Evolving Reasons for Tests or

Can we gain something from Directly Searching SE Decision Spaces?

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CREST Open Workshop, UCL, London, 2011-05-12

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What is Engineering?

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“Making trade-offs & Balancing competing constraints”

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[Cockburn2006]

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Justifying Decisions

Changing Decisions

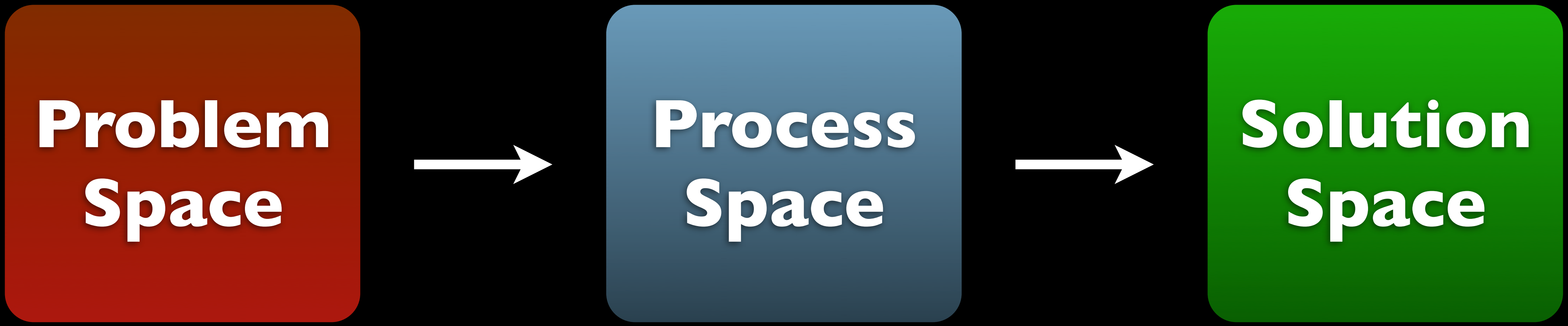
SBSE motivation

- Fits search/optimization like a glove so we argue that SBSE:
  - Easily Applicable ("We already have many spaces!" & "Requires relatively little expertise!")
  - Generic ("Same idea/search in many spaces!")
  - Robust ("Works even if info *incomplete, fuzzy, ...*")
  - Realistic ("Caters for multiple objectives")
  - Insight-rich ("We can learn about spaces we search manually")
  - Scalable ("CPU's gets cheaper and faster!")
  - Less Biased ("Fewer assumptions, that might be wrong!")
    - Than Humans & Than other Engineering Disciplines

