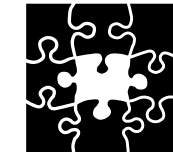




UNIVERSITEIT VAN AMSTERDAM

Improving sample efficiency with expert communication

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Abstract

We introduce an agent that uses **discrete communication** to guide other agents in a simulated environment. The developed language is **trainable**, **emergent** and requires **no additional supervision**. It **speeds up** learning of new agents, **generalizes** across incrementally more difficult tasks and, contrary to most other emergent languages, is highly **interpretable**. We also experiment with **co-evolution of language and agents** and with **intermittent communication**.

BabyAI Framework

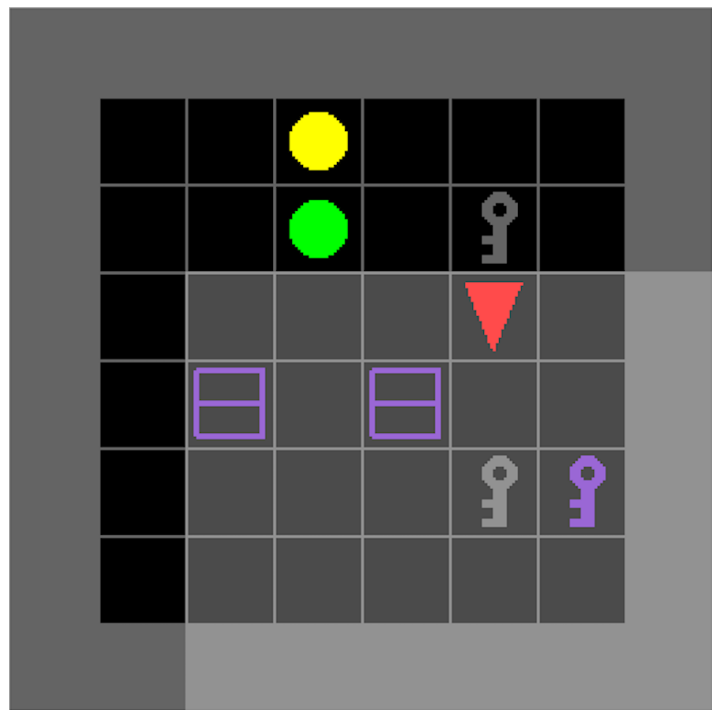


Figure 1: GoToLocal, ‘go to the

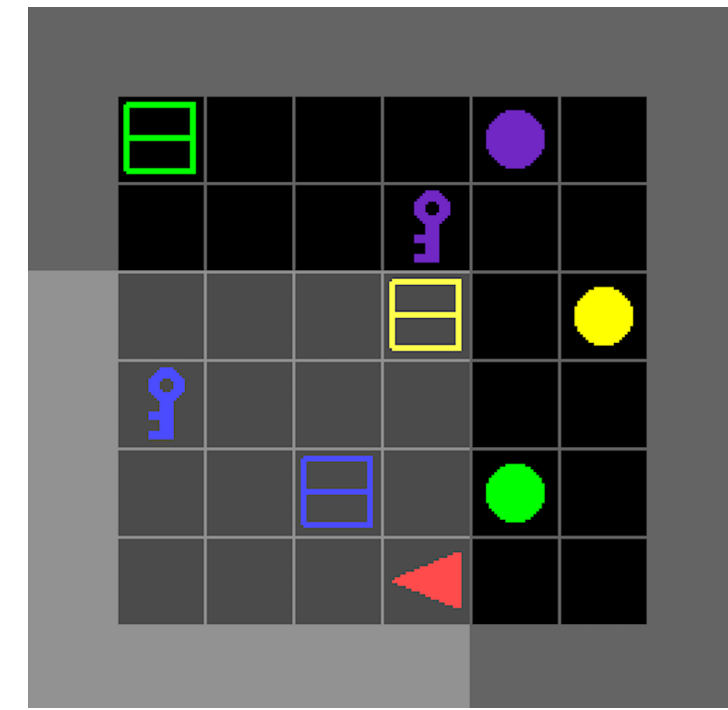
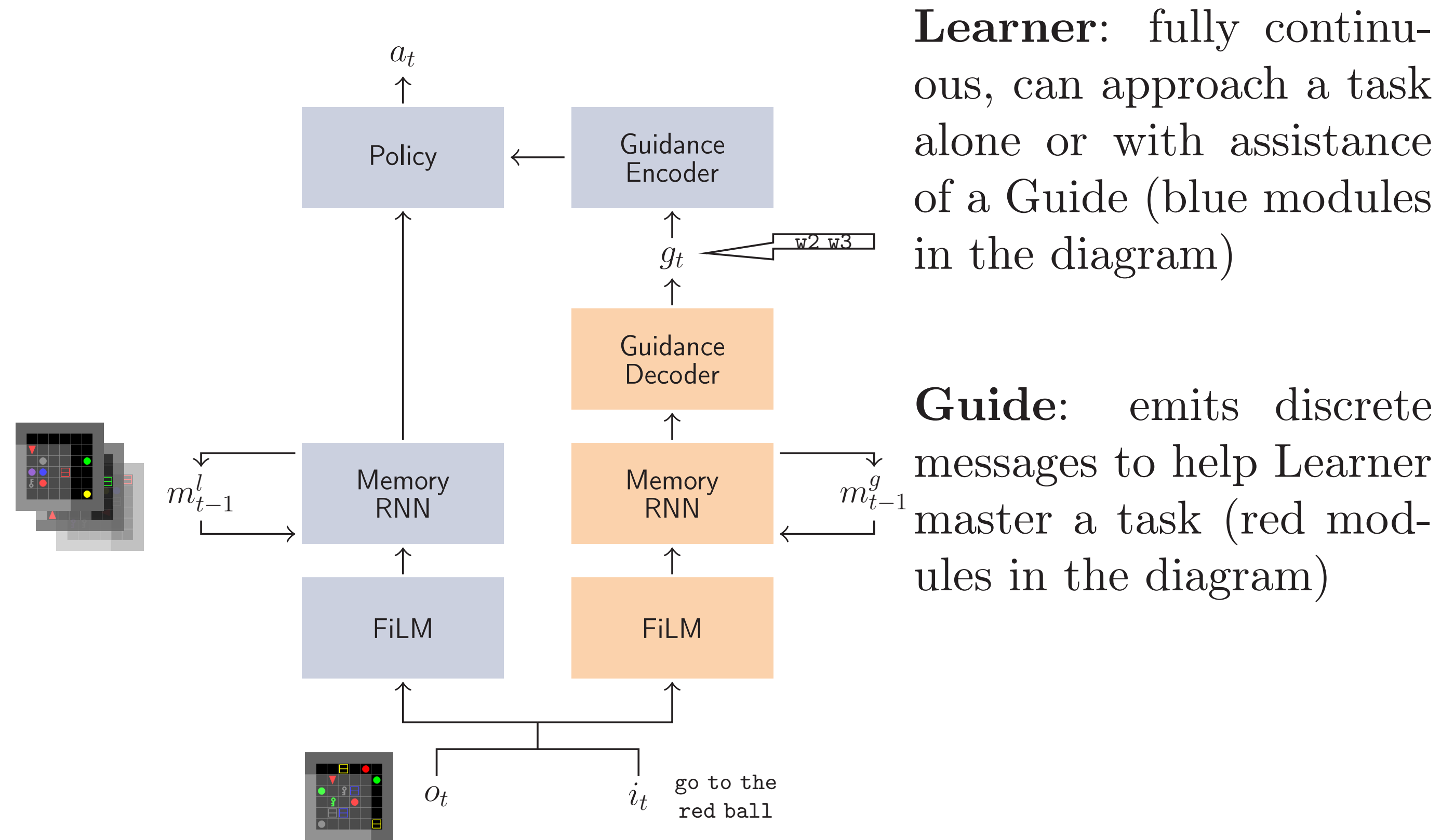


Figure 2: PutNextLocal, ‘put the green box next to the green ball’

Model



Intra-level guidance

The discrete messages sent by pretrained Guides allow new Learners to converge faster.

