

In first place, it's interesting to see how the baseline heuristic performs against sample opponents. For the following set of parameters:

- # of games = 20
- Time Limit = 150

Against	Win Rate
Greedy	97,5%
Minimax	87,5%
Self	55,0%
Random	97,5%

Then, it seems a good idea to select Minimax as a sample opponent to test performance of both the baseline & the custom heuristic developed, as it is a challenging one.

The Win Rate again "Self" seems reasonable as we expect it to be around 50%.

Now, in order to compare performance of Baseline and Custom heuristic developed I increased the number of matches to increase the confidence in my results.

Parameters used:

- # of games = 100
- Time Limit = 150
- Comparing with = Minimax

Heuristic	Win Rate
Baseline	87,0%
Custom	93,5%

In order to think a custom heuristic that performs better than the baseline, a new version could be $w_1 \cdot \text{my_moves} + w_2 \cdot \text{opponent_moves}$. It makes sense to give more weight to positions with less opponent moves available, so a negative value of w_2 could be useful.

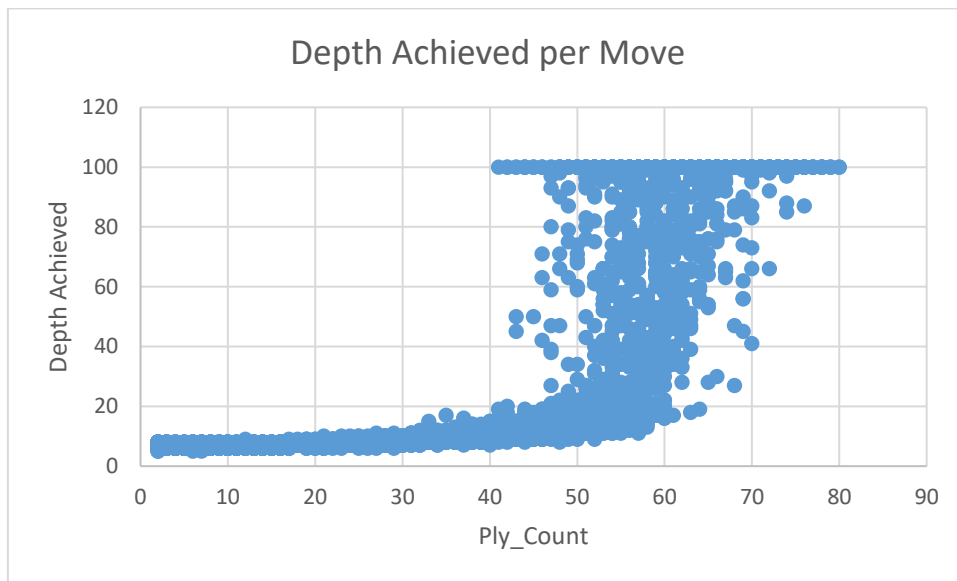
Another element that could be added in the custom heuristic is the distance of my agent from the board center, as we can infer that this would be a privileged position.

With these two ideas in mind, we could also insert thresholds along the game, in order to behave differently over or before certain number of moves.

Custom Heuristic configuration:

- First Aggressive Chasing Movements Threshold: 30 moves → $\text{My_Moves} - 4 \cdot \text{Opponents_Moves} - \text{Player Distance}$
- Mid-Game Strategy: If the opponent surpasses these number of movements, a more careful strategy can make sense, keeping the board center till a new threshold of Movements: 50 → $0 - \text{Player Distance} + \text{My_Moves} - 4 \cdot \text{Opponents_Moves} + \text{Distance to Board Center}$
- End-Game Strategy: Keep the Center but be more aggressive to close the game → $\text{Player Distance} + (\text{My_Moves} - 4 \cdot \text{Opponent_Moves}) \cdot 2 - \text{Distance to Board Center}$.

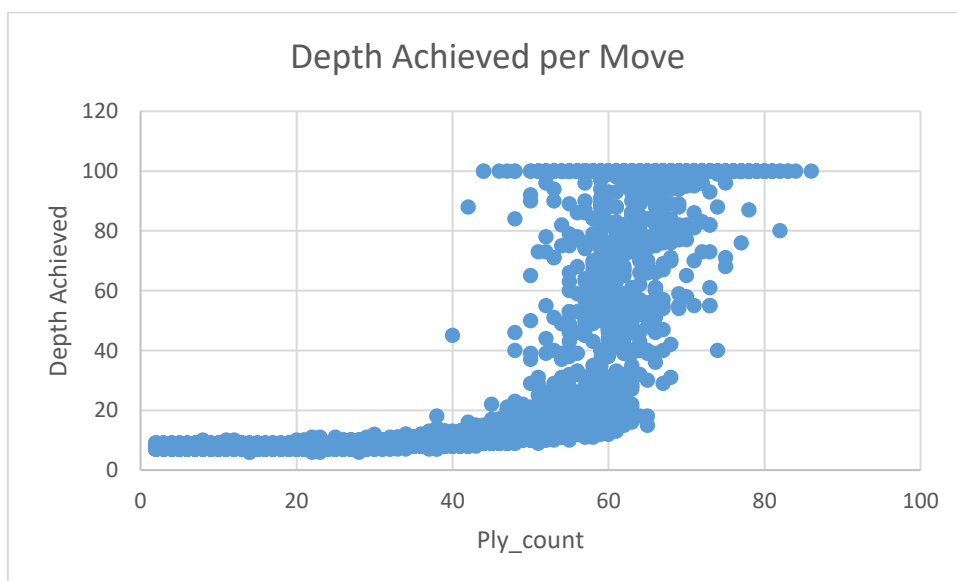
Search depth analysis.
Custom Heuristic



From the chart above I can interpret that the Depth achieved increases as the number of moves increases (which could be related to the game difficulty). The slope is always positive, with a significant change from Ply_Count 40. Then we have:

- A different behavior in depth depending on thresholds used in configuration.
- A visible variability in depth achieved from Ply_Count 40 onwards
- A set of cases reaching the depth limit established in the Custom Heuristic configuration.

Baseline



In general terms, I can observe a similar behavior with respect to the previous heuristic. The Custom Heuristic shows a slight higher variance with less outliers from Ply_Count 40 onwards.

What happens when search time changes?

- # of games = 120
- Comparing with = Minimax

Heuristic	Win Rate 50ms	Win Rate 150ms	Win Rate 200ms
Custom	89,2%	93%	92,9%

I ran Custom Heuristic in two additional scenarios: 50ms and 200ms.

It is clear that a reduction in time influenced negatively in the performance. On the contrary, an increment in time didn't impact significantly in the Win Rate achieved.

This would partially support the tradeoff concept between speed and accuracy, as more depth in enabled (through time) to be reached we could expect better performance.