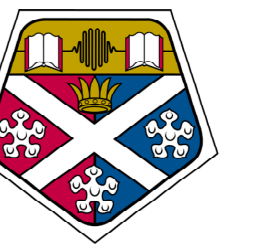


Wizard: Suggesting Macro-Actions Comprehensively

Hakim Newton, John Levine



Macro-Actions

- Also called Macros
- Groups of Actions
- Compound Statements
- Procedures/Subroutines
- Plan Segments/Subplans

Wizard's Context

Given a Planner and a Domain

- How to improve performance?
Assist with knowledge.
- How to represent knowledge?
Use macro-actions.
- What macro-actions?
Wizard suggests.

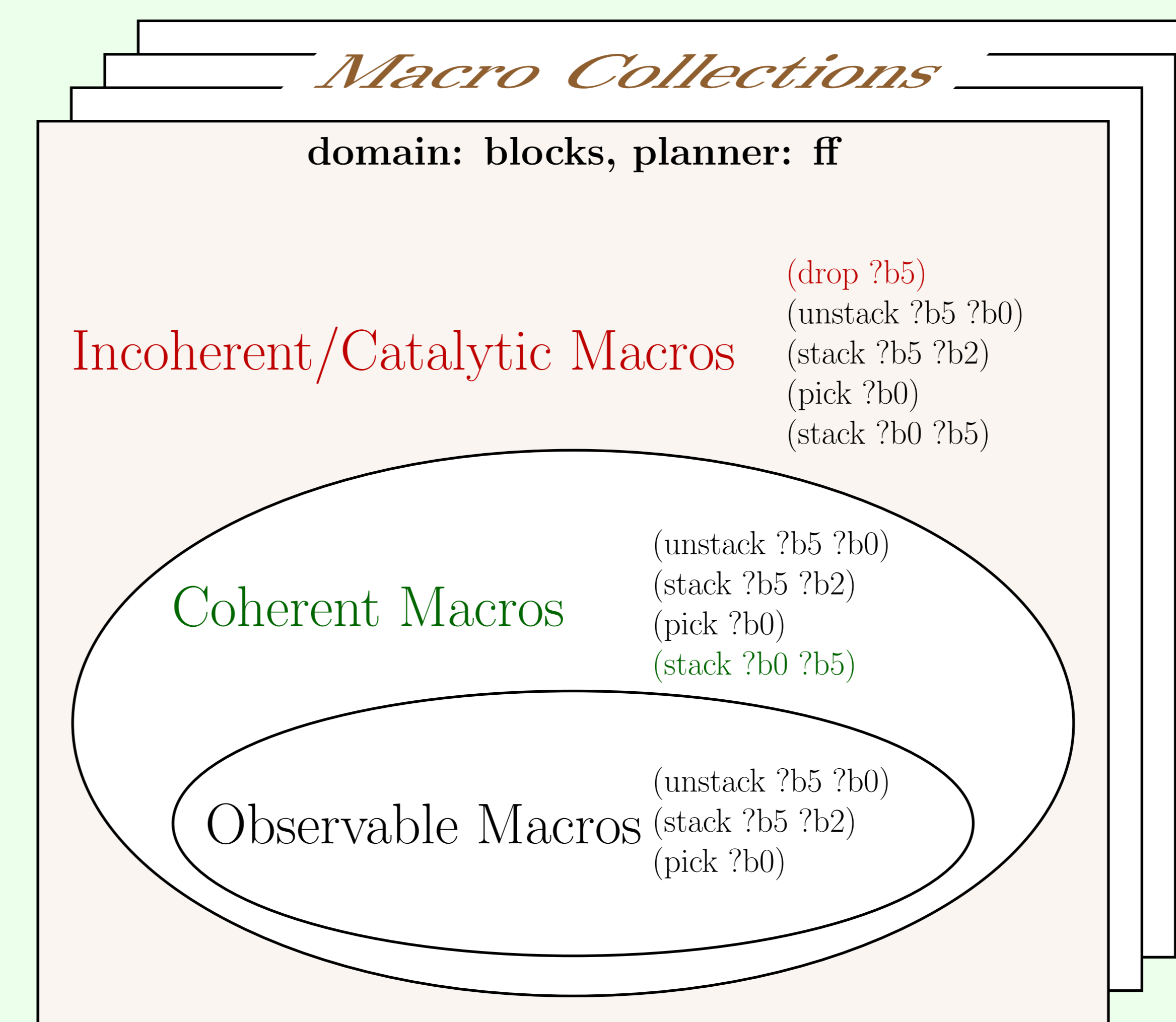
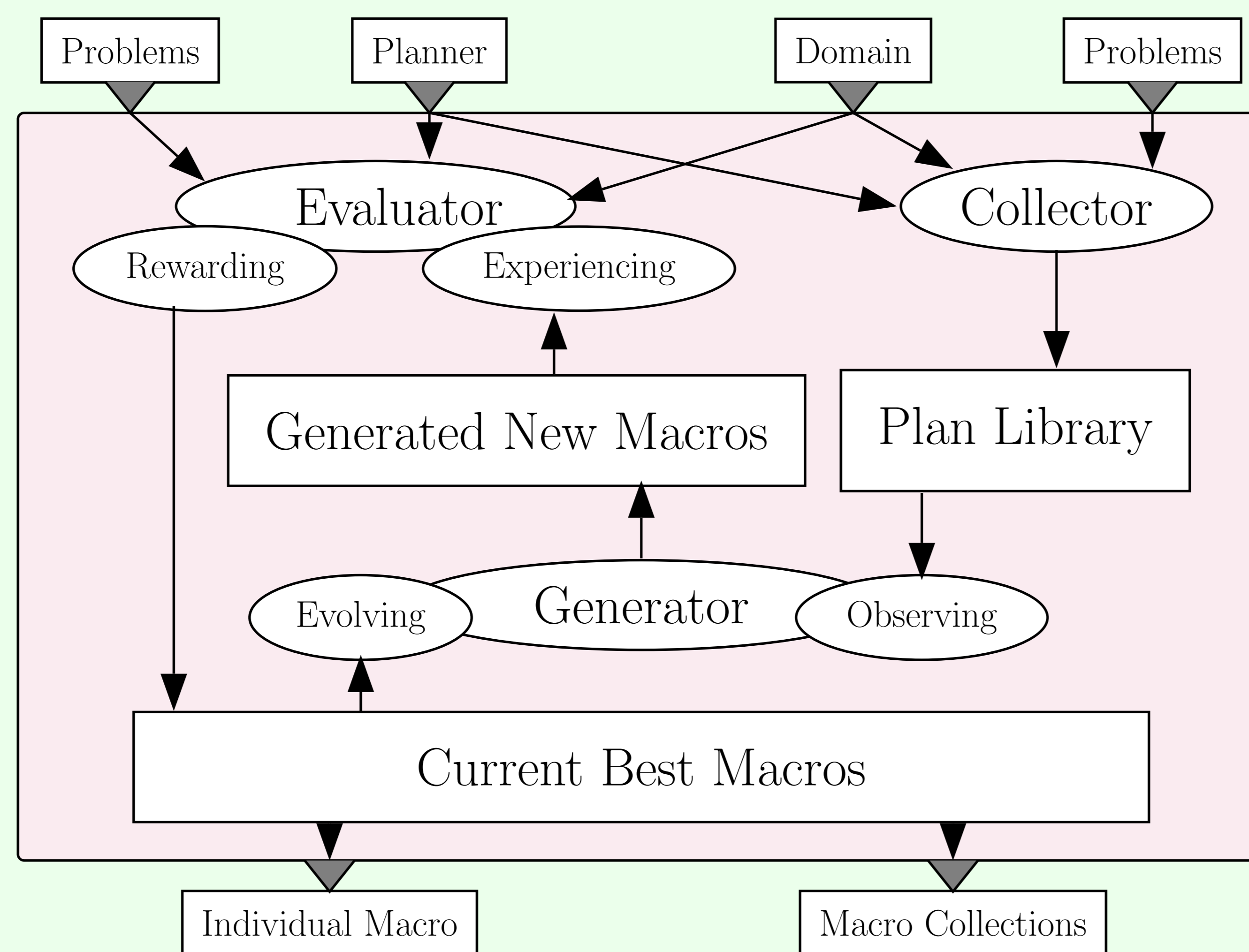
Wizard and Related Work

