Upper Confidence Bound 101

Upper Confidence Bound

Introduction

- Reinforcement learning algorithm
- Problem: find a solution to a problem with incomplete information, uncertain rewards
- Takes „learnings“ into account to define future actions
- Solves the exploration/exploitation dilemma elegantly

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Exploration / Exploitation Dilemma

- Problem
  - incomplete information on a process
  - No simple solution

- Exploitation
  - Choose an action that you know
  - Getting a reward close to what I expect

- Exploration
  - Choose an action with an unsure outcome
  - Possibly learn something

- Best long-term solution might have short-term costs!

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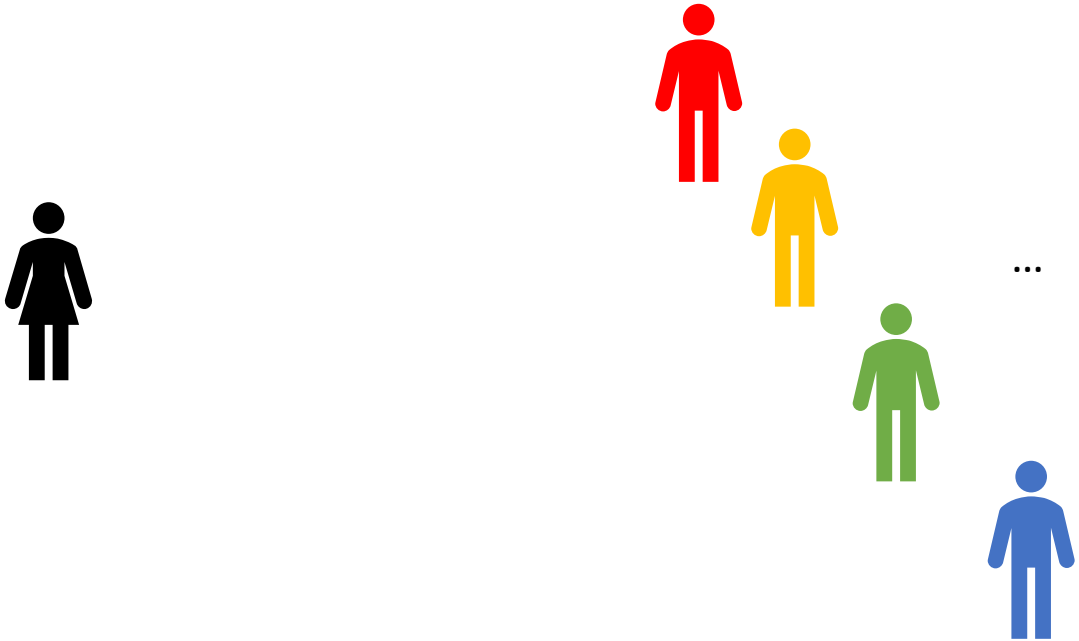
Exploration / Exploitation Dilemma

- Exploration/exploitation dilemma found in many aspects of life
  - Example: Dating



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Multi-Armed-Bandit Problem

- Multi-Armed Bandit Problem

Bandit A

Bandit B

Bandit C

Bandit D

Bandit E

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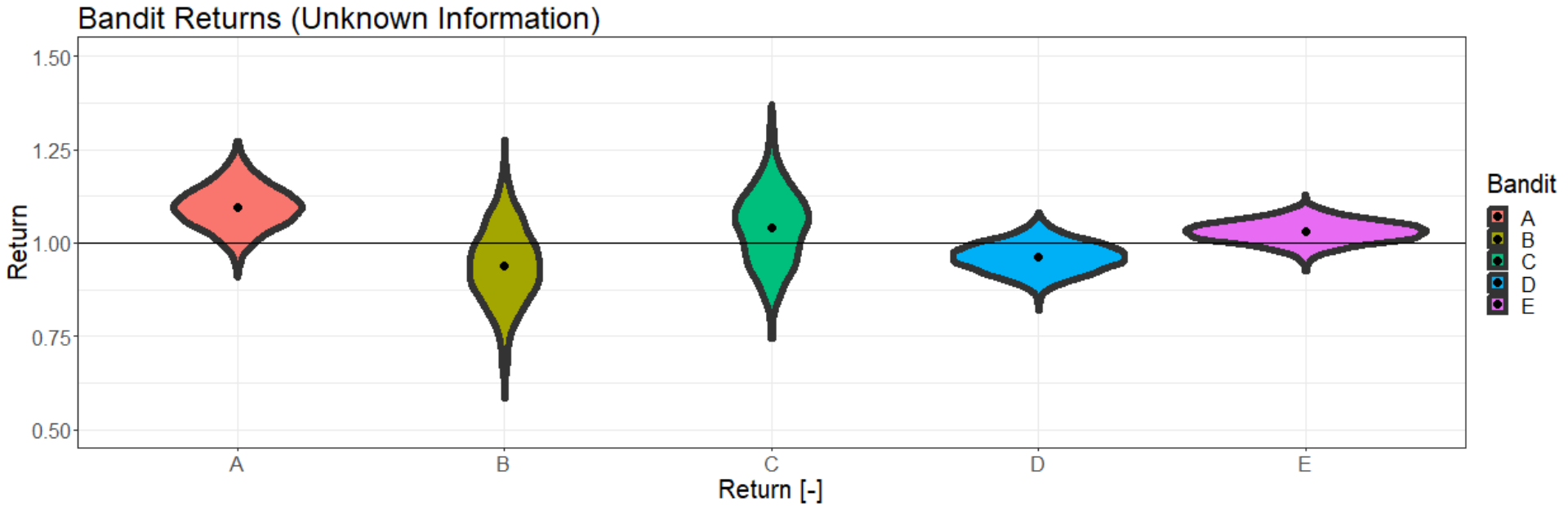
Multi-Armed-Bandit Problem

