

Learning programs through play

**Where do we get background
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- Hand-crafted rules
- Supervised multitask learning
- Self-supervised learning

Idea



Playing

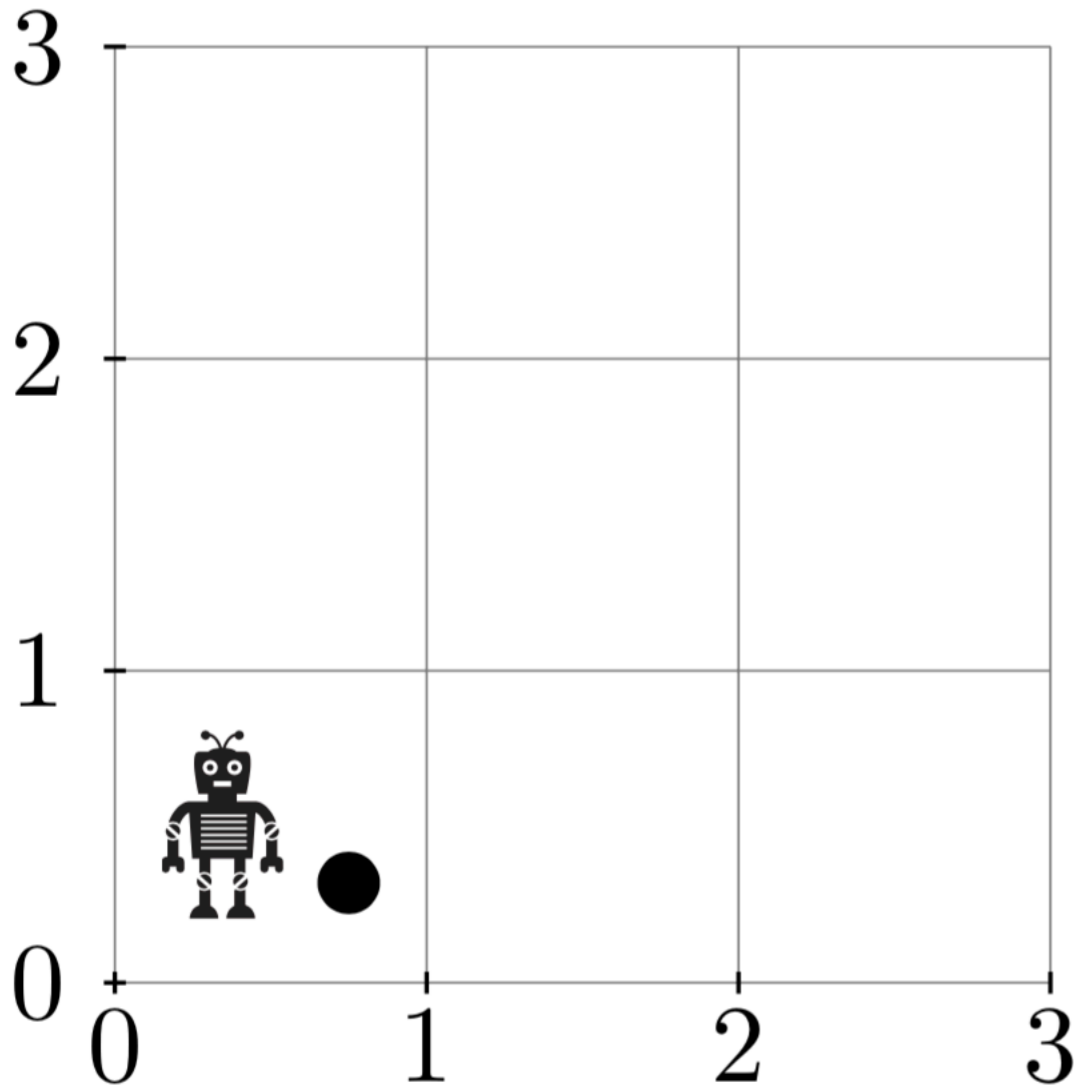
1. Generate random tasks
2. Learn solutions to them
3. Add solutions to the BK

