

# A Tic Tac Toe game with an artificial intelligence that can play perfectly by BadToxic

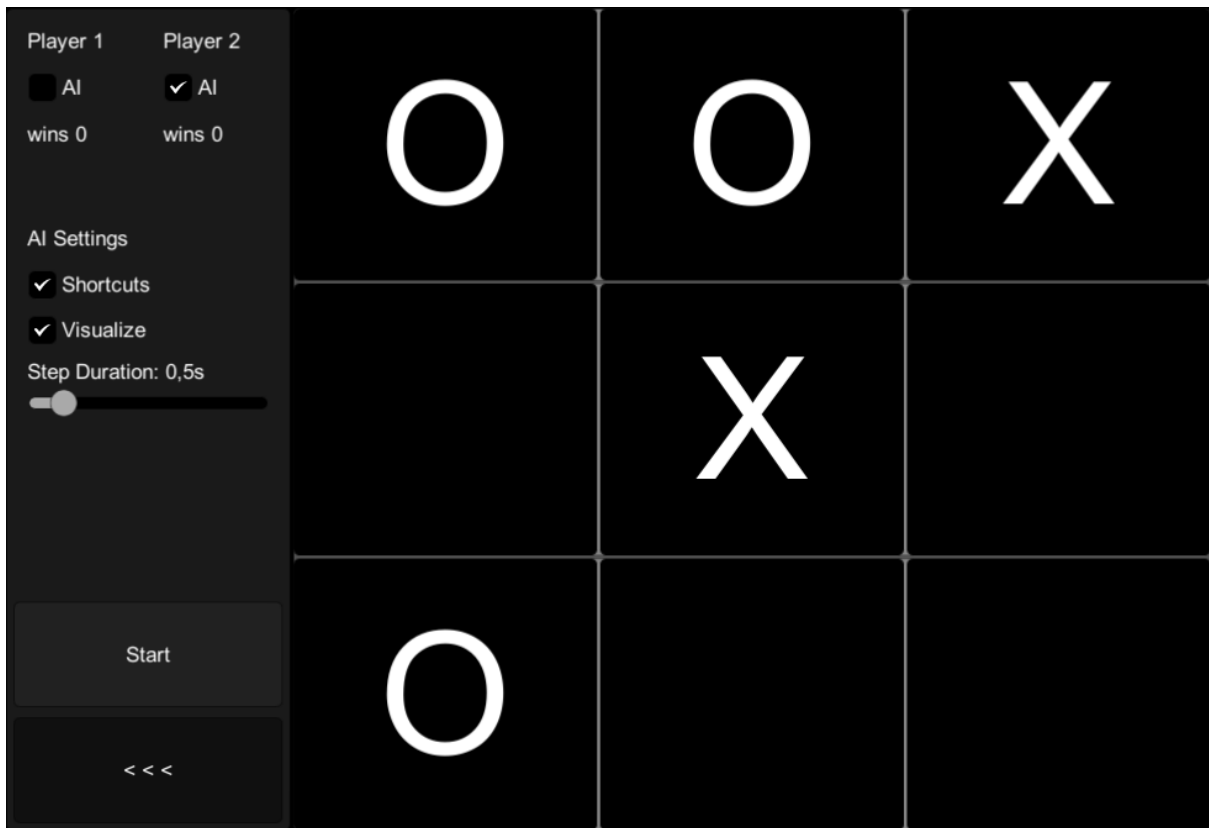


Fig1. The game with open settings panel

## Documentation

### Content

- See and try it yourself
- Scripts - How to use
- Minimax - The used Algorithm
- Support and Contact

## See and try it yourself

See it on [YouTube](https://youtu.be/k8xzddhVlws): <https://youtu.be/k8xzddhVlws>

Or see the game and AI in action and play it via [WebGL](https://badtoxic.de/ttt): <https://badtoxic.de/ttt>

## Scripts

### TicTacToeController

This class represents the complete game itself including the AI.

The following values can be altered:

| Variable                                     | Type  | Description  |
|--|-------|--|
| <i><a href="#">p1Ai</a></i>                  | bool  | true: Player 1 controlled by the AI  |
| <i><a href="#">p2Ai</a></i>                  | bool  | true: Player 2 controlled by the AI  |
| <i><a href="#">useShortcuts</a></i>          | bool  | If this is set, the AI will look up the optimal moves of the first two turns in a “database”. This is to demonstrate how to optimize runtime in AI algorithms through combination with knowledge. You can see the behavior in the method <i>CheckBaseCaseAndShortcuts</i> .<br>Eg.: if all fields are empty (= first turn) the AI will choose one of the four corner fields as they are the optimal first move. It will choose by random to generate some variety. |
| <i><a href="#">visualizeAI</a></i>           | bool  | If this is set, all moves tested by the MinMax algorithm are visualized. The AI tests every possible move for the best outcome. It also displays the recursion depth and the points (score / rating) of the current move on each used field. (See Fig.2)   |
| <i><a href="#">algorithmStepDuration</a></i> | float | This slider can change the duration (in seconds) each visualized AI move should take. Increase this value to have more time to retrace the steps.  |

Furthermore the class offers access and feedback through:

| Method / Delegate                                      | Description  |
|--|--|
| <i><a href="#">StartGame()</a></i>                     | Starts the game  |
| <i><a href="#">OnGameOver(int win)</a></i><br>delegate | Is called when the game is over. <i>win</i> will hold:<br>-1: Draw; 0: Player 1 wins; 1: Player 2 wins |