- Multi-Armed Bandit Problem



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Multi-Armed-Bandit Problem

- Possible strategies
  - No exploration
  - Random exploration
  - Smart exploration

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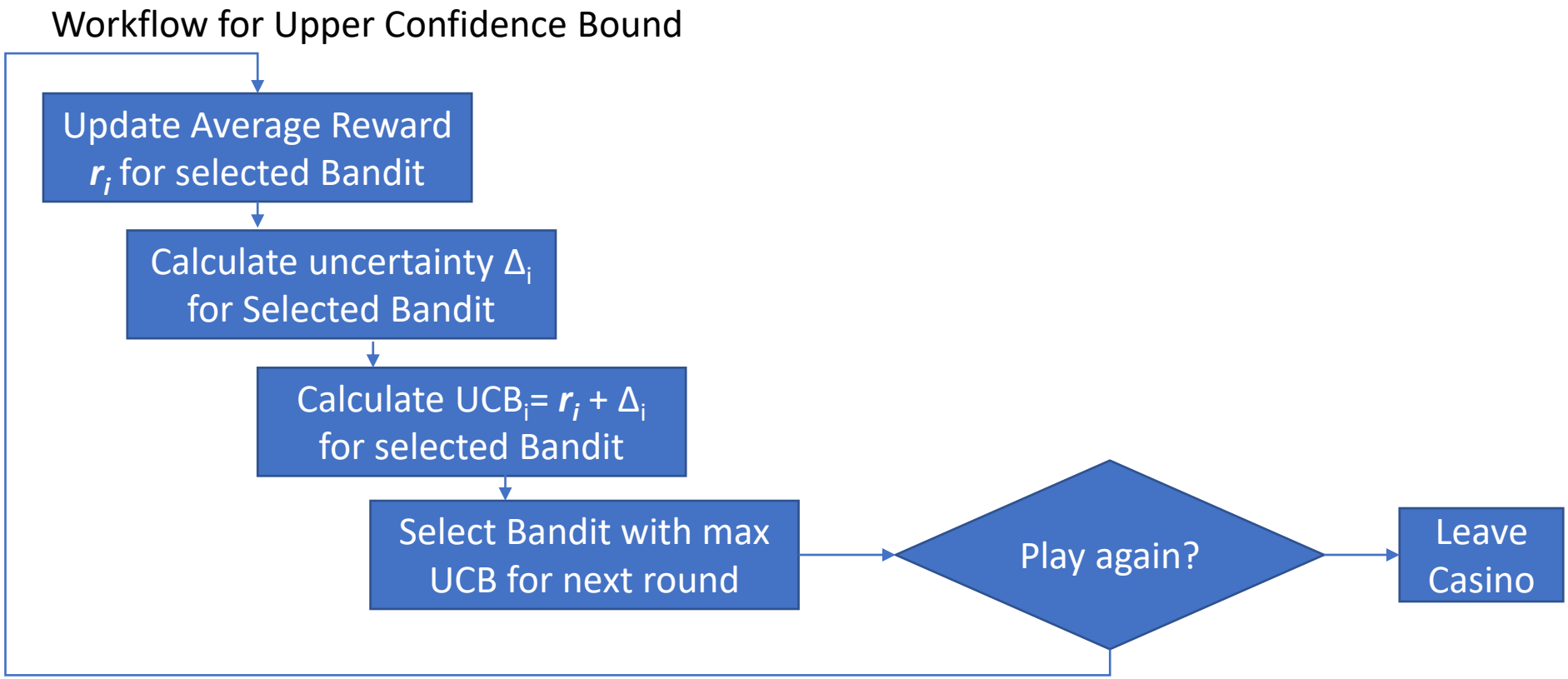
Workflow



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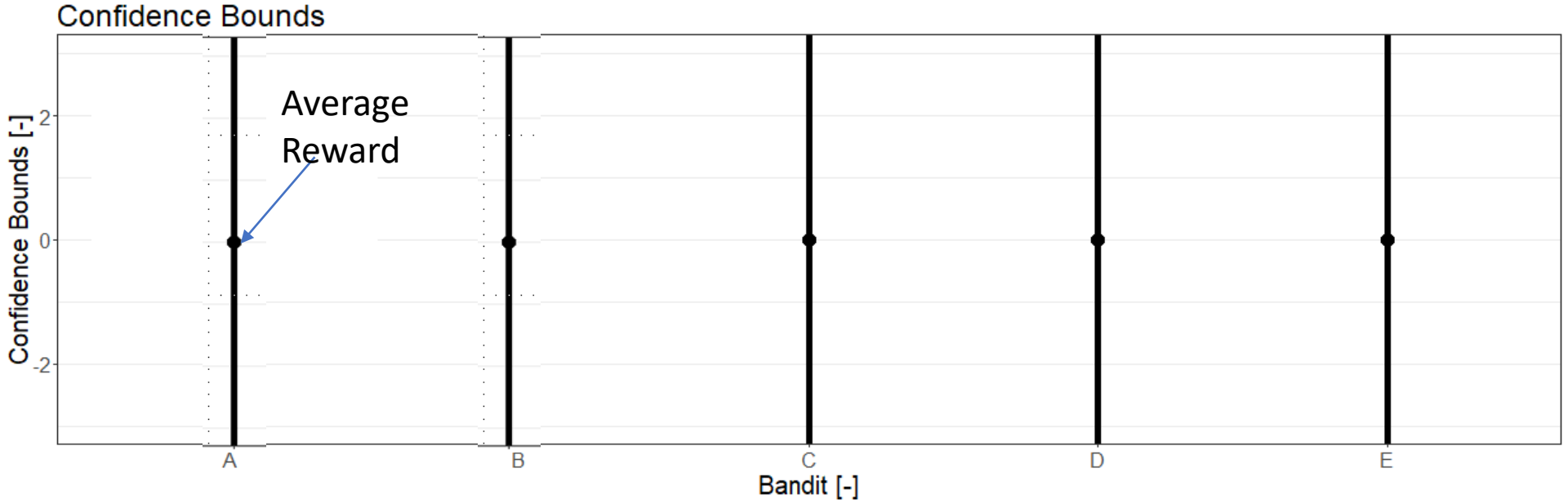
Multi-Armed-Bandit Problem

