

# Plan Recovery in Reactive HTNs Using Symbolic Planning

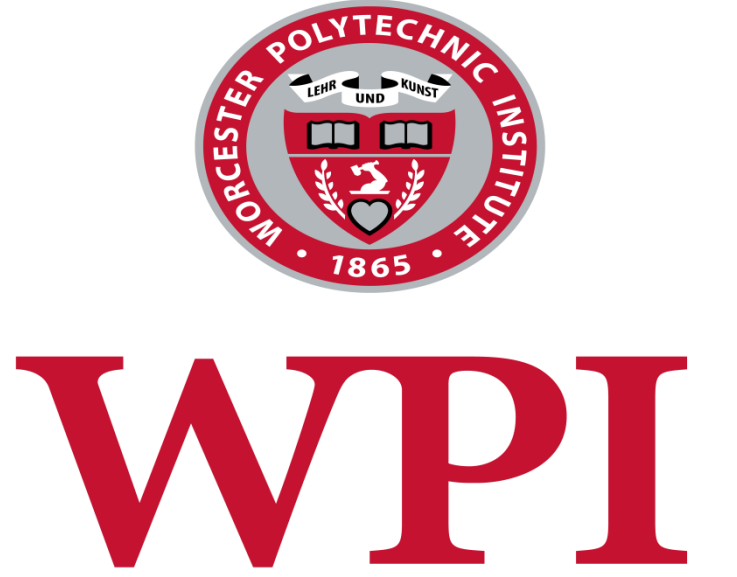
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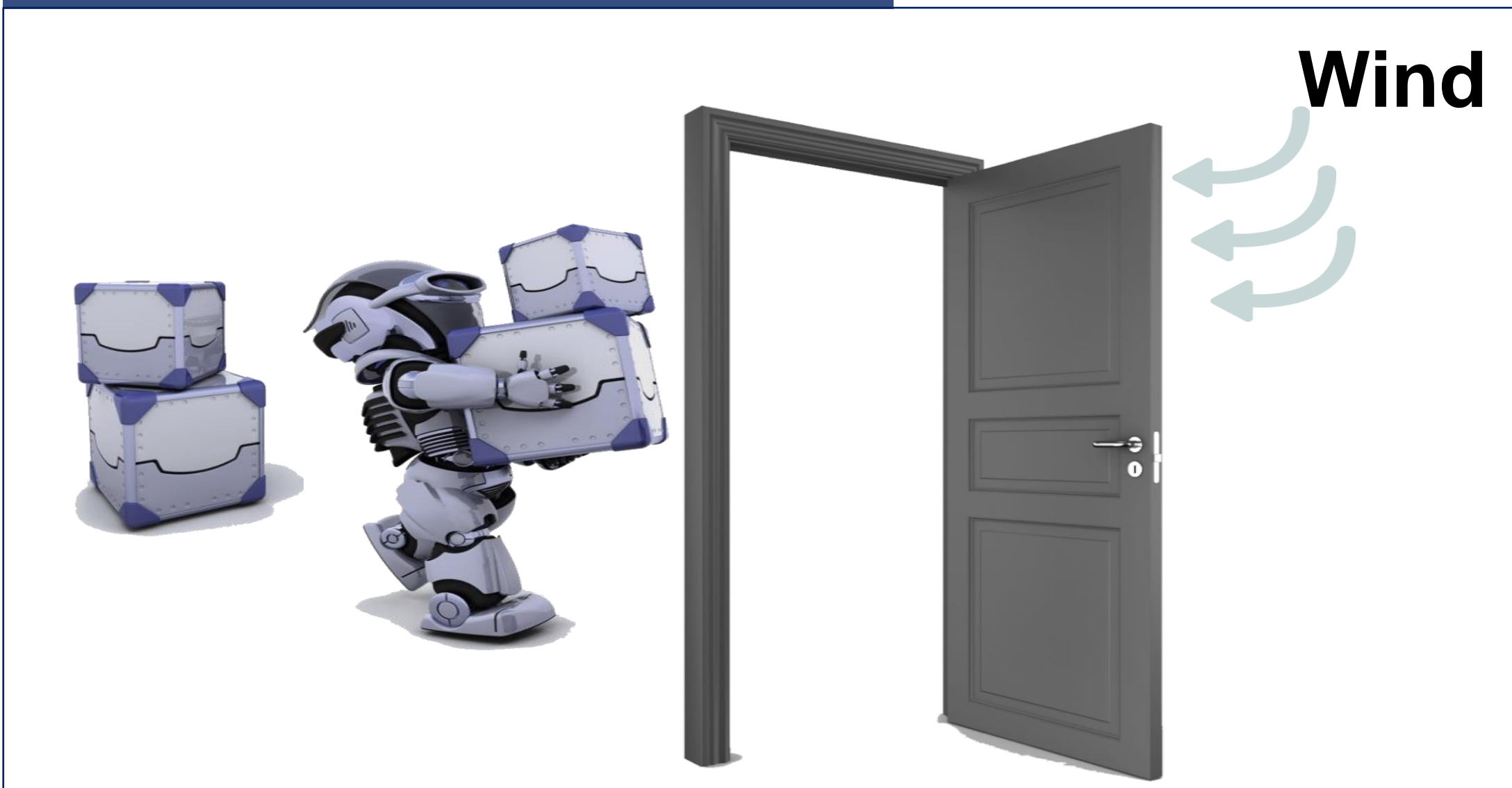