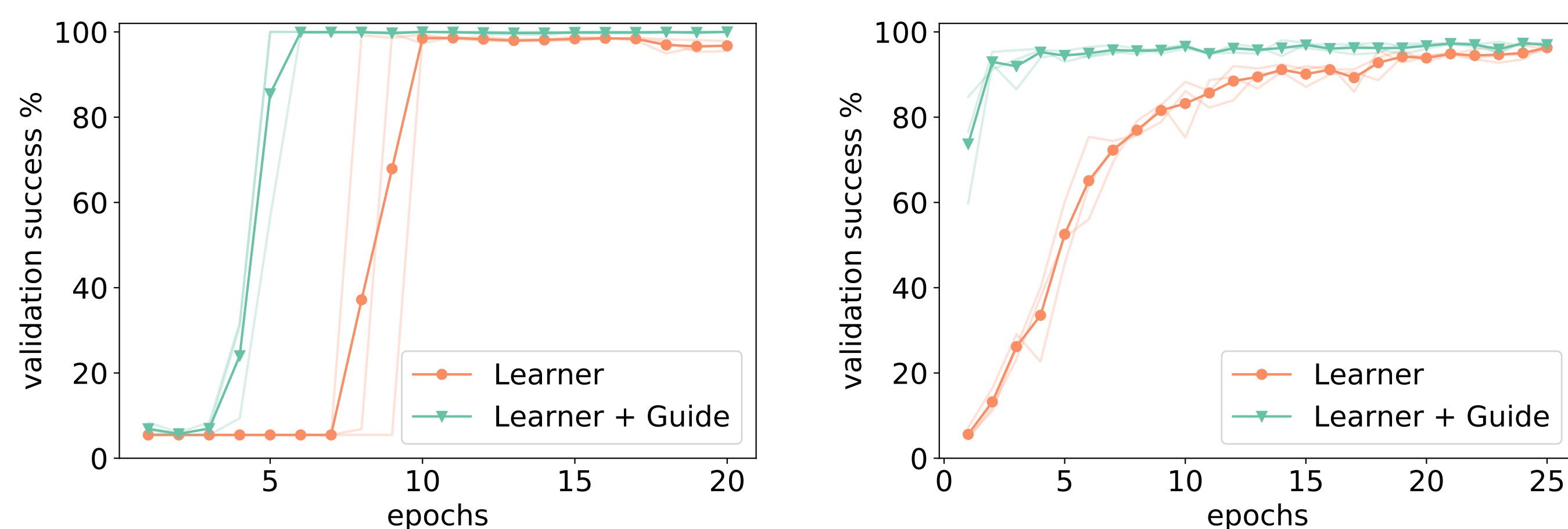