- Round: 0



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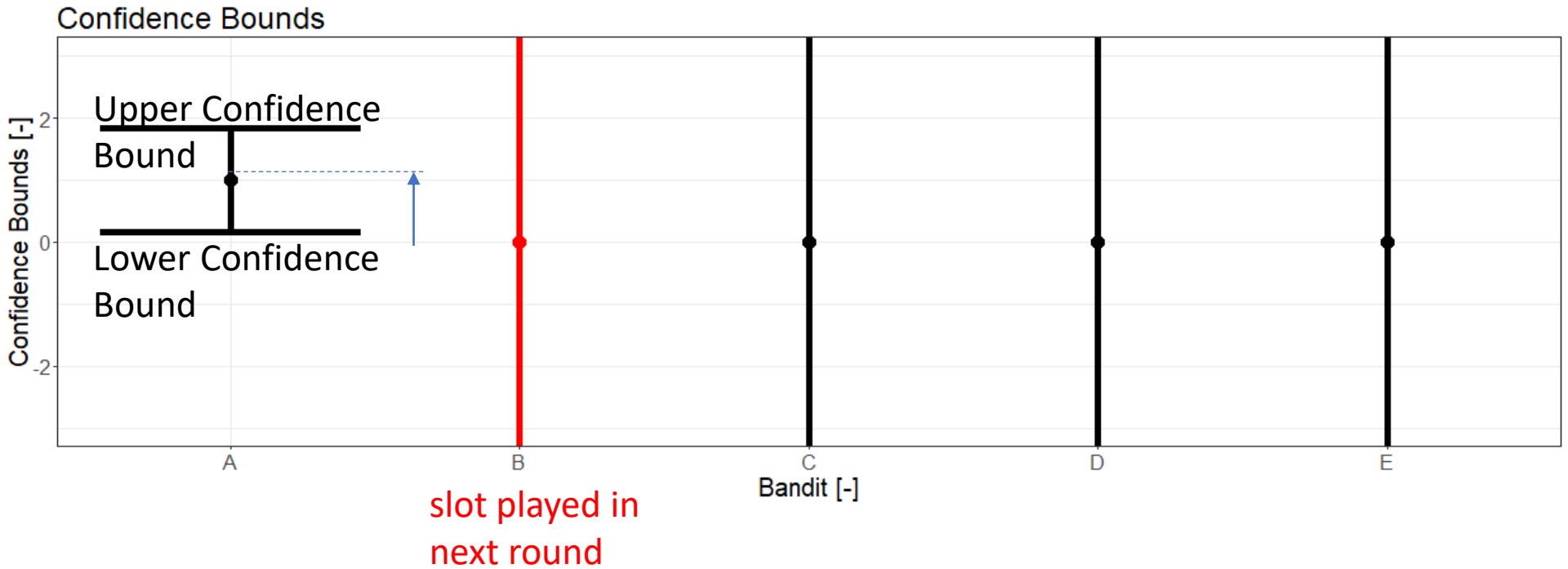
Multi-Armed-Bandit Problem