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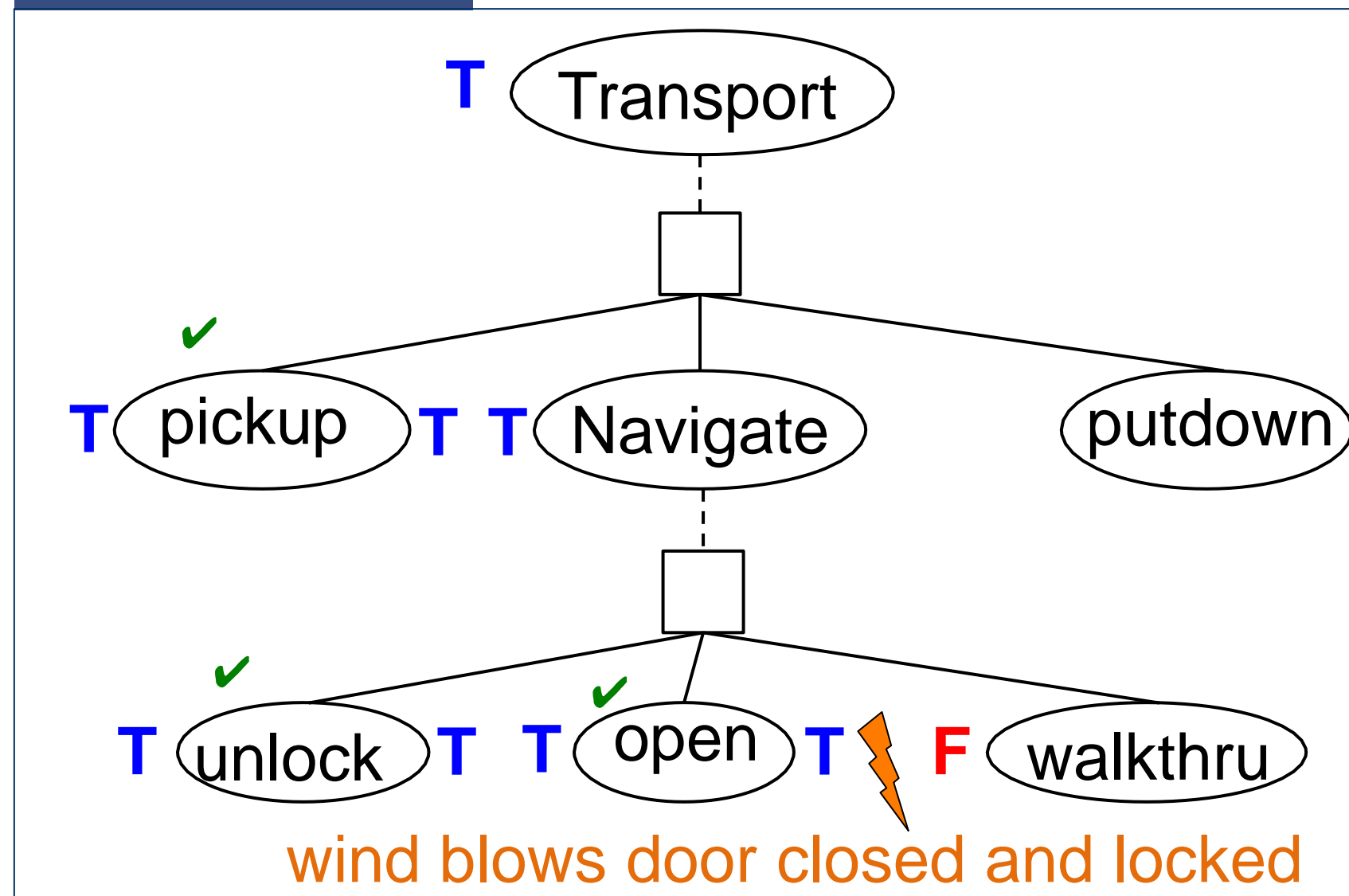
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## Environnement



