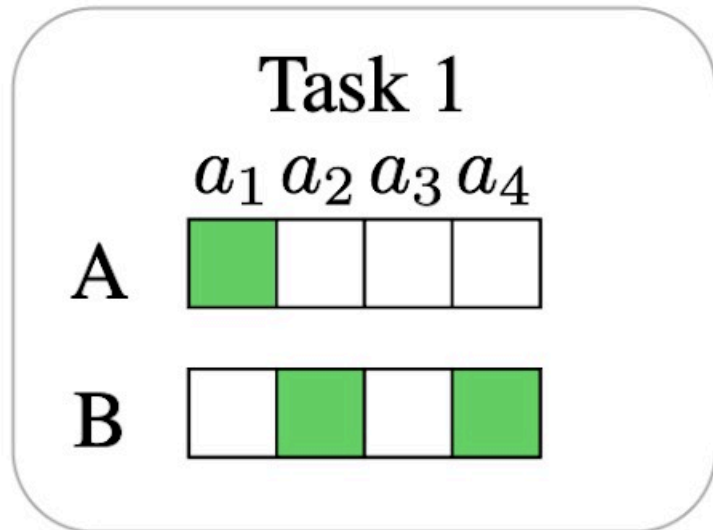


# Collaborative Contextual Bandit



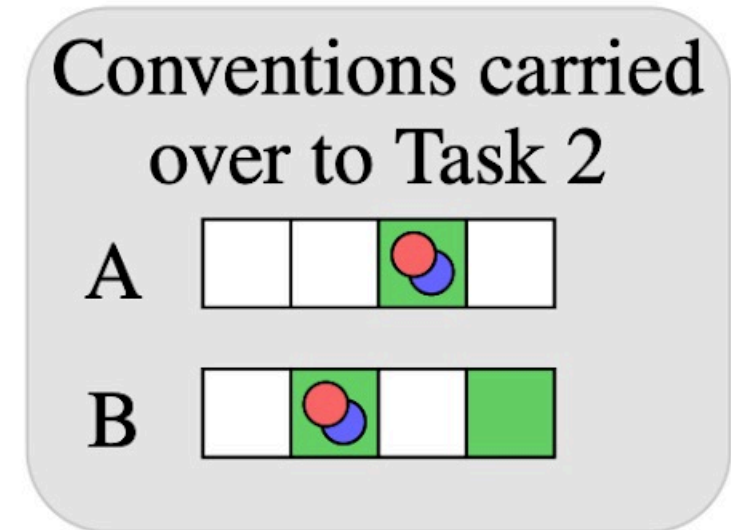
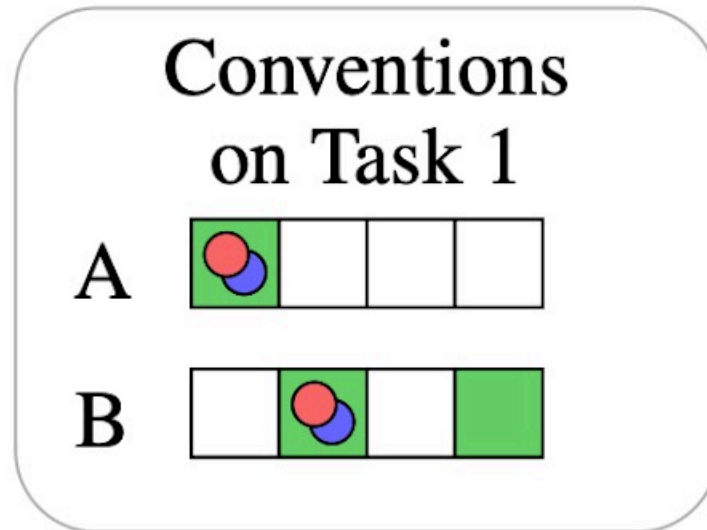
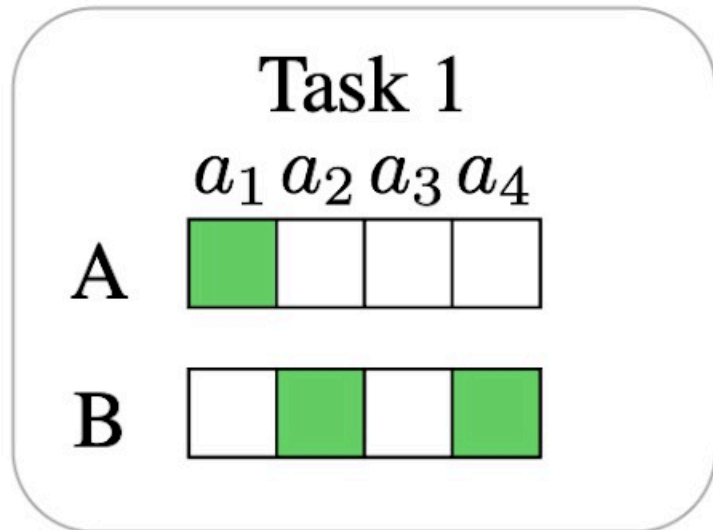
In each context (A and B), each partner independently picks one of the green boxes. Scores a point if the same green box is chosen.