- Round: 1



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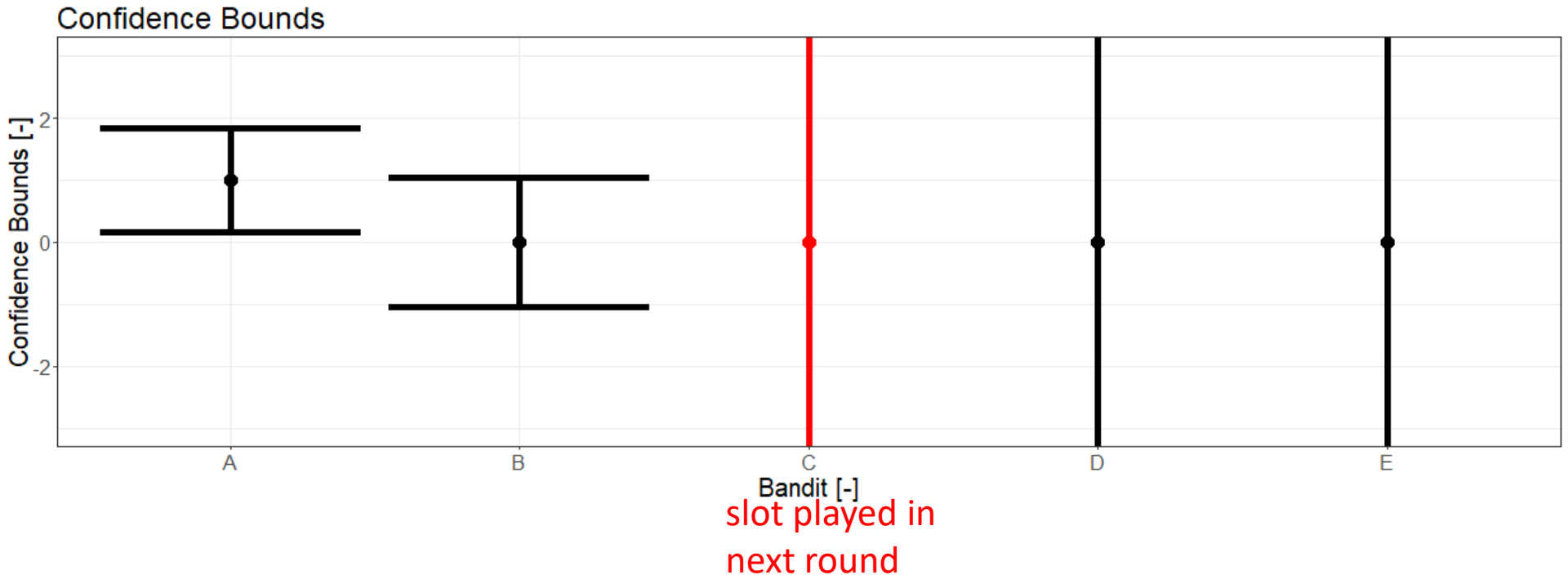
Multi-Armed-Bandit Problem

- Round: 2



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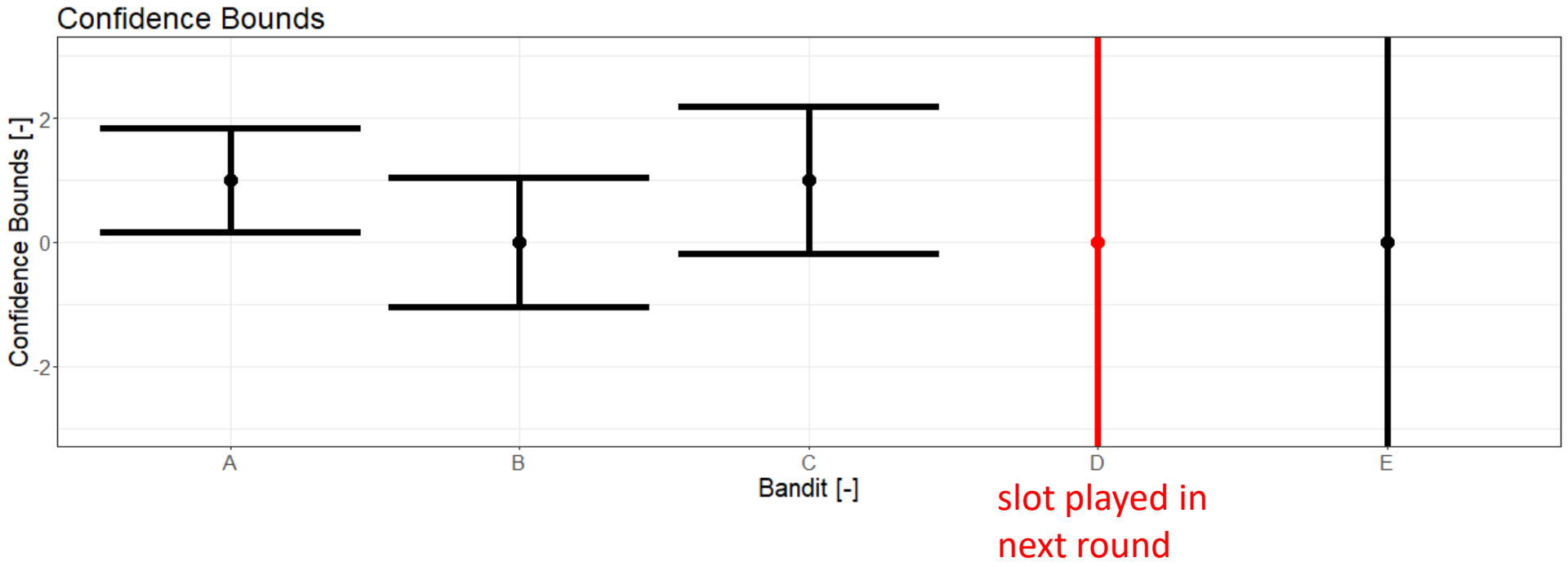
Multi-Armed-Bandit Problem