Characteristic	Domain/Planner	Solution
Plateau escaping sequence	Fast Forward	MARVIN
Valley travelling sequence	One heuristic planner	MACLEARN
Causally linked macro	Fast Forward	Macro-FF
<i>Don't care; don't know</i>	<i>Any planner</i>	<i>Wizard</i>
Symmetry, almost symmetry	Briefcase, Gripper, etc.	MARVIN
Component abstraction	Gripper, Rover, etc.	Macro-FF
Operator decomposability	Rubik's cube, etc.	Korf's MPS
<i>Don't care; don't know</i>	<i>Any domain</i>	<i>Wizard</i>

Why Wizard?

- ★ *Readily Works*
- ★ *Arbitrary Domains*
- ★ *Arbitrary Planners*
- ★ *Single or set of macros*
- ★ *Non-observable macros*

System Architecture and Macro Space



Macros Conceptually

- Frequently used subplans
- Difficult to find subplans
- Trouble avoiding subplans
- Trouble recovering subplans

- Extended search space visibility
- Fewer intermediate states visited
- Additional search neighbourhood
- More branches at search nodes

Macros Technically

- Macros not supported in PDDL
- Planners not aware of macros
- Macros in disguise of actions
- Currently in STRIPS & FLUENTS
- Hope, macros be recognised in PDDL

Syntactical Limits

Macro Generation

- Operators on macros' sequences
- Operators on macro collections
- Macro pruning strategies used

- Cover = % problems solved
- Scope = Weighted mean time gain
- Point = % problems solved faster
- Utility = Cover × Score × Point

Macro Evaluation

No Exploitation of Specific Structural Properties

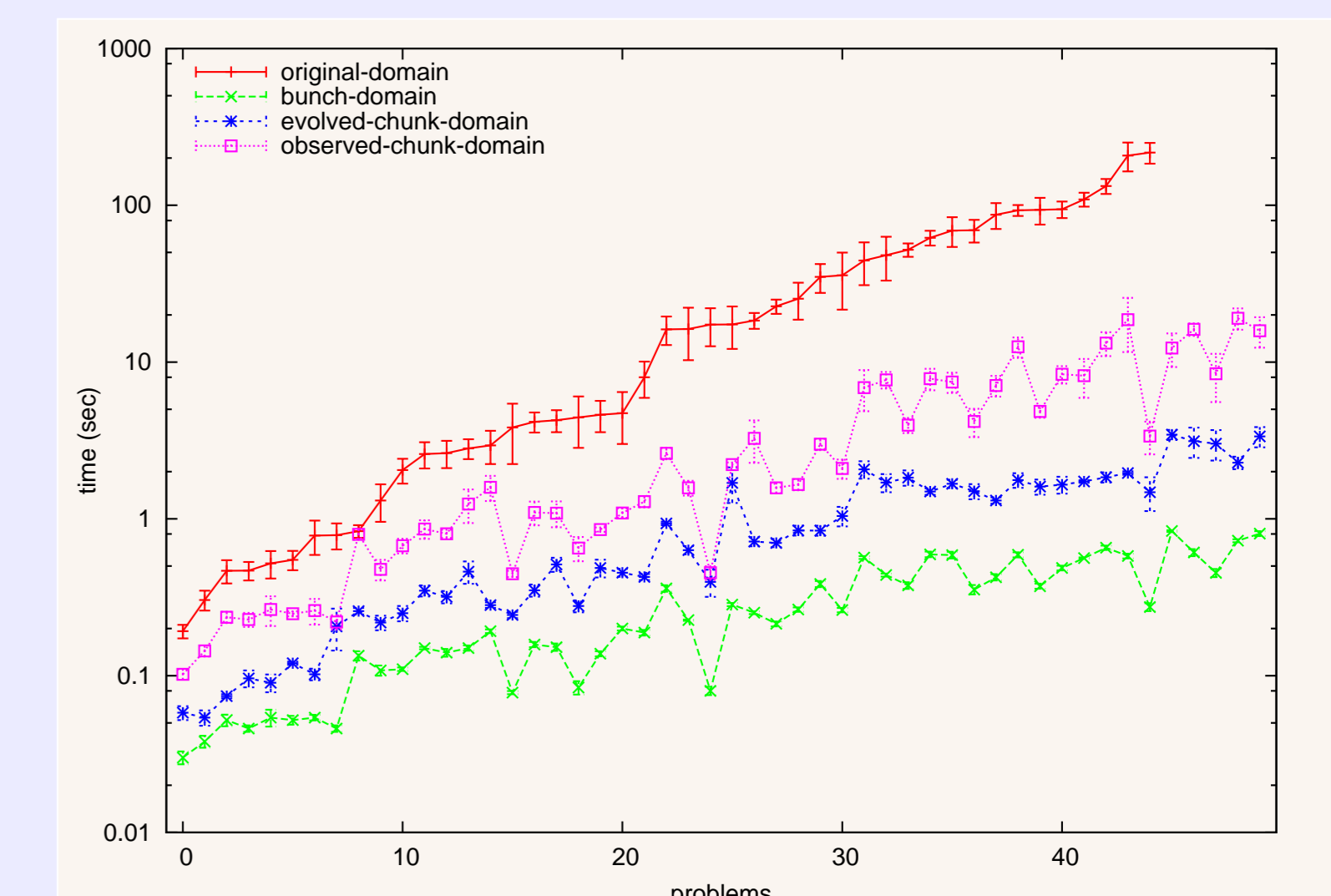
Acquisition
Representation
Exploitation

No change to the exploitation component
Representation can be obtained somehow
Learning performance improving macros
Arbitrariness in structural properties

Wizard, a Learner

Not a Planner
with Limited Learning

Scope of Wizard



Results: Blocks-LPG