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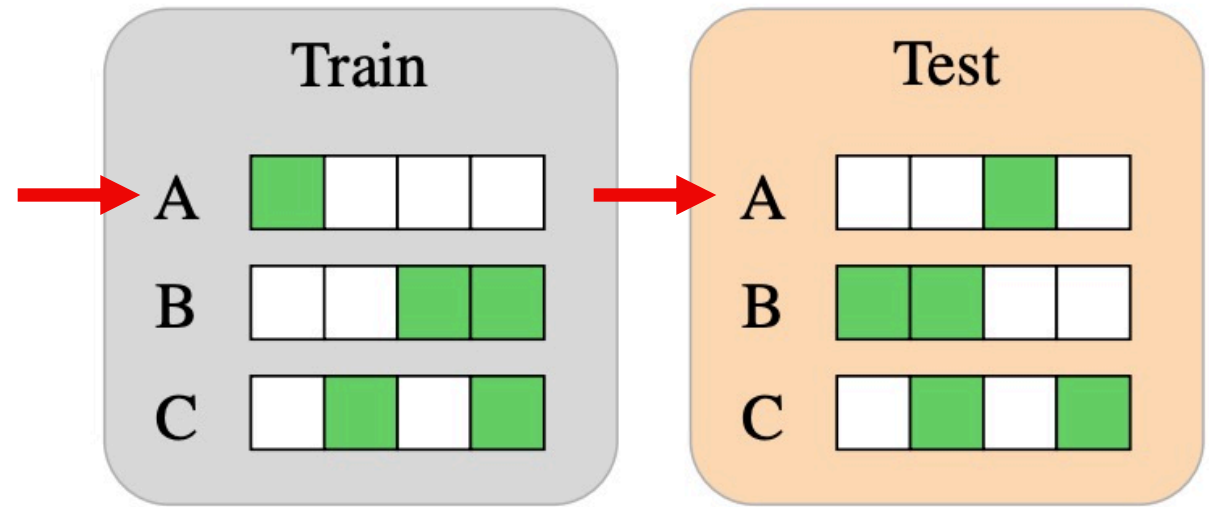
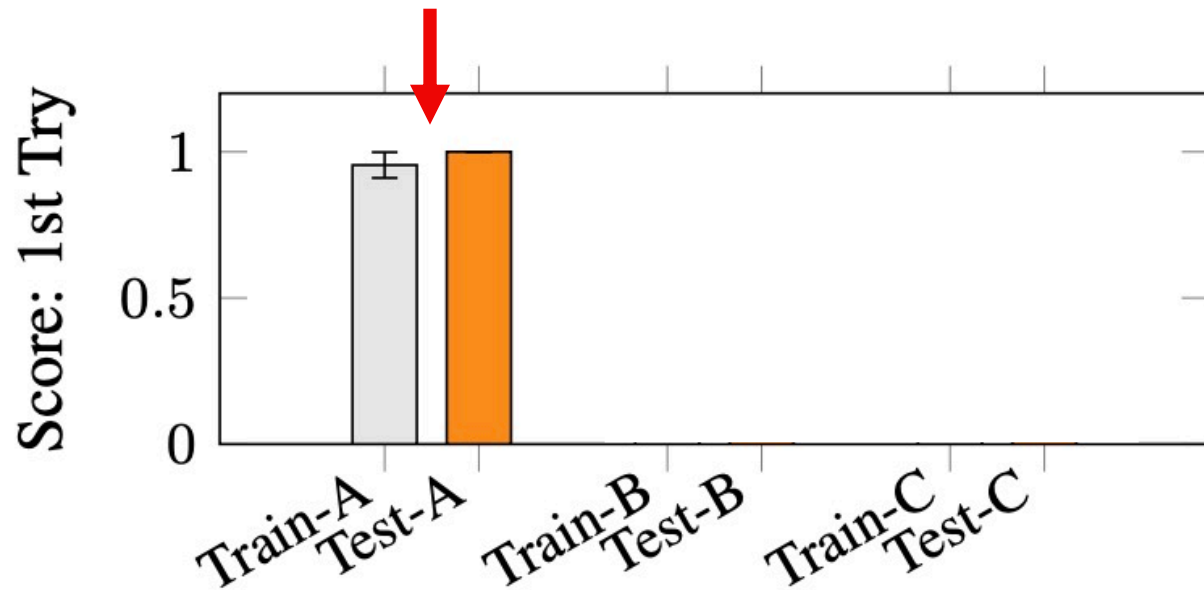
