Maze Shaping Report: Revisit-Penalty Threshold with Manhattan PBRS (v1)

February 13, 2026

1 Setup

This experiment relaxes immediate revisit termination by allowing limited revisits and terminating only when revisit count in the same episode reaches a threshold.

Core settings:

- Maze: `../../outputs/maze_samples_v1/grids/maze_00.npy`
- Termination: goal reached or revisit count reaches `revisit_terminate_count=3`
- Episodes: 5000, Runs: 12
- Validation: every 25 episodes (plus episode 1), 30 rollouts
- Learning: tabular SARSA, $\alpha = 0.02$, $\epsilon = 0.10$, $\gamma = 0.99$

2 Reward Design

Base reward and penalty:

$$R(s, a, s') = \begin{cases} 1.0 & \text{if } s' \text{ is goal} \\ -0.05 & \text{if } s' \text{ is revisit} \\ 0.0 & \text{otherwise} \end{cases}$$

Potential-based shaping (Manhattan):

$$R'_k = R + \gamma \Phi_k(s') - \Phi_k(s), \quad \Phi(s) = -(|r - r_g| + |c - c_g|), \quad \Phi_k(s) = k\Phi(s),\ k \in \{0, 0.5, 1.0\}.$$

3 Curves

4 Final Metrics

Condition	Train mean steps (ep5000)	Val success (ep5000)	Val mean steps (ep5000)
`no_shaping`	25.166666666666668	0.0	47.583333333333336
`phi_half`	13.166666666666666	0.0	15.333333333333334
`phi_full`	11.333333333333334	0.0	11.5

Table 1: Episode-5000 summary.

Best observed validation success:

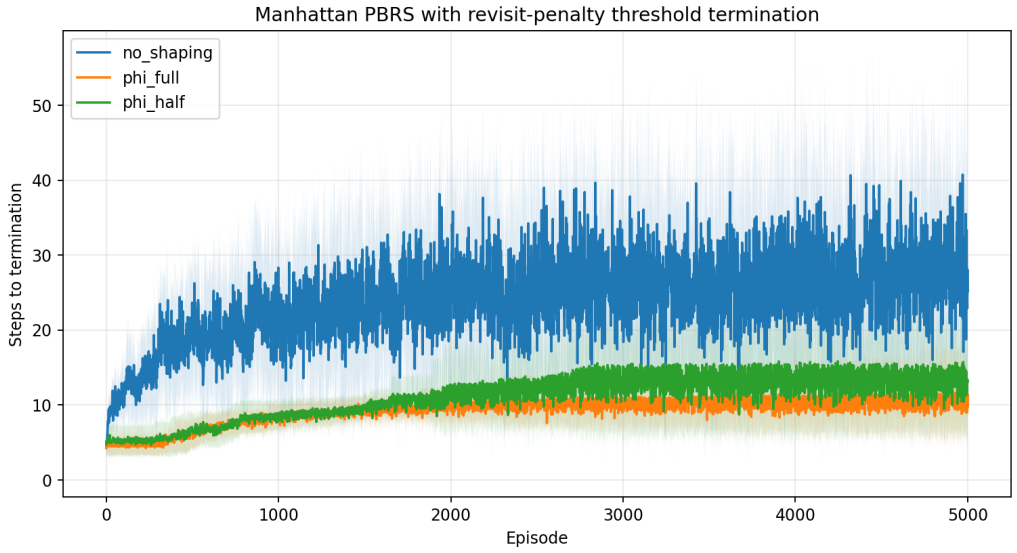

Figure 1: Training curve (steps to termination).

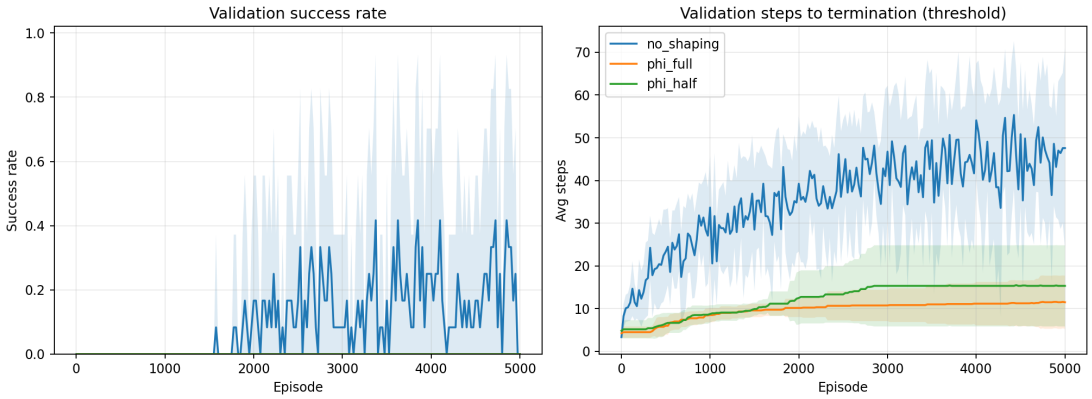

Figure 2: Validation success rate and validation mean steps.

- `no_shaping`: 0.4166666666666667 at episode 4850
- `phi_half`: 0.0
- `phi_full`: 0.0

5 Interpretation

The thresholded revisit termination changes trajectory length dynamics, but under current parameters it still does not produce stable goal-reaching behavior in Manhattan PBRS conditions. The metric split (lower termination steps without success gains) suggests optimization toward early termination patterns rather than successful navigation.

6 Artifacts

- Output root: `../../outputs/maze_shaping_revisit_penalty_threshold_manhattan_v1`
- Files: `learning_curve.csv/png`, `validation_progress.csv/png`, `run_summary.json`