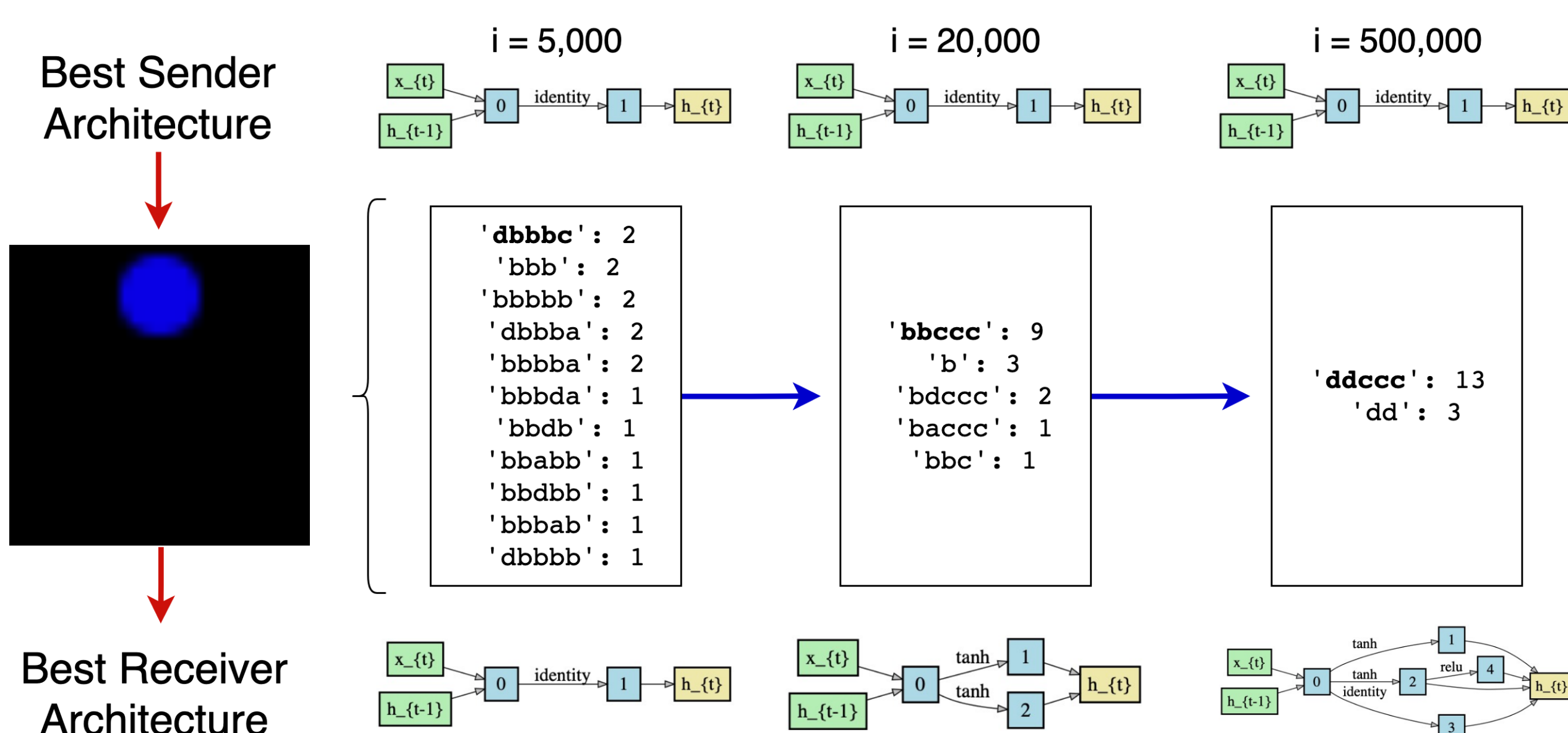