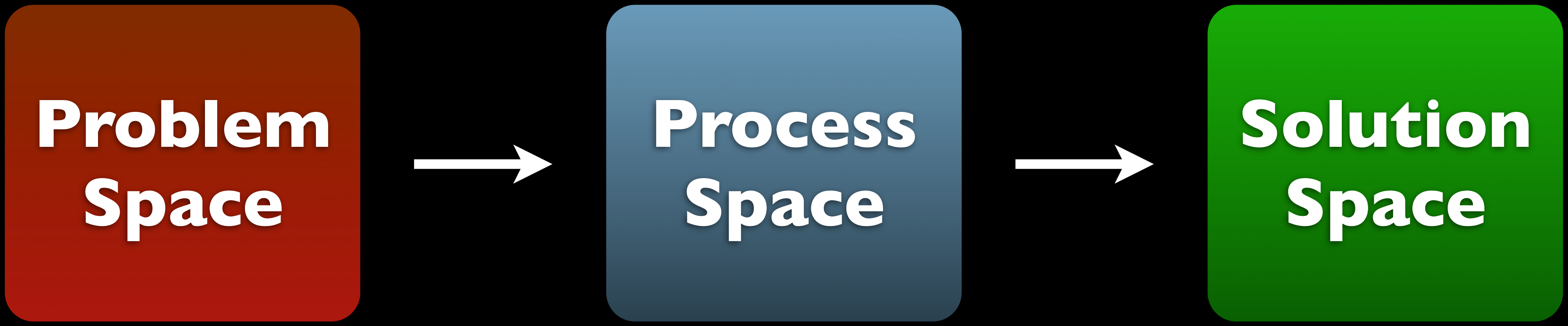
Solution Space

Problem Space

Solution Space

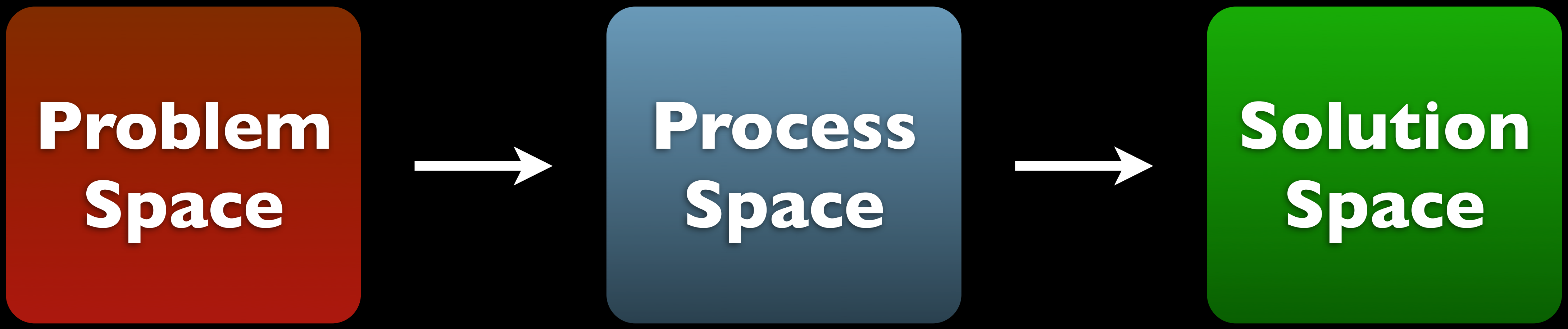


Problem Space → Process Space → Solution Space



Problem Space → Process Space → Solution Space

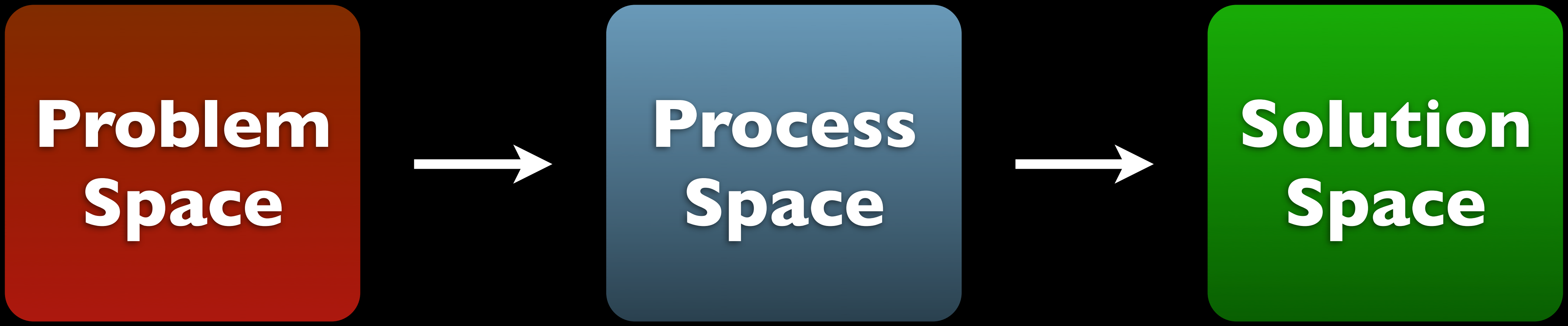
It Executes!



Problem Space → Process Space → Solution Space

It Executes!

It AutoCreates what Executes!



Problem Space

Process Space

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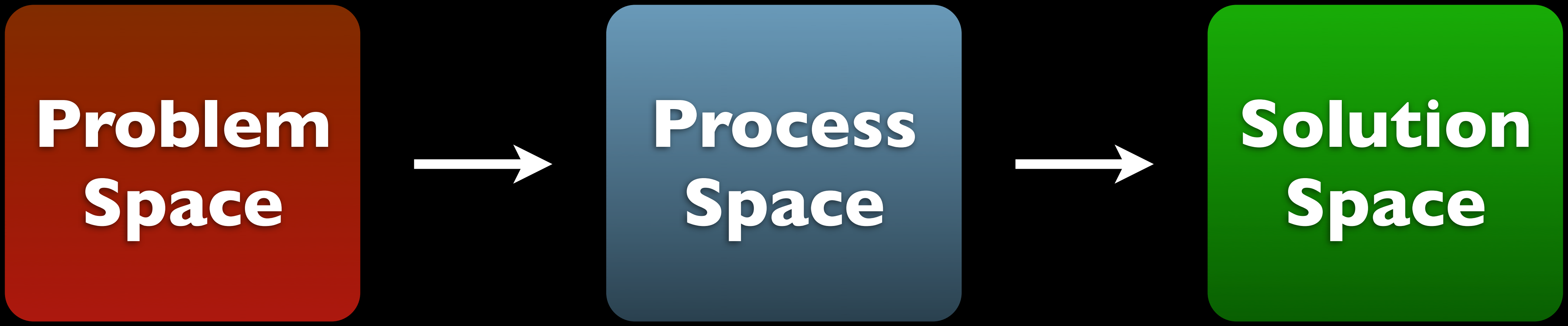
It Searches while Executing!



Problem Space

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It Helps ManuCreate what Executes!

