Comparison between A* search and Best first search algorithms

Best-first search algorithm visits next state based on heuristics function f(n) = h with lowest heuristic value (often called greedy). It doesn't consider cost of the path to that particular state. All it cares about is that which next state from the current state has lowest heuristics.

A* search algorithm visits next state based on heuristics f(n) = h + g where h component is same heuristics applied as in Best-first search but g component is path from the initial state to the particular state. Therefore it doesn't chooses next state only with lowest heuristics value but one that gives lowest value when considering it's heuristics and cost of getting to that state.

So, in this way A* gives more optimal solution than Best-first search algorithm.

To support above arguments following observations are being used with different heuristics method on given example:

```
Start State
 [4, 5, 1]
[2, 3, 8]
[0, 6, 7]
```

```
Goal State
 [1, 2, 3]
[4, 5, 6]
[7, 8, 0]
```

	A* search (Manhattan distance)	Best First Search (Manhattan distance)	A* search (#Misplaced Tiles)	Best First Search (#Misplaced Tiles)
No. of states generated	2085	170	14295	2986
No. of states explored	1291	98	8945	1837
No. of states to optimal path	22	40	22	78
Optimal path cost	22	40	22	78
Time taken	0.12383246422	0.00404882431	3.63628578186	0.18448138237

From the above observations its quite clear that A* search gives much better optimal path than best first search,

Hence A* is optimal than best first search.

But when it comes to space and time complexities best first search performs better than A*, it is evident from above results and therefore, space and time complexities are as follows

	A* search	Best first search
Time	$O(b^m)$	$O(b^m)$
Space	Polynomial	$O(b^m)$

Also, Manhattan heuristics are much better than the No. of misplaced tiles, as it is evident from observations that search space becomes much larger in no. of misplaced tiles heuristics and also time taken is more in later case.