Figure 3: Level GoToObj (left) and PutNextLocal (right)

Co-Evolving Language and Agent



Curriculum guidance

The guidance messages even speed up learning when assisting new agents at unseen levels.

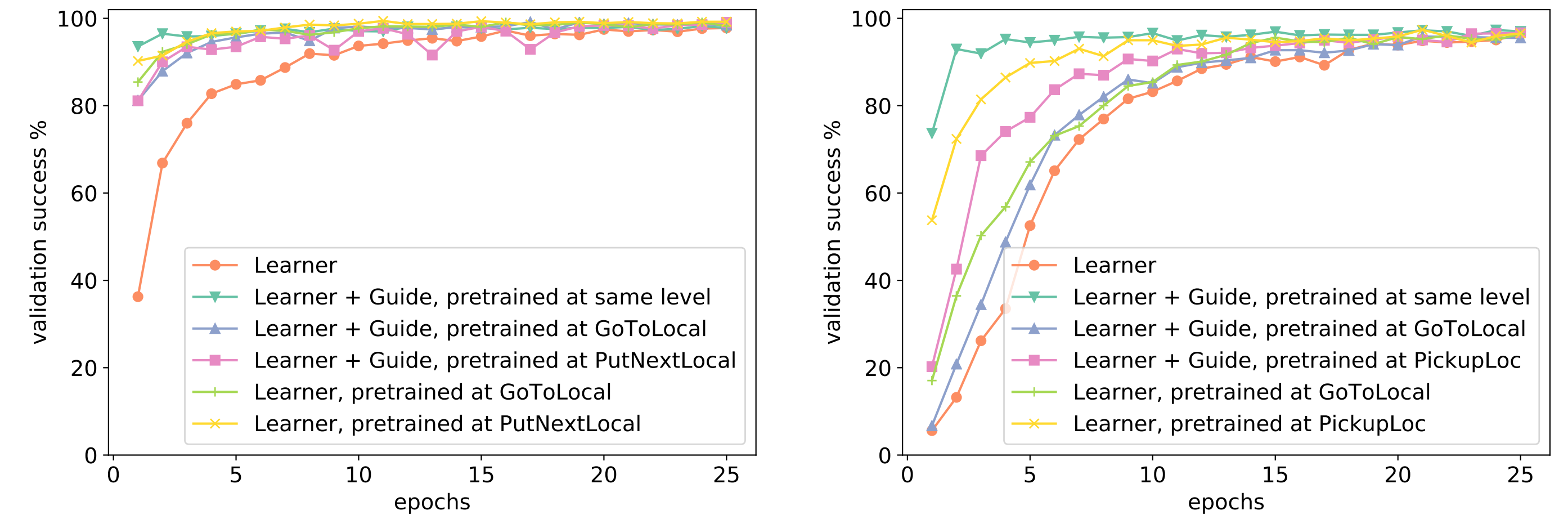


Figure 4: Level PickupLoc (left) and PutNextLocal (right)

Guide language

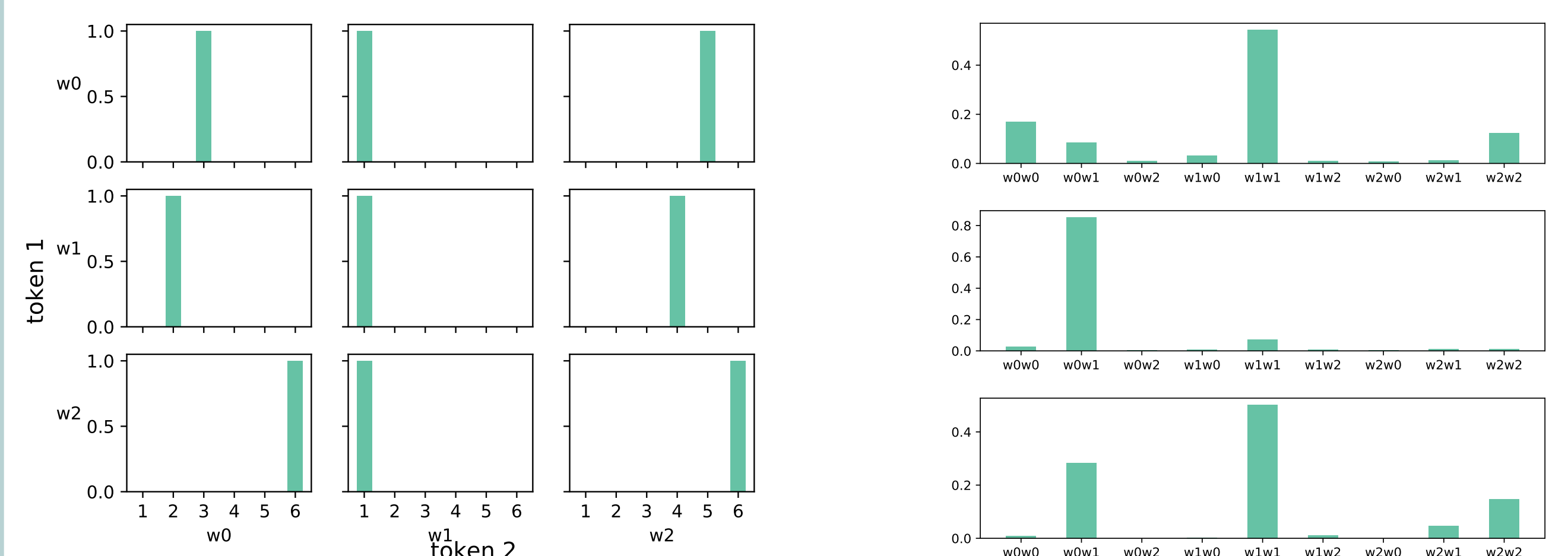


Figure 5: Conditional distribution of actions given messages at PutNextLocal (500 episodes)