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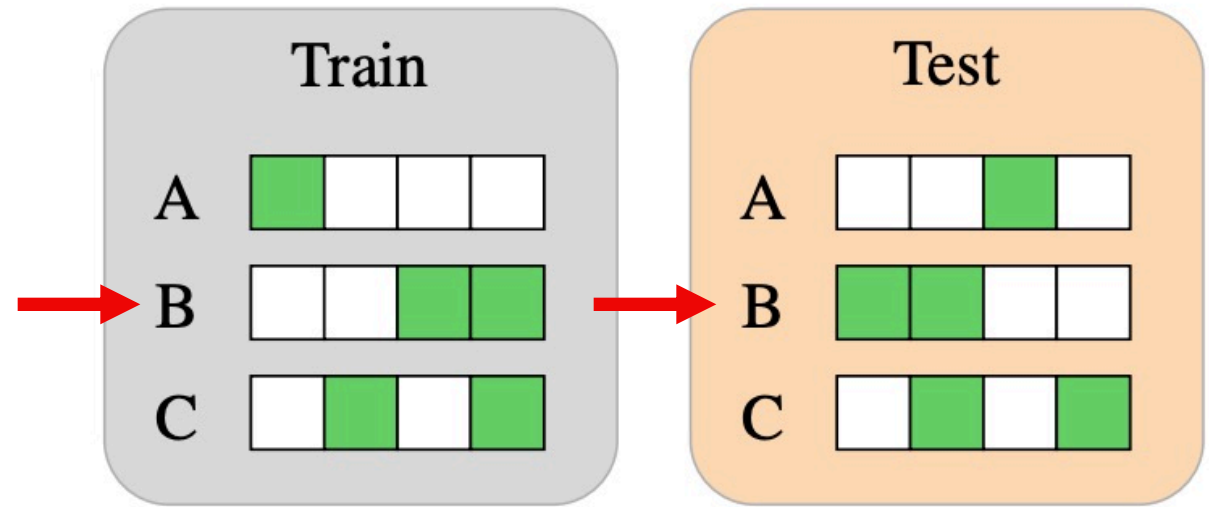
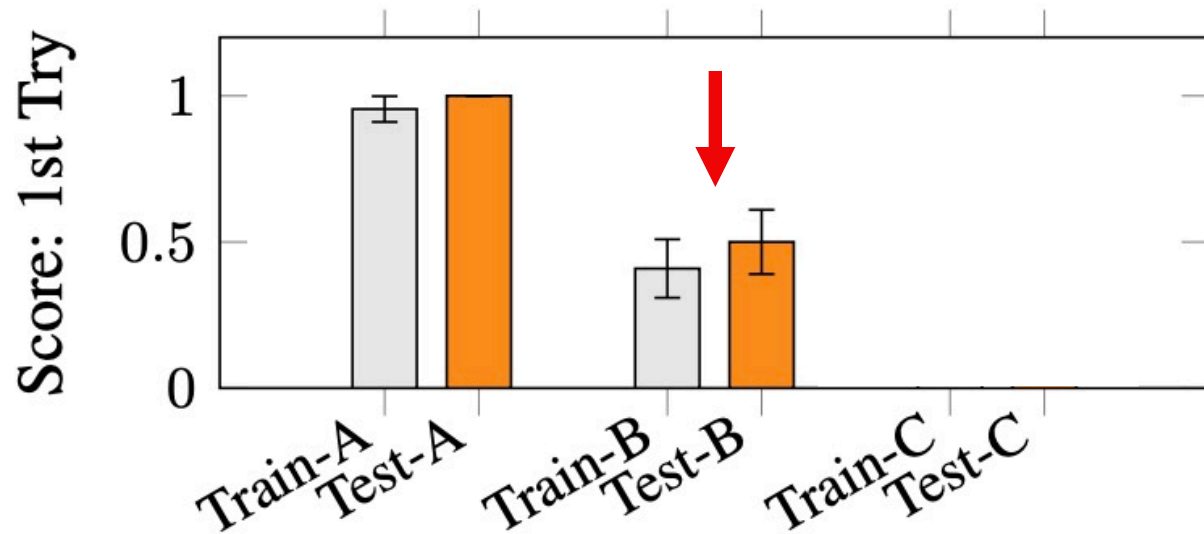