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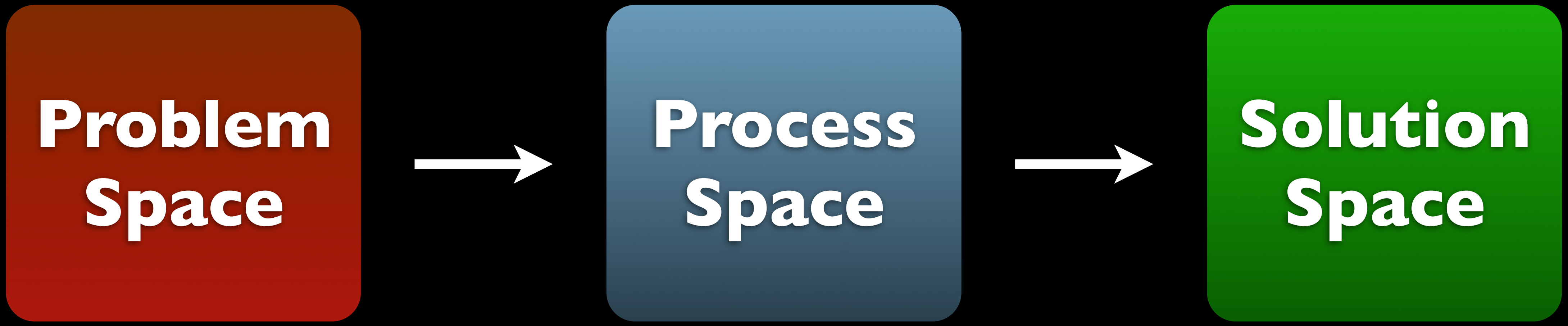

Problem Space → Process Space → Solution Space

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It Helps with How to ManuCreate!

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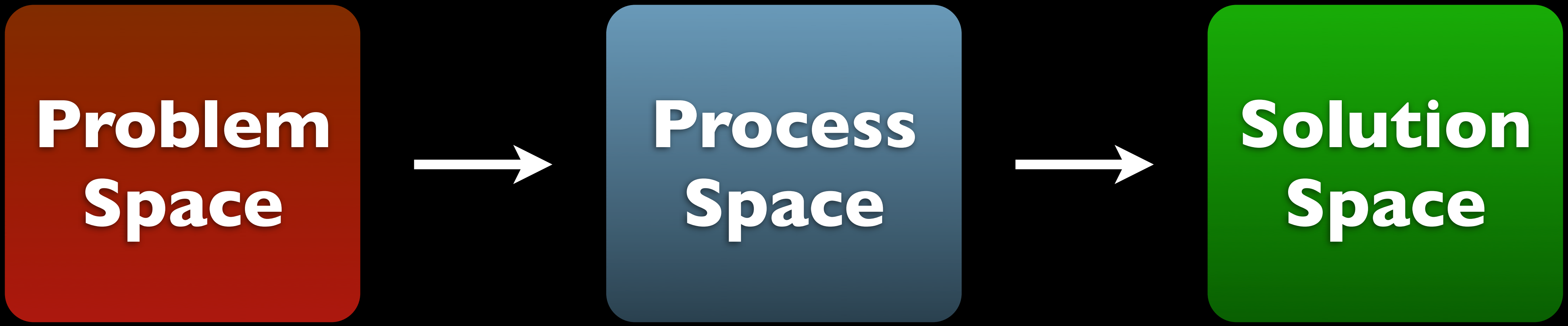

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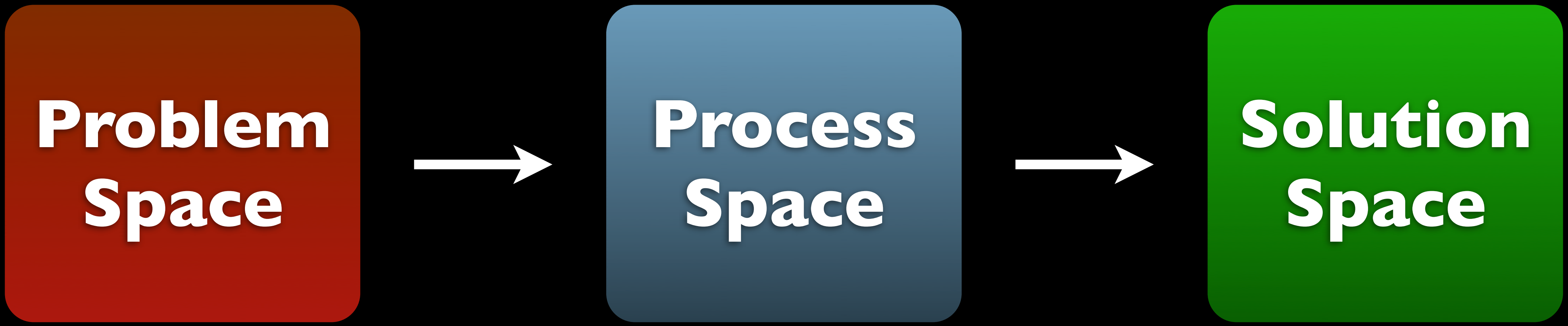