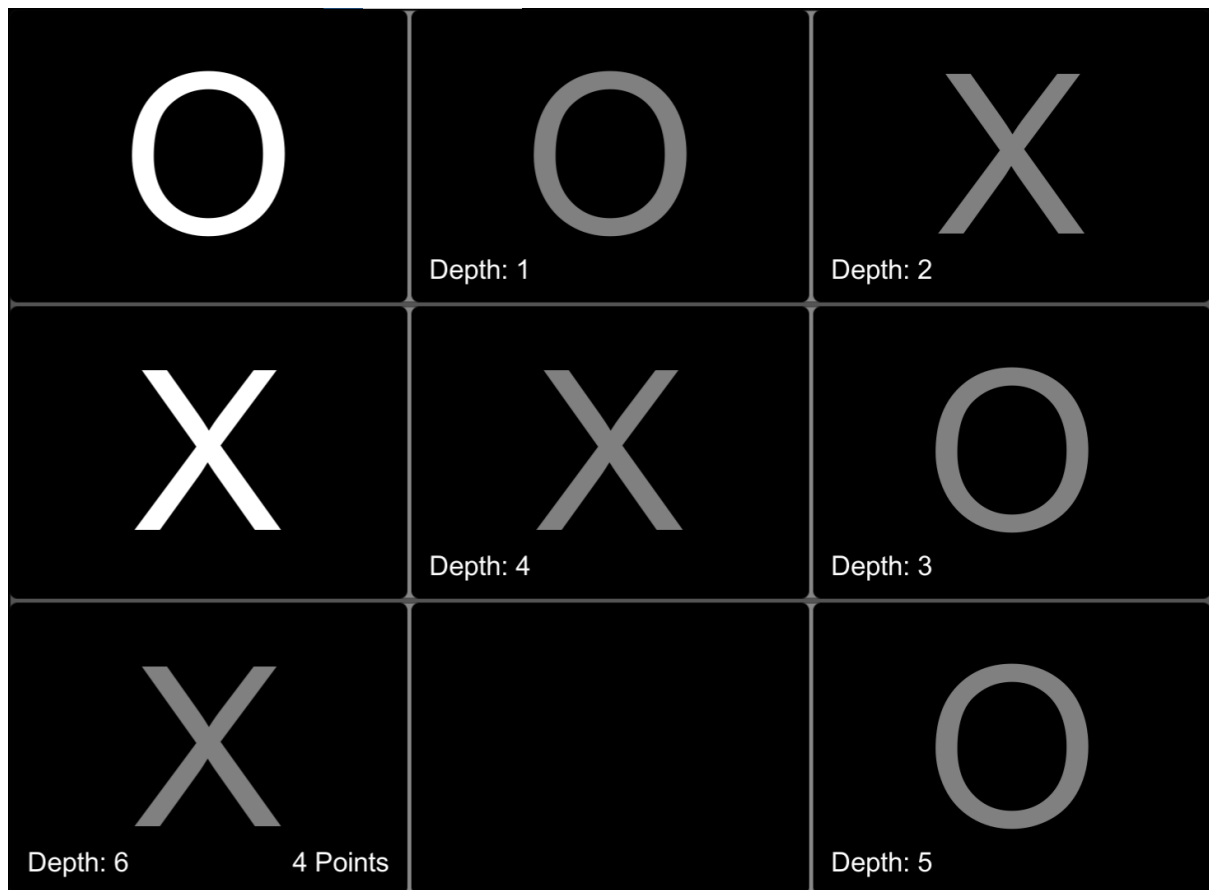


Fig2. AI visualization turned on - depths and points for each tested move.

## TicTacToeSettings

This class is for controlling the game via the UI and demonstrates how to get feedback from the game. It uses UI toggles and a slider to alter:

1. Which player is controlled by the AI (None, P1, P2 or both)  
-> eg. `ticTacToeController.p1Ai = active;`
2. If the shortcuts should be used (see TicTacToeController for further explanation)  
-> eg. `ticTacToeController.useShortcuts = active;`
3. If the AI should be visualized  
-> eg. `ticTacToeController.visualizeAI = active;`
4. Step duration of the moves the AI tries out  
-> eg. `ticTacToeController.algorithmStepDuration = value;`

It also offers a button to start the game (`ticTacToeController.StartGame();`), a button to hide the menu and implements the `OnGameOver` delegate of the `ticTacToeController`:

-> `ticTacToeController.onGameOverDelegate = OnGameOver;`

## Minimax

For more information about the basics of the used MinMax algorithm I can recommend reading the Wikipedia article:

**Minimax** (sometimes **MinMax**, **MM** or **saddle point**) is a decision rule used in artificial intelligence, decision theory, game theory, statistics, and philosophy for *minimizing* the possible loss for a worst case (*maximum* loss) scenario. When dealing with gains, it is referred to as "maximin"—to maximize the minimum gain. Originally formulated for n-player zero-sum game theory, covering both the cases where players take alternate moves and those where they make simultaneous moves, it has also been extended to more complex games and to general decision-making in the presence of uncertainty.

[\[Wikipedia\]](#)

## Support and Contact

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