# Human Study



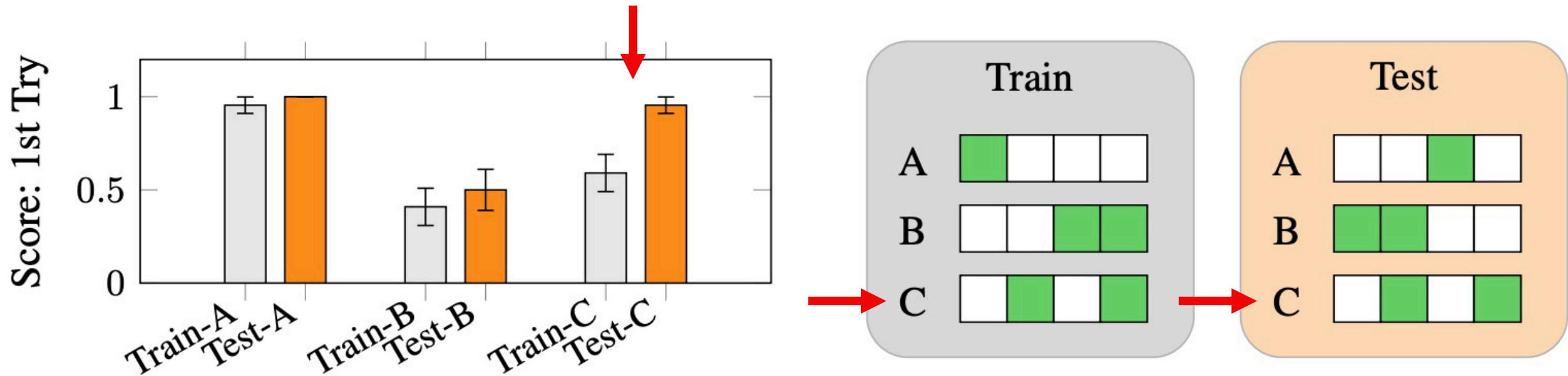
In context A, there is only one choice. No conventions needed.

# Human Study



In context B, it is unclear how to carry over conventions.

# Human Study



In context C, conventions successfully carry over to test task.