Building

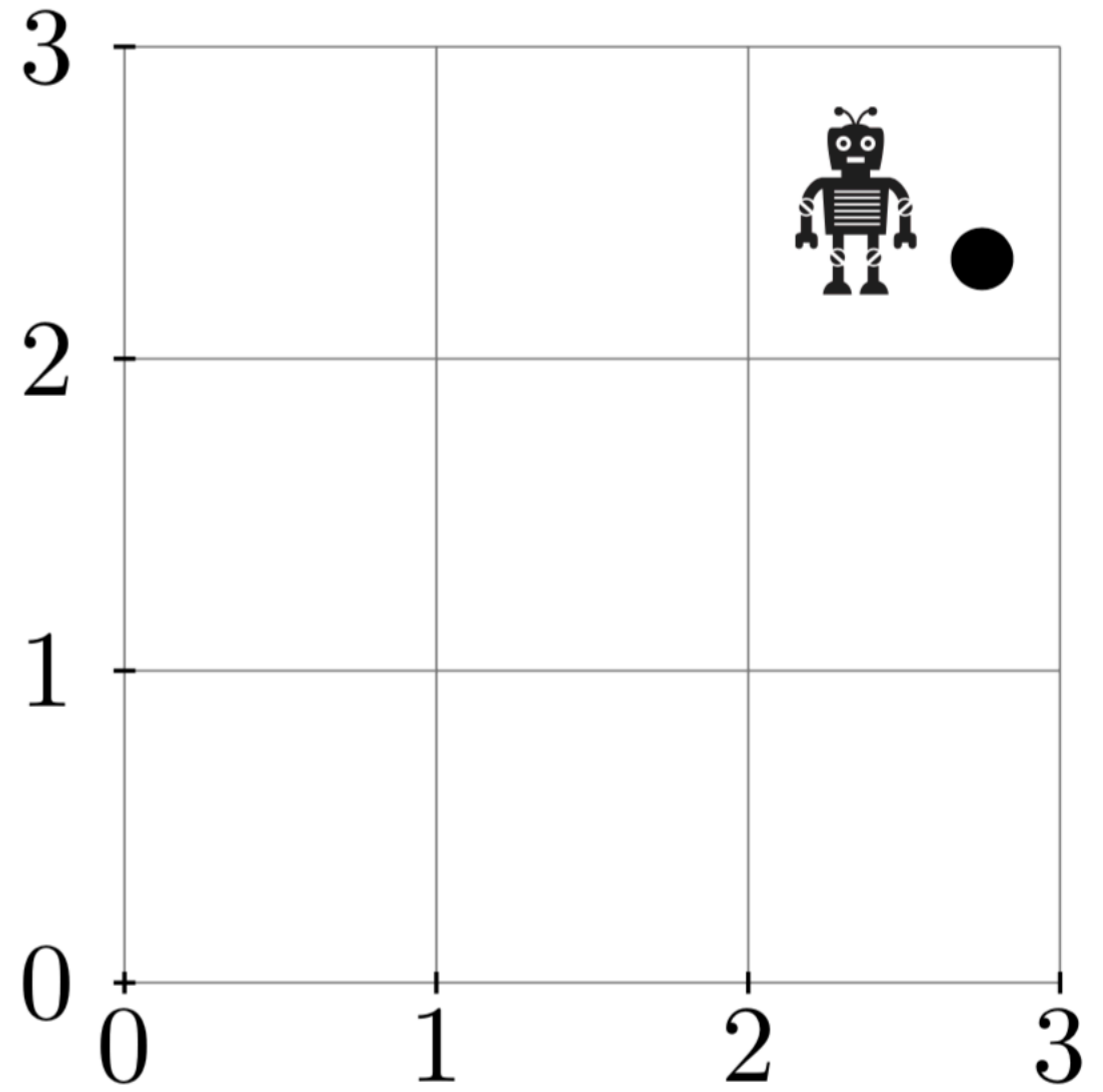
Solve real problems using the augmented BK

Why?