- Round: 3



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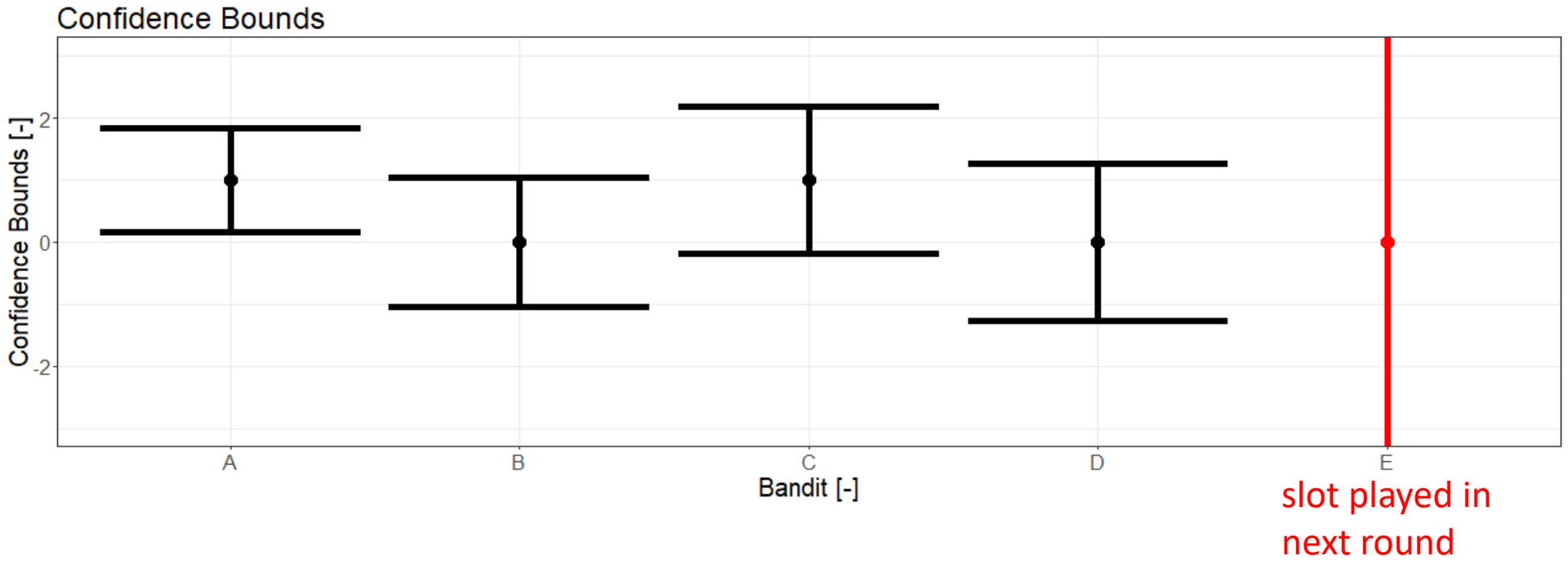
Multi-Armed-Bandit Problem

- Round: 4



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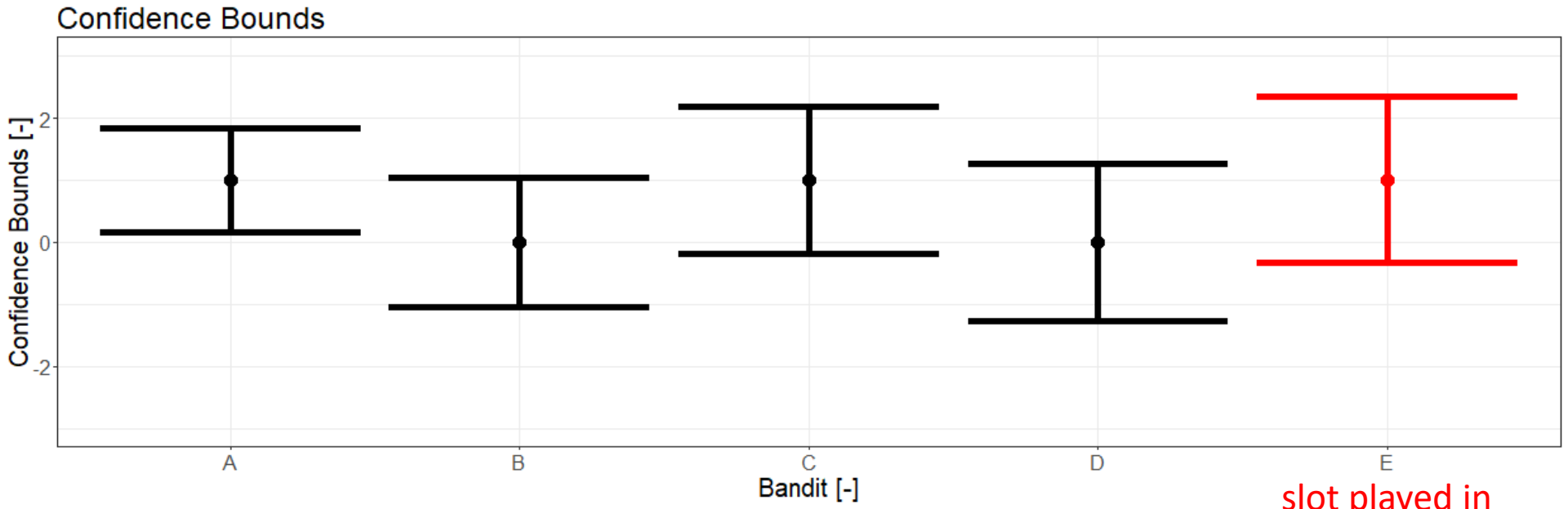
Multi-Armed-Bandit Problem