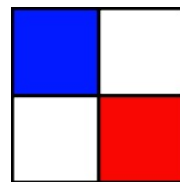
# Adapting to new partner

Ours: **Colored** lines  
Baselines: **Grey** lines  
Higher is better

arms



blocks



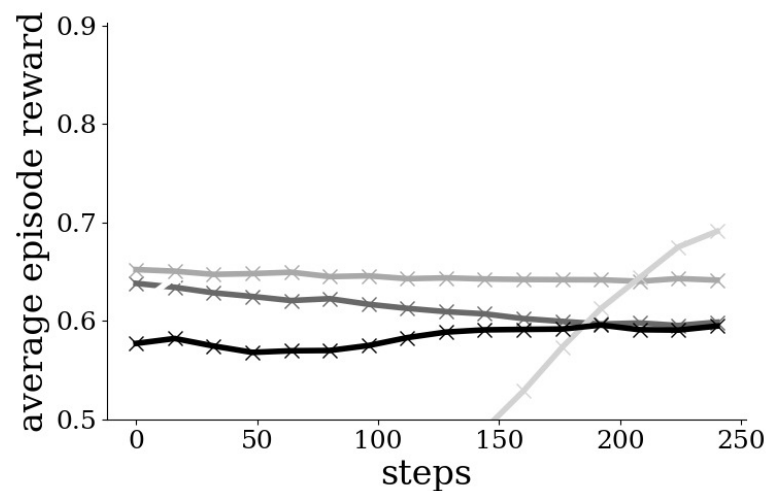
Hanabi



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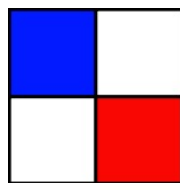
Our Method    BaselineAgg    BaselineAgg EarlyStopping    BaselineModular    FOMAML