## Model



**Breakdown** : HTN execution fails → No executable task in the current state.

- External agent changes the environment (e.g., the wind).
- Incomplete or incorrect modeling of the HTN conditions / actions.

## Reactive planning [Firby,1987]

- ✓ **Procedural** modeling of knowledge (e.g. JavaScript).
- ✓ Support incomplete domain knowledge.
- ✗ Execution in the current state only.

## Symbolic planning [Nau et al, 2000]

- ✓ **Logical** modeling of knowledge (e.g. Prolog).
- ✓ Allows prediction and repair.
- ✗ Need correct and complete representation

## Proposition

### Reactive HTN

Domain knowledge

Planning engine

Procedural knowledge

Execution in the current state

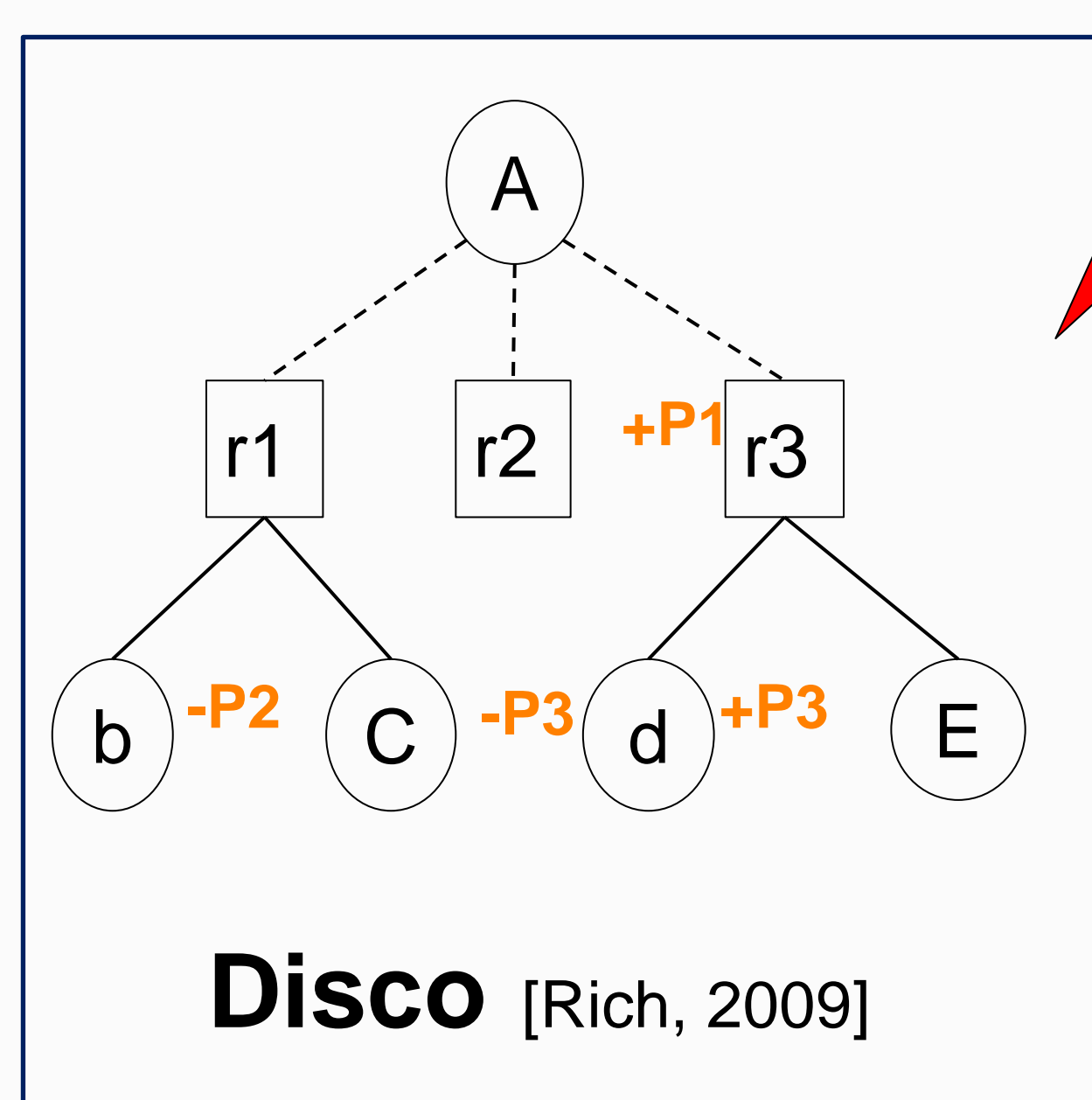
Plan repair

Symbolic knowledge (primitive tasks)