Figure 6: Conditional distribution of messages given input at GoToObj (500 episodes)

Causal influence of communication

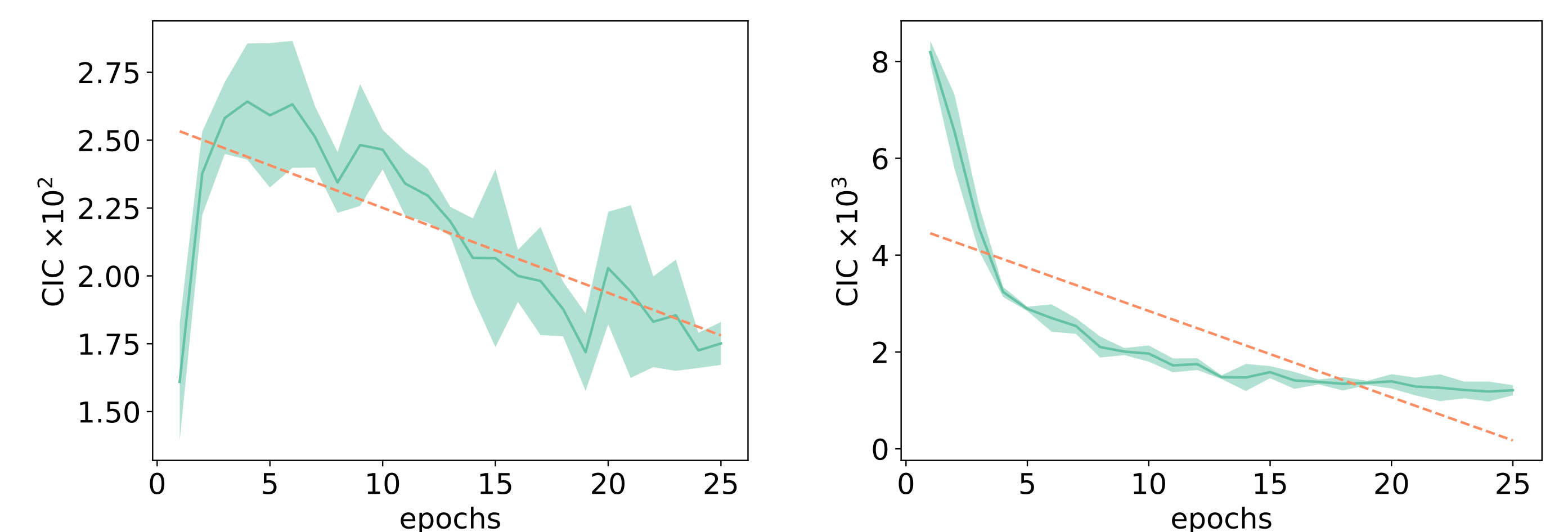


Figure 7: Development of CIC at GoToLocal (left) and GoTo (right)

Speaking back

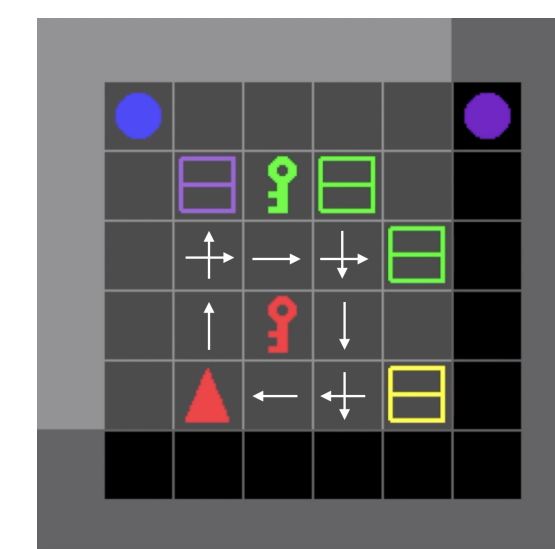


Figure 8: Trajectory of a Learner at GoToLocal when told by means of messages to perform a waltz (c.q. $4 \times w1 \ w2, w1 \ w2, w1 \ w1$)

Archimedean Sender, Myopic Receiver