arms



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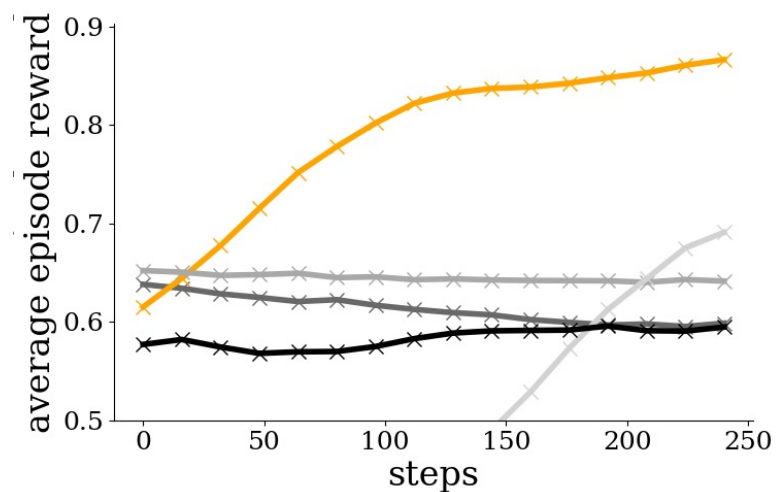
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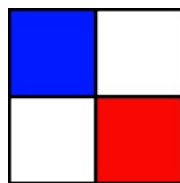
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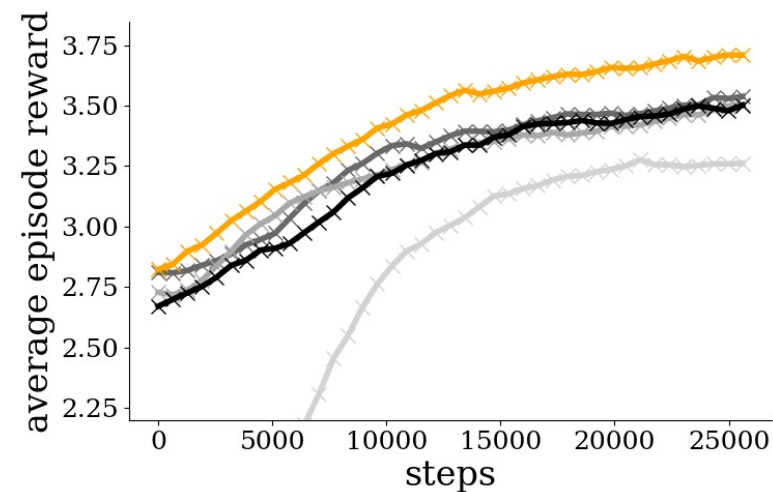
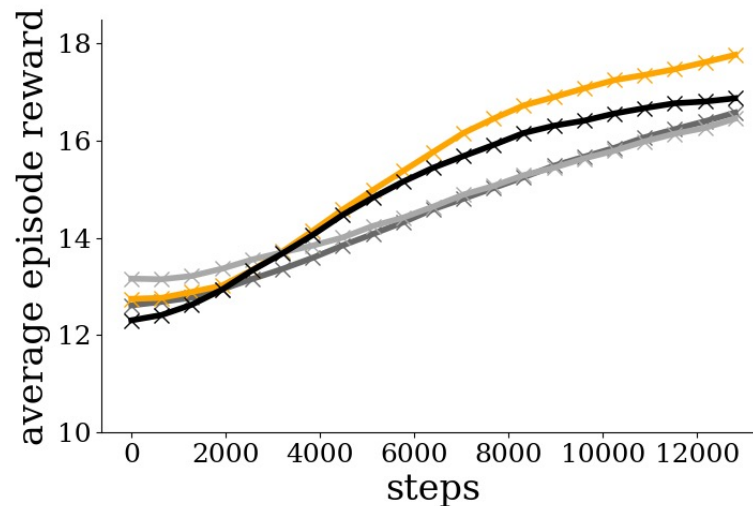
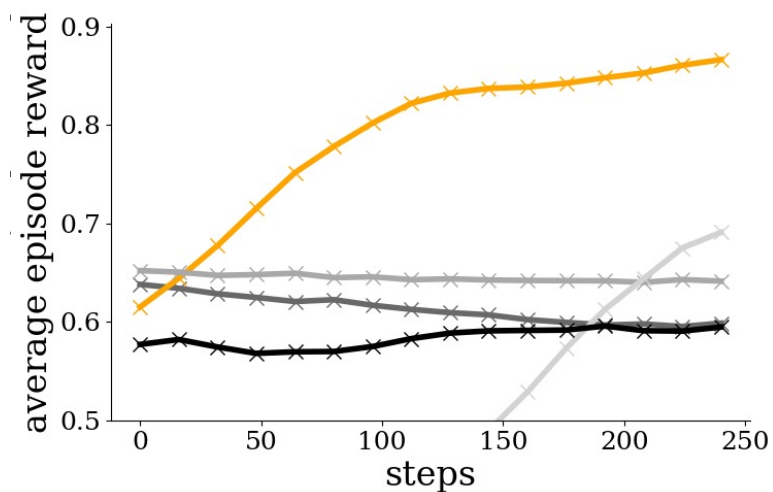
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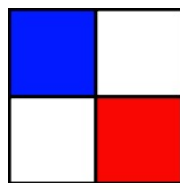
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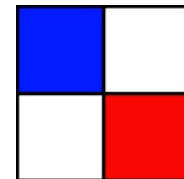
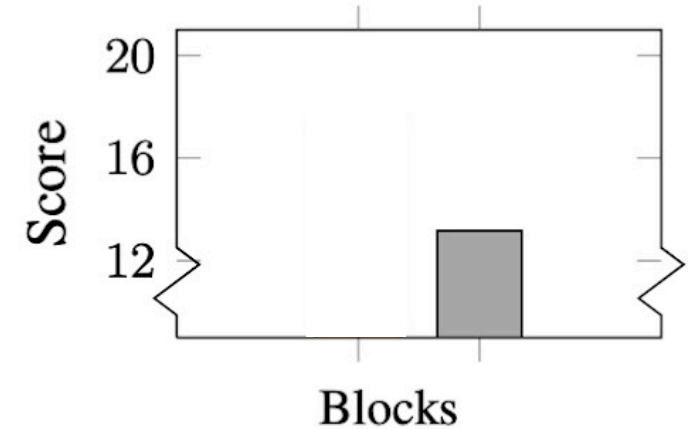
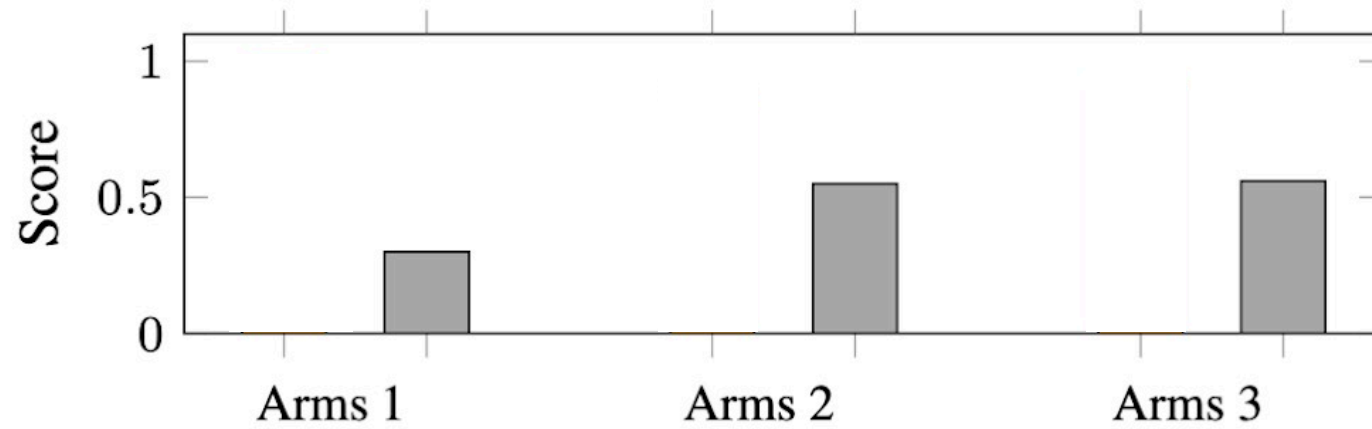