- Round: 5



slot played in next round

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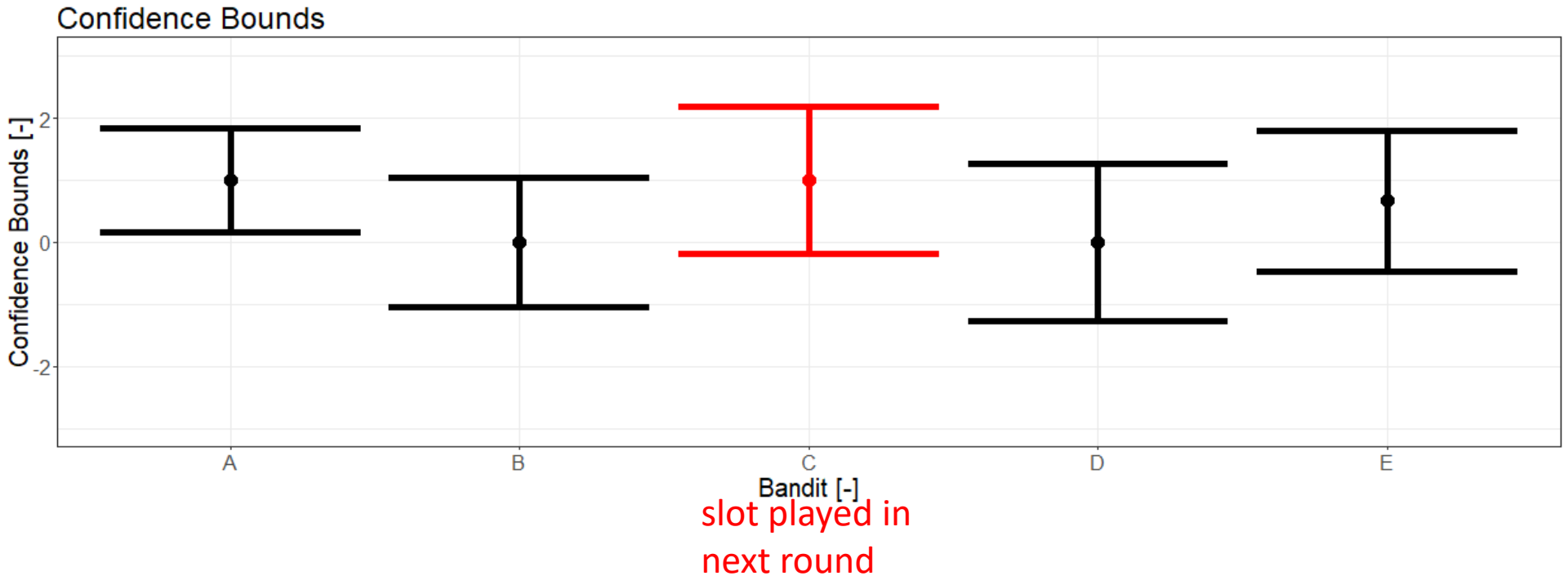
Multi-Armed-Bandit Problem