We increase branching but reduce depth



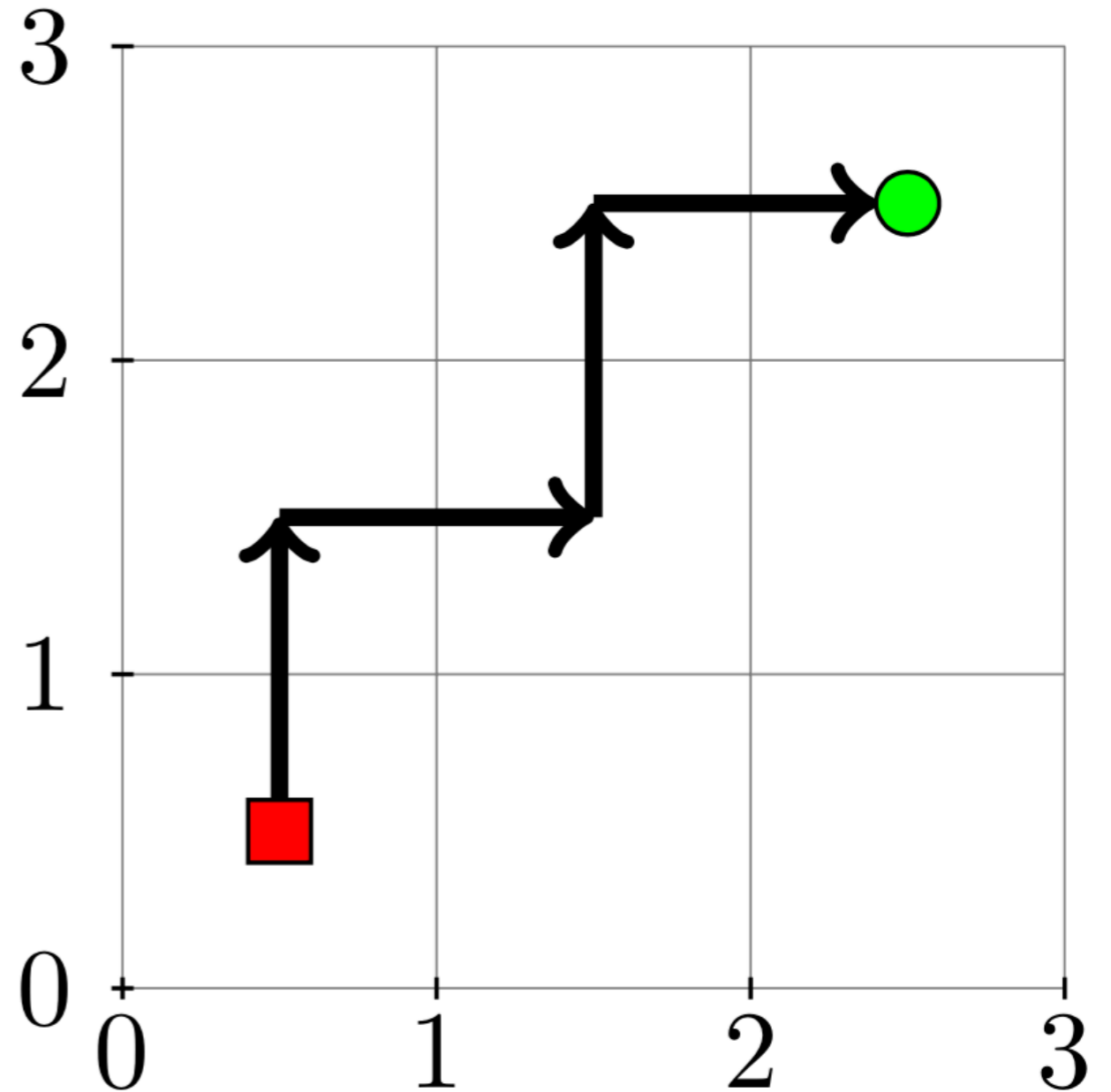
(a) Initial state