Hanabi



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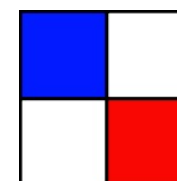
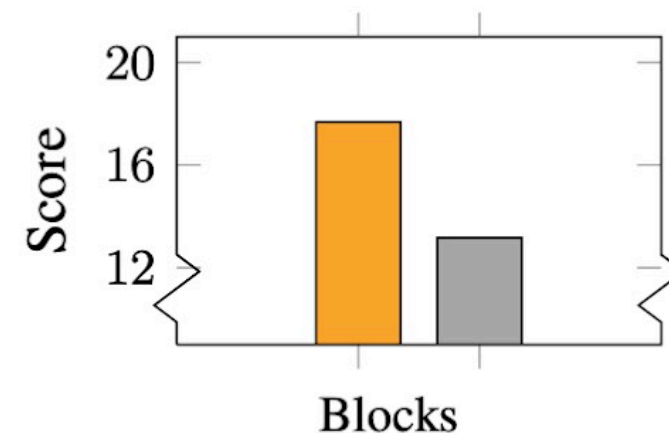
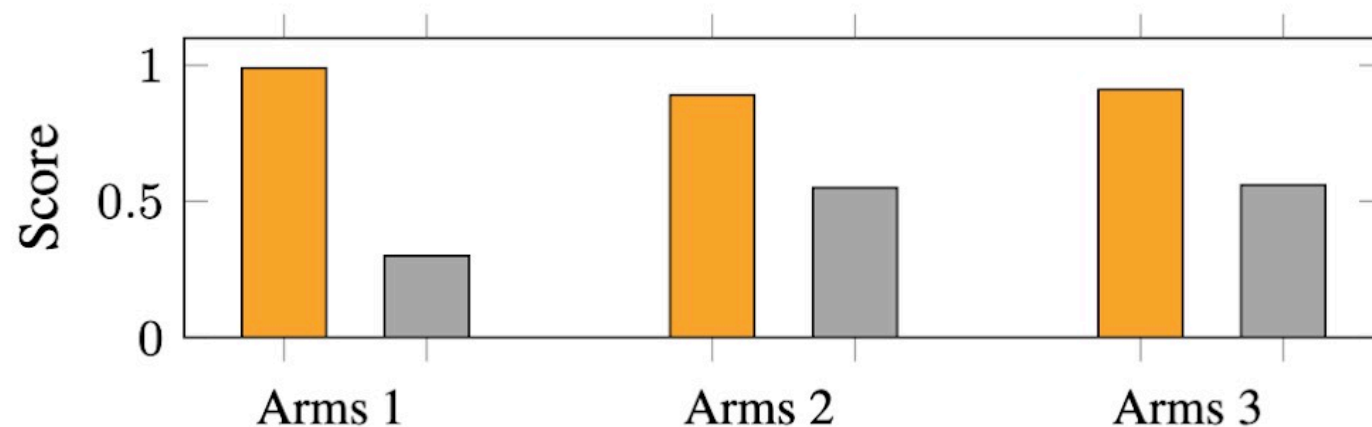
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# Takeaways

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Collaborative tasks involve a combination of **rules** and **conventions**.

**Rules** carry over to different **partners**;

**Conventions** carry over to different **tasks**;

Learn separate composable representations for **rules** and **conventions** to quickly adapt to new **tasks** and **partners**.