- Round: 6

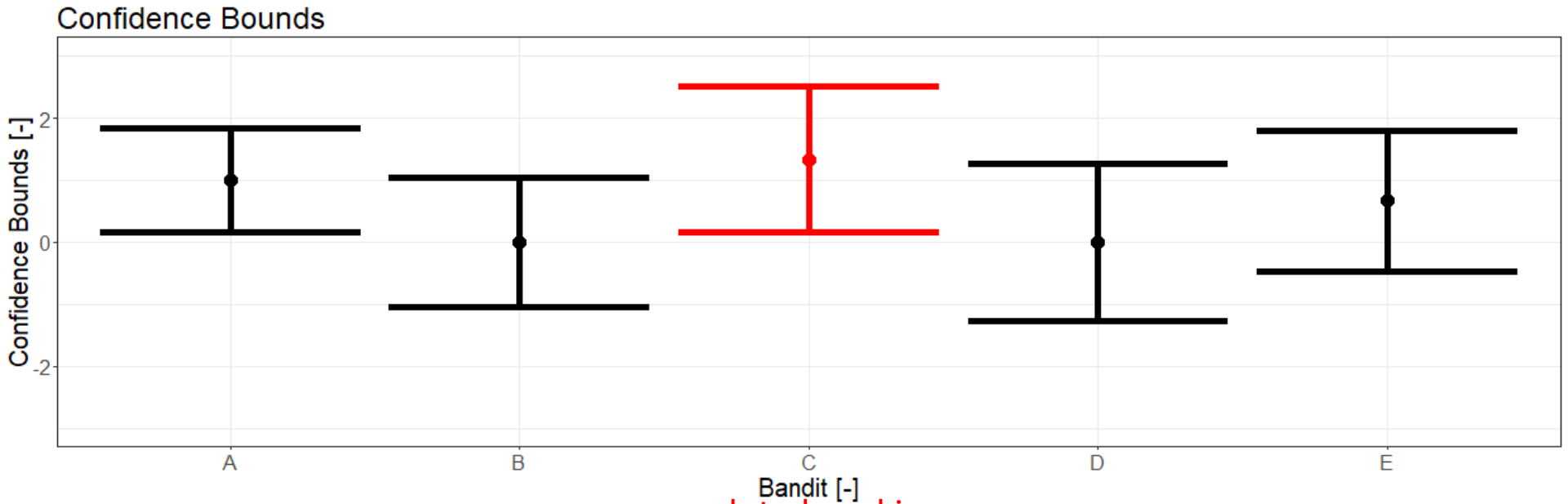


slot played in next round

Upper Confidence Bound

Multi-Armed-Bandit Problem

- Round: 7



slot played in next round

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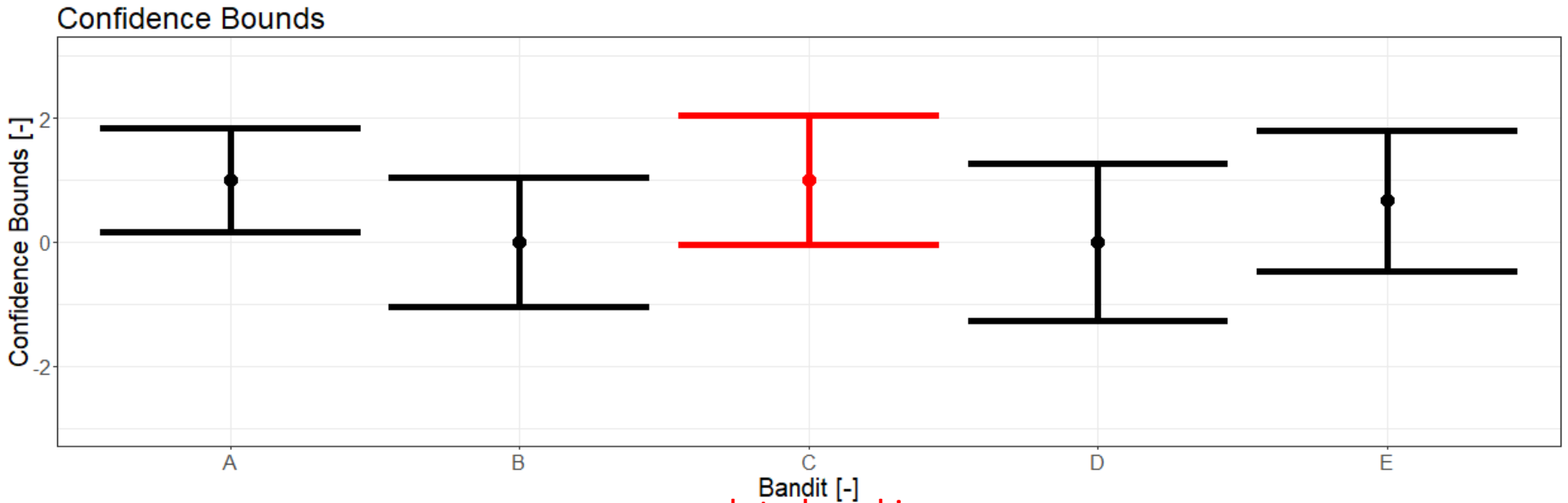
Multi-Armed-Bandit Problem

- Round: 8



slot played in next round

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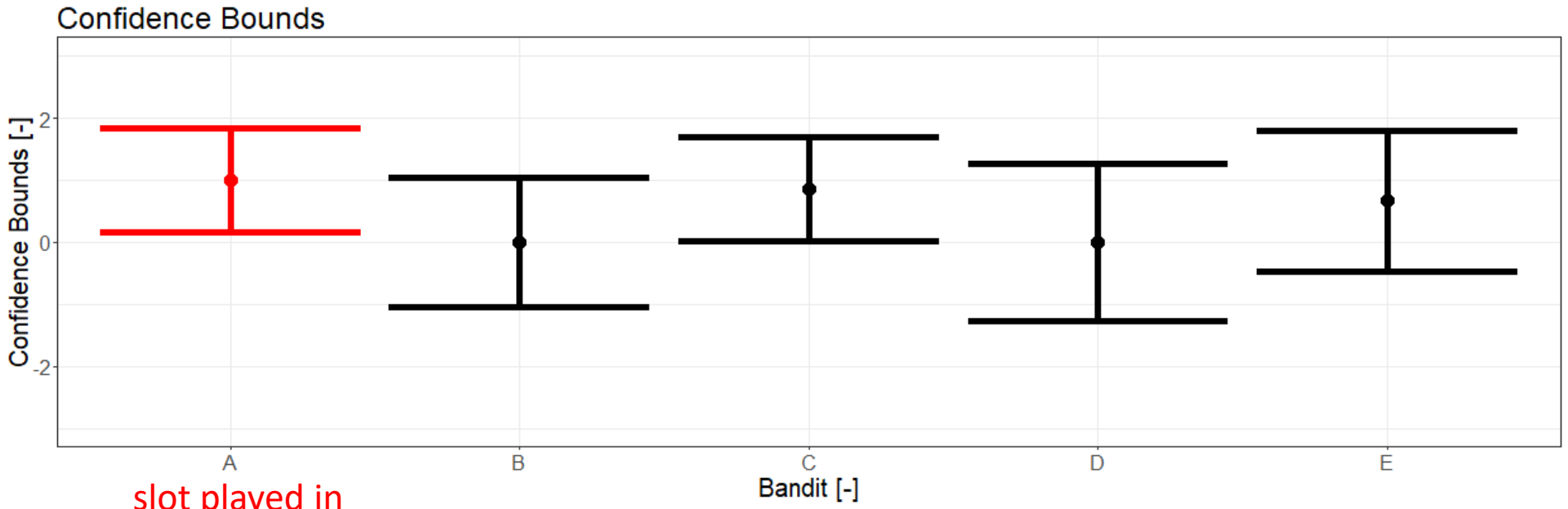
Multi-Armed-Bandit Problem