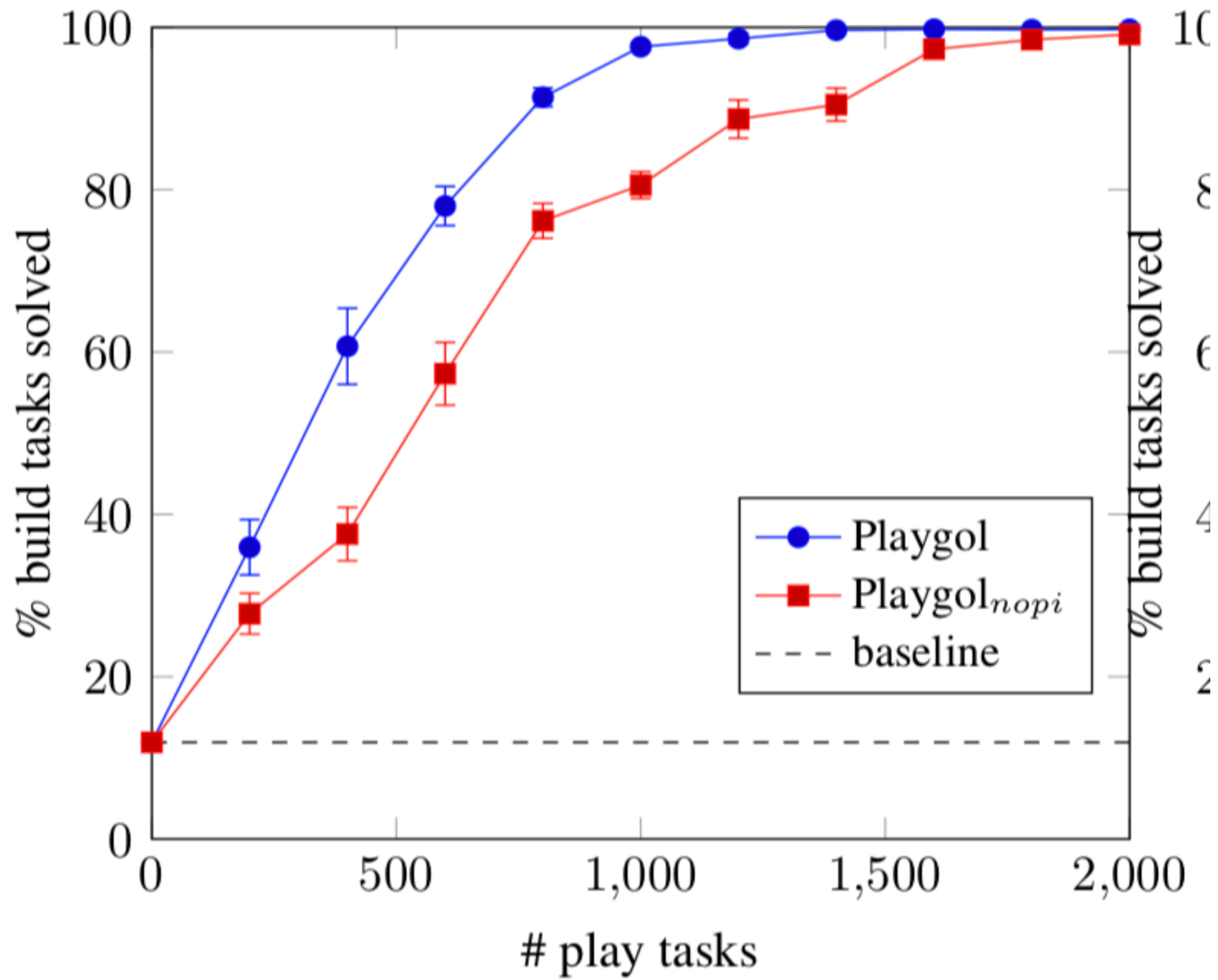
(b) Final state

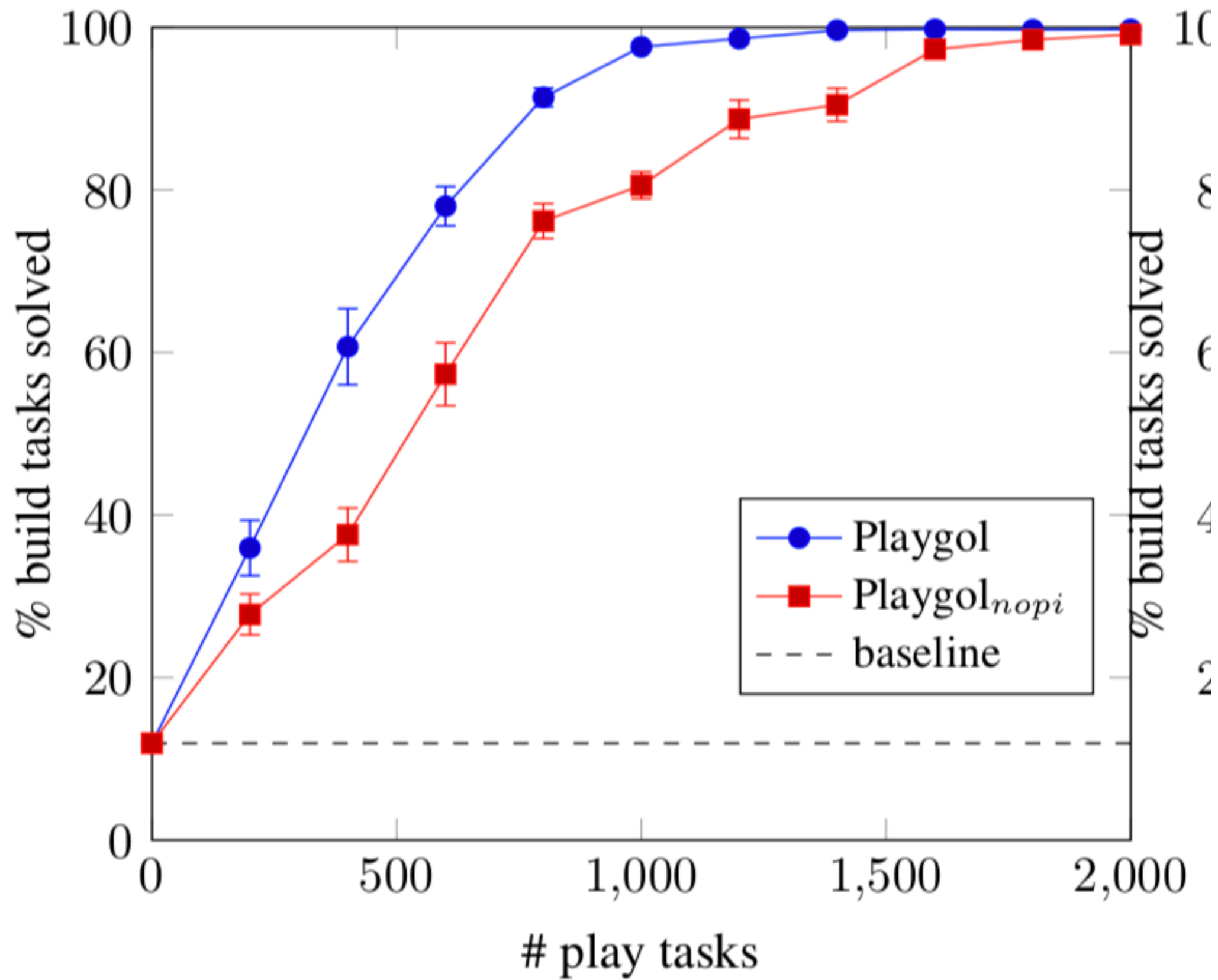
```
f(A,B):-  
  grab(A,C),  
  f1(C,D),  
  f1(D,E),  
  drop(E,B).  
f1(A,B):-  
  up(A,C),  
  right(C,B).
```