Linear symbolic planner

Manuel extraction

### Discolog



Breakdown

Failed conditions

Symbolic representation

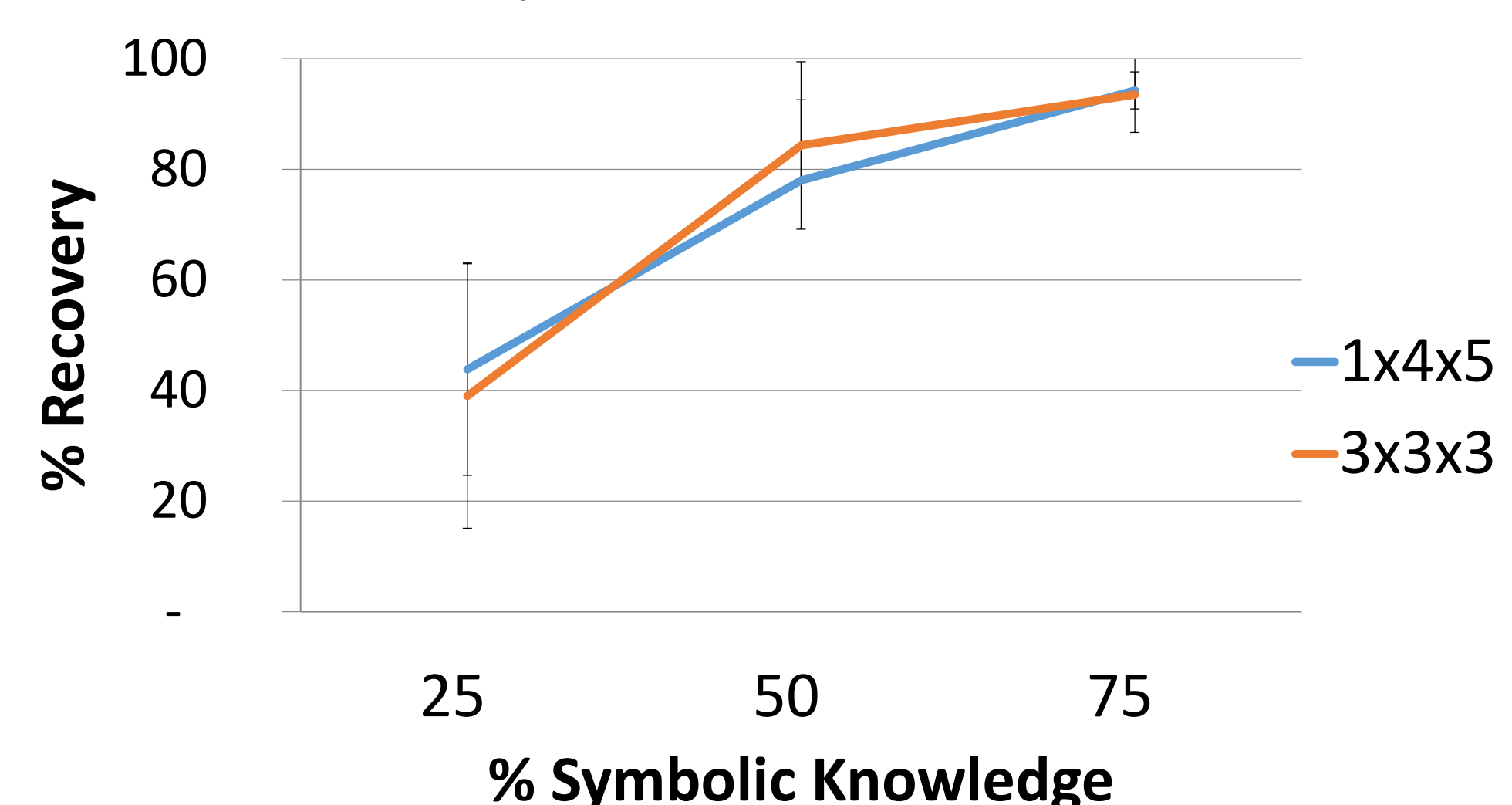
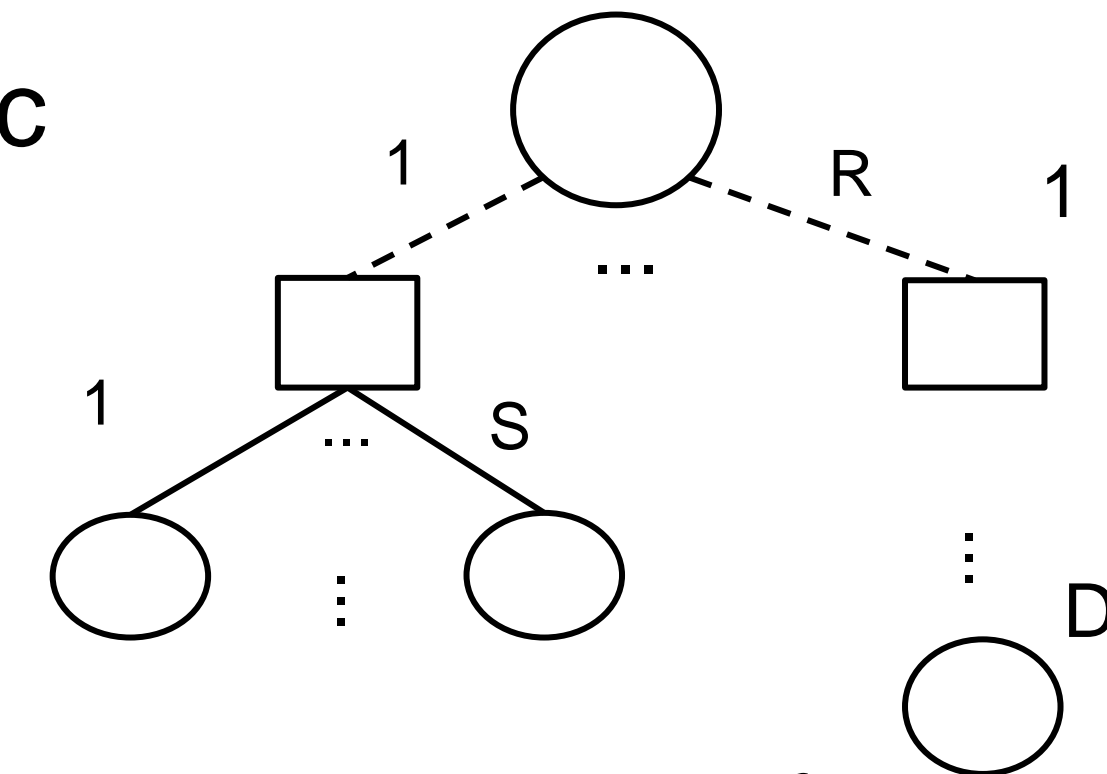
STRIPS in Prolog

[Fike&Nilsson 1997]