- Round: 9



slot played in next round

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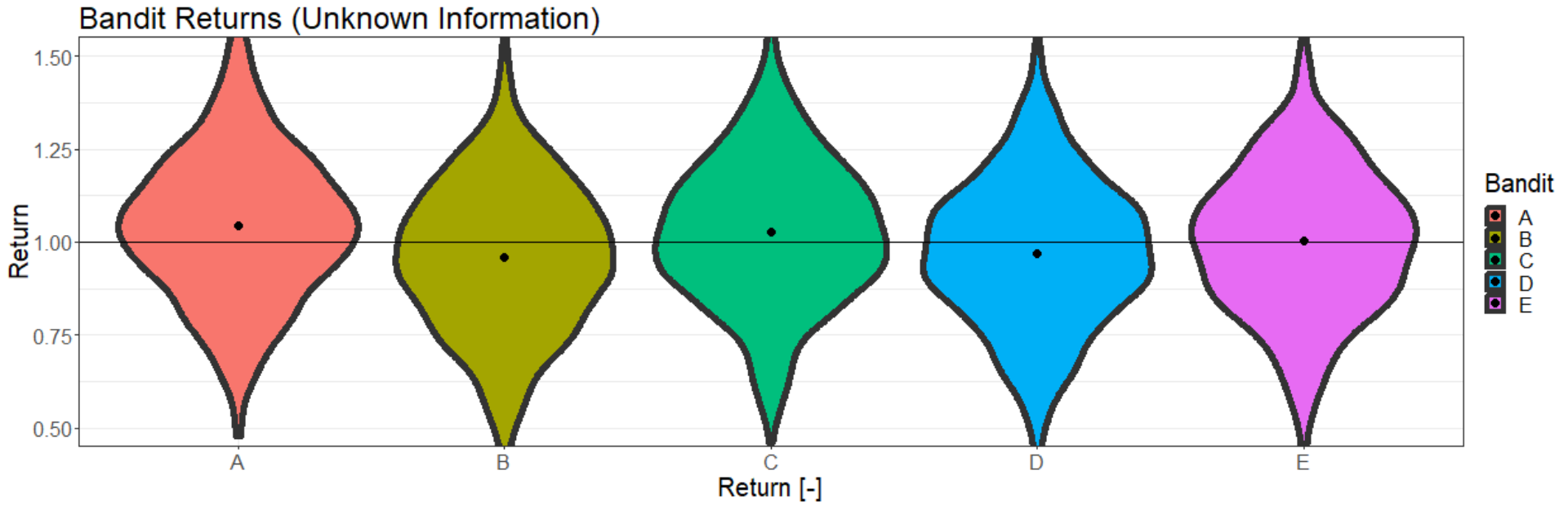
Multi-Armed-Bandit Problem

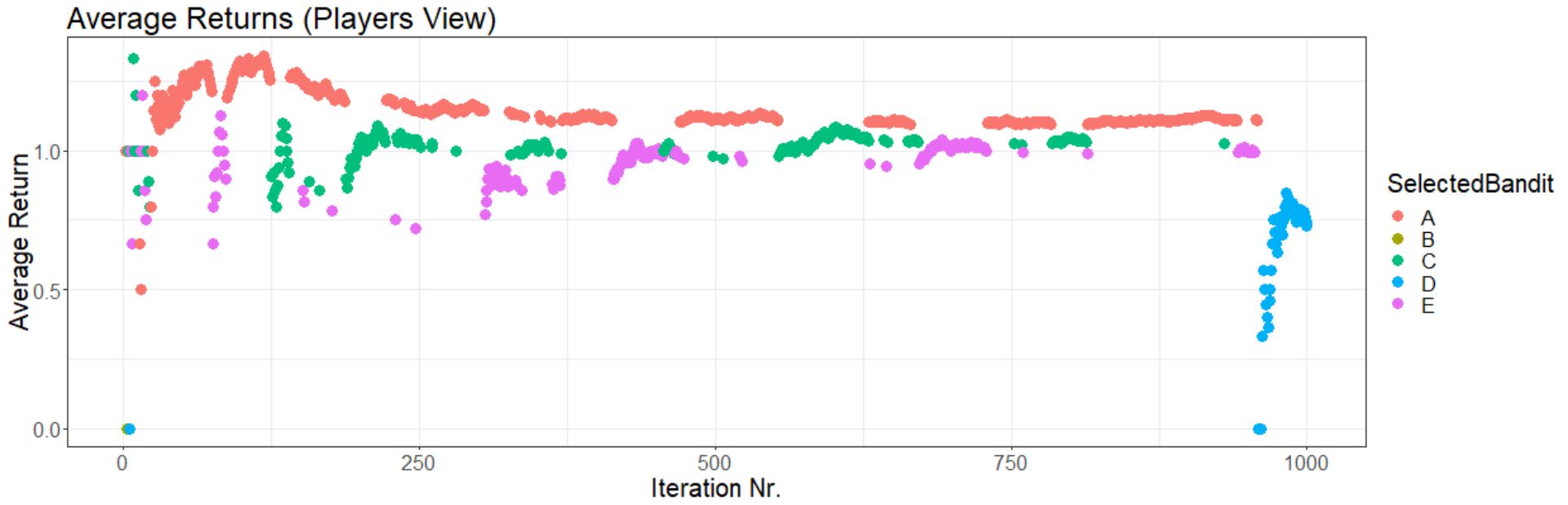
- Round: 1000



Upper Confidence Bound

Multi-Armed-Bandit Problem

- Round: 1000



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Advantages / Disadvantages

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- Adds some randomness
- Good balance of exploration and exploitation

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- Bad action might be explored