(a) Program

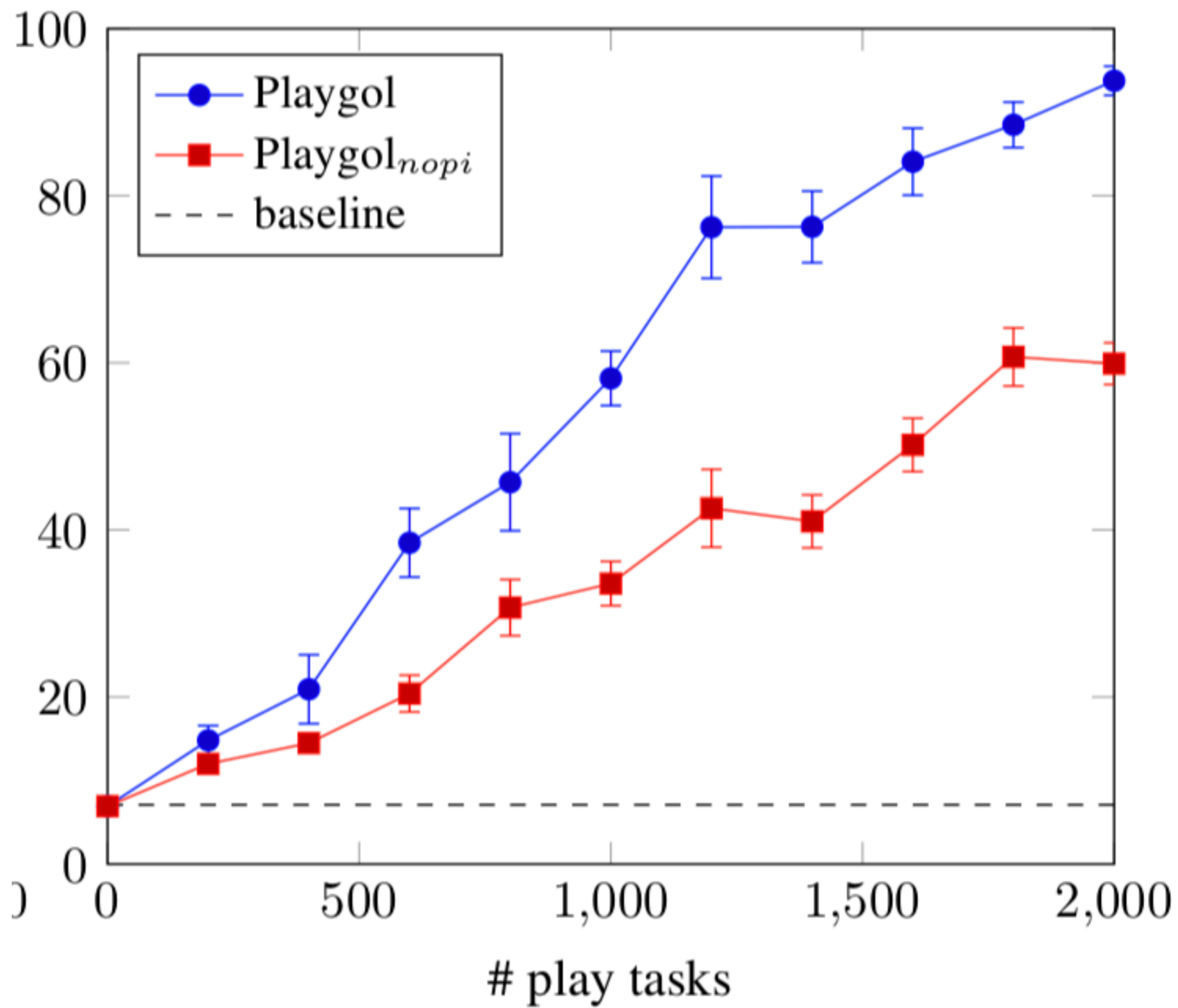


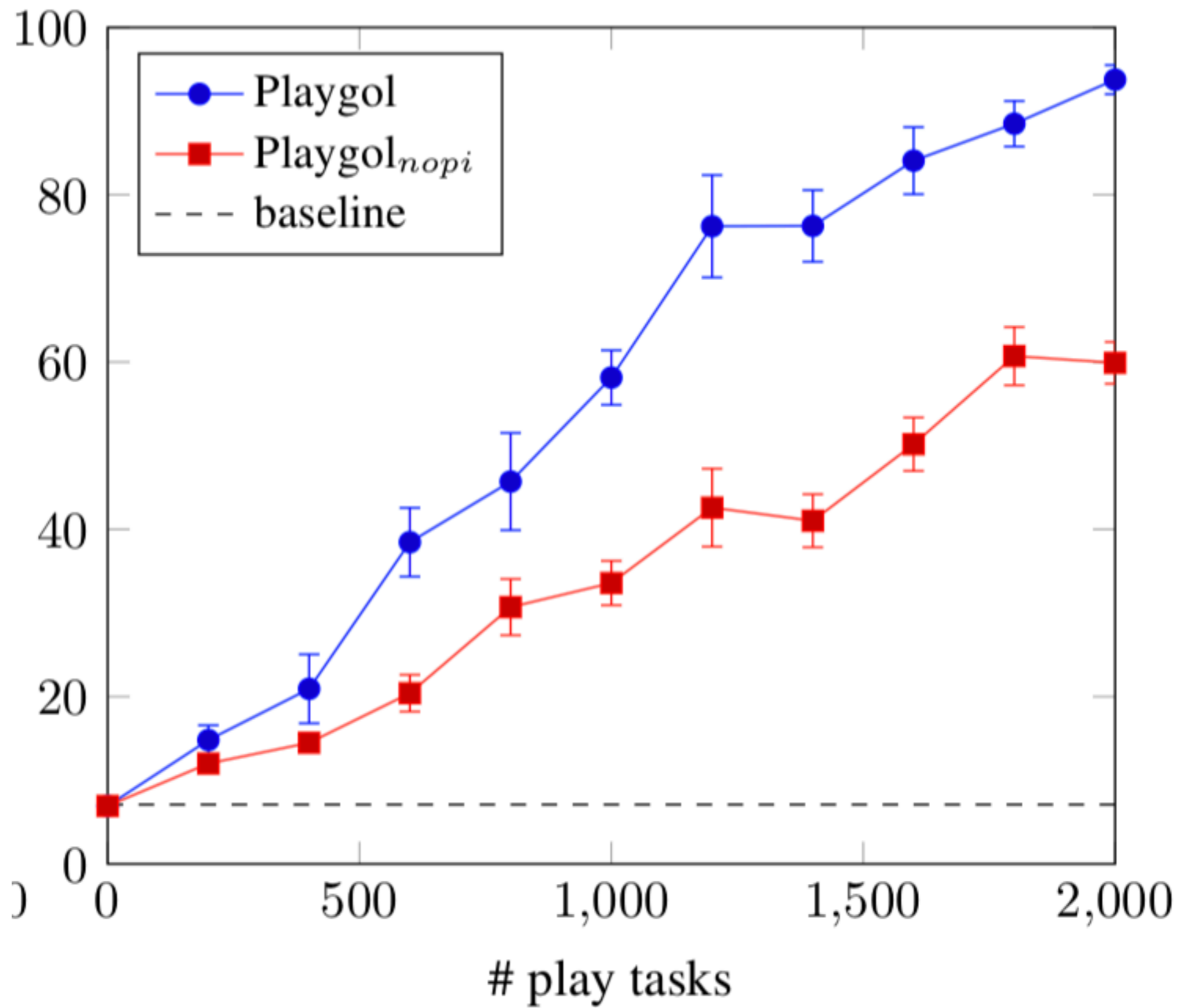
(b) Plan





2000 \ll 5,000,000





2000 \ll 24,000,000

Input

Output

22 July, 1983 (35 years old)

JUL

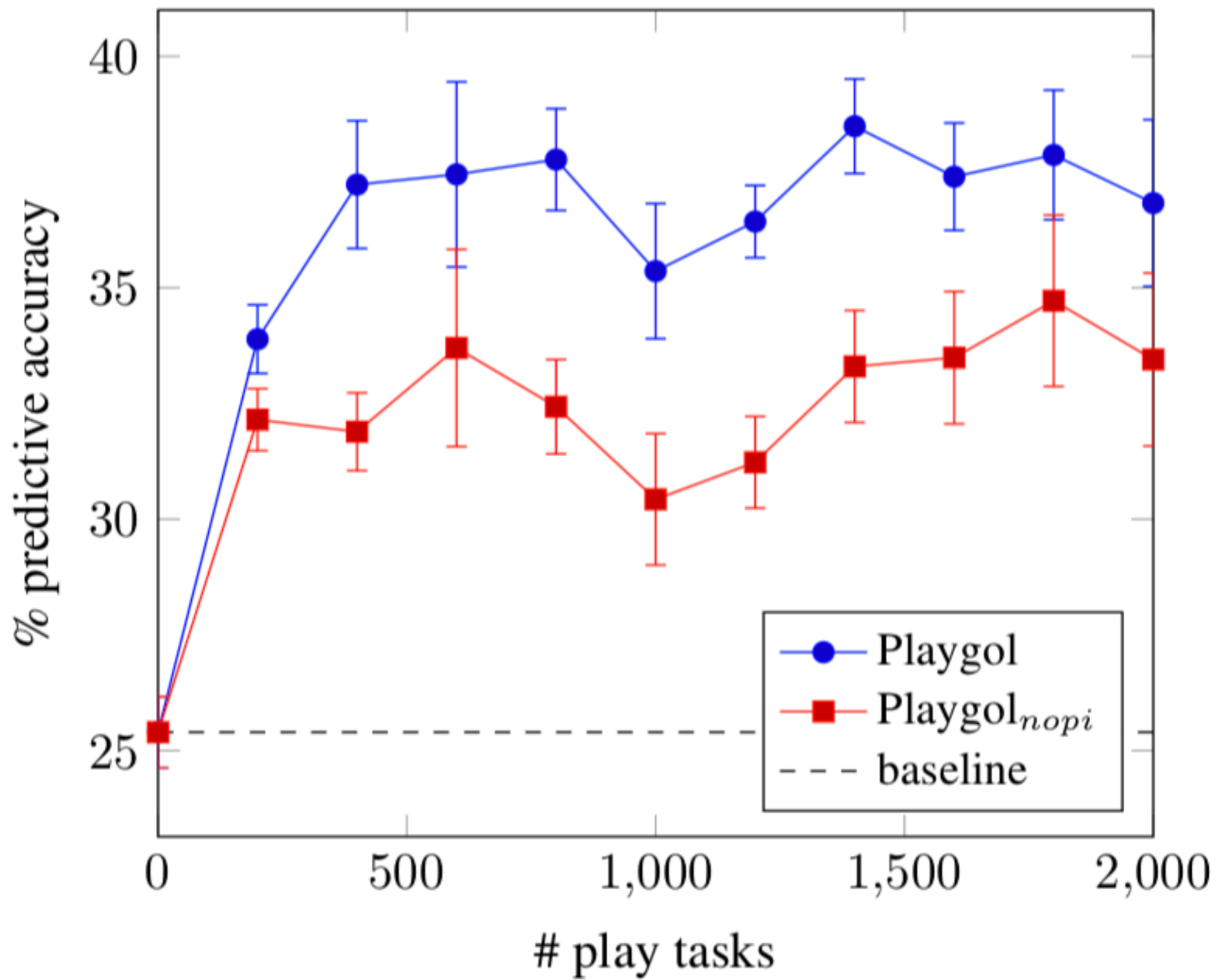
30 October, 1955 (63 years old)

OCT

2 November, 1954 (64 years old)

NOV

Task	Input	Output
play_9	.f\73\R)	F
play_52	@B4\X;3MjKdyZzC	B
play_136	9pfy'ktfbS1v	99PF
play_228	I6zihQk-	Q



```
build_95(A,B):-play_228(A,C),play_136_1(C,B).
play_228(A,B):-play_52(A,B),uppercase(B).
play_228(A,B):-skip1(A,C),play_228(C,B).
play_136_1(A,B):-play_9(A,C),mk_uppercase(C,B).
play_9(A,B):-skip1(A,C),mk_uppercase(C,B).
play_52(A,B):-skip1(A,C),copy1(C,B).
```

Todo

1. Better sampling
2. Forgetting
3. When does it work?