Examining the role of vicarious trial-and-error in a robotic experiment

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Abstract

Vicarious trial-and-error(VTE)(Muenzinger and Fletcher, 1934) is a measure of choosing behavior at decision points. Studies of VTE have shown a correlation between the number of VTEs exhibited by an individual with its learning efficiency. During a learning task, the number of VTEs increases until mastery is reached to progressively decrease afterward. Our work relies on a model developed by Bovet and Pfeifer(2005) where a neural network equipped with Hebbian learning commands a robot evolved to complete a T-maze task using multiple sensory modalities. This setup allows us to compute the number of VTEs during learning of the task. Similarly to animals, the number of VTEs increases until mastery, only to decrease afterward. We also found out that a model with minimal connectivity showing the same performance does not present this phenomenon. This implies that VTE might not be related to performance in learning but would rather be caused by a redundant connectivity pattern. We also noticed that models exhibiting less VTEs were less adaptive to changes in initial conditions. It is not yet clear what is causing the VTEs in our model. VTEs have been reported in T-maze experiments in rats who were shown to be simulating their next decisions internally before acting(Johnson and Redish, 2007). This capacity of internal simulation can be connected to consciousness through Bergson's philosophical idea of mental imagery. Additional studies of this model could shed some lights on the connection between VTE and internal simulation in animals.