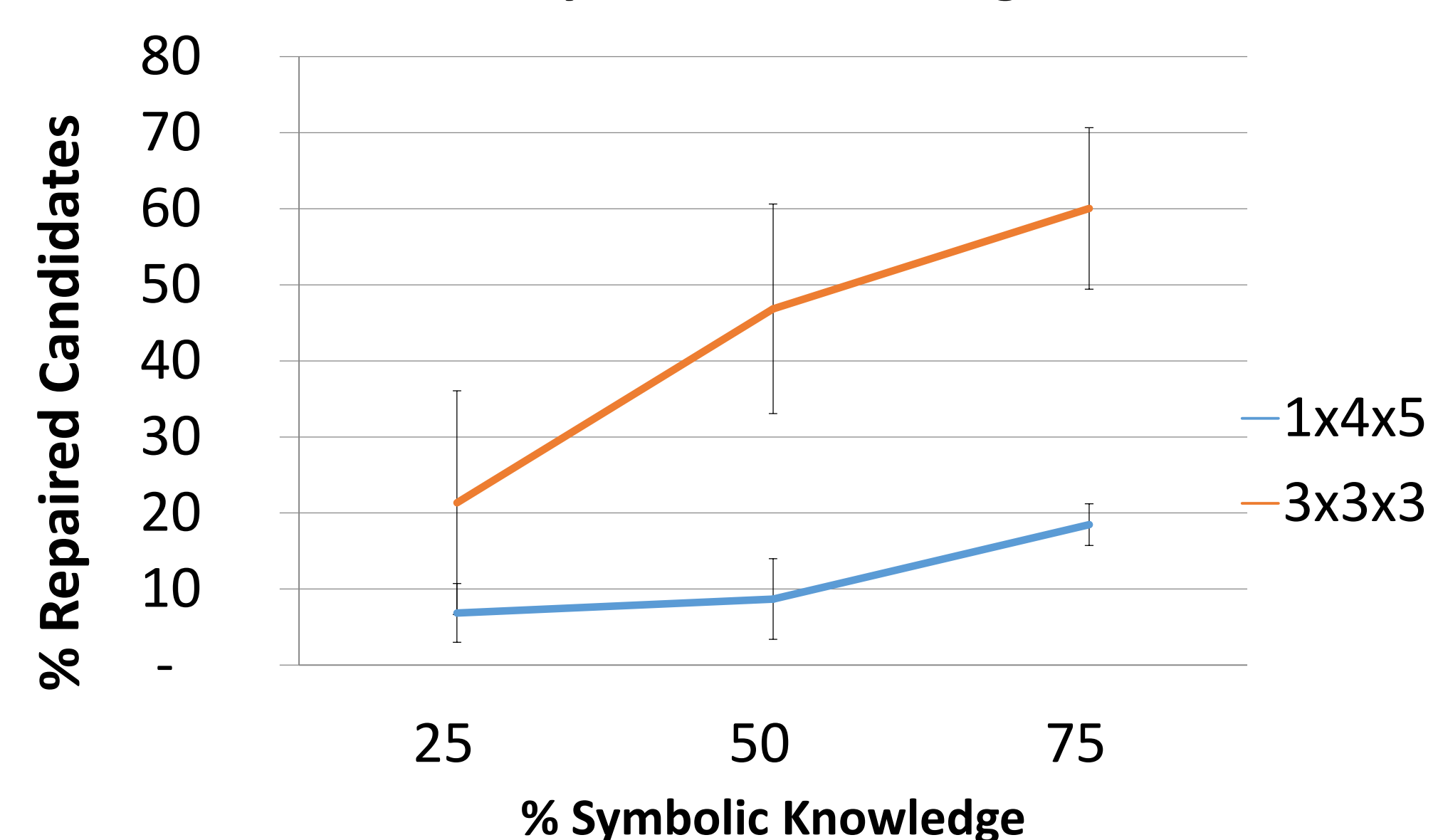
Disco [Rich, 2009]

## Experiments and Results

- Using randomly generated synthetic HTNs:  $D \times R \times S$   
 $D$  = depth (of task nodes)  
 $R$  = recipe branching factor  
 $S$  = subtask branching factor
- Different levels of symbolic information: 25%, 50%, 75% of conditions are symbolic.



Repaired Candidates Vs Symbolic Knowledge



Recovery Vs Symbolic Knowledge

## Perspectives

### Real experience

- Complex robot procedures.
- Adaptable social dialogue (PhD thesis)

Social Aspect (social variables)

DK

Tasks + Dialogue Tree

symbolic knowledge

Discolog

Disco

STRIPS

## References

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R. E. Fikes and N. J. Nilsson. STRIPS: A new approach to the application of theorem proving to problem solving. *Artificial Intelligence*, 2:189-208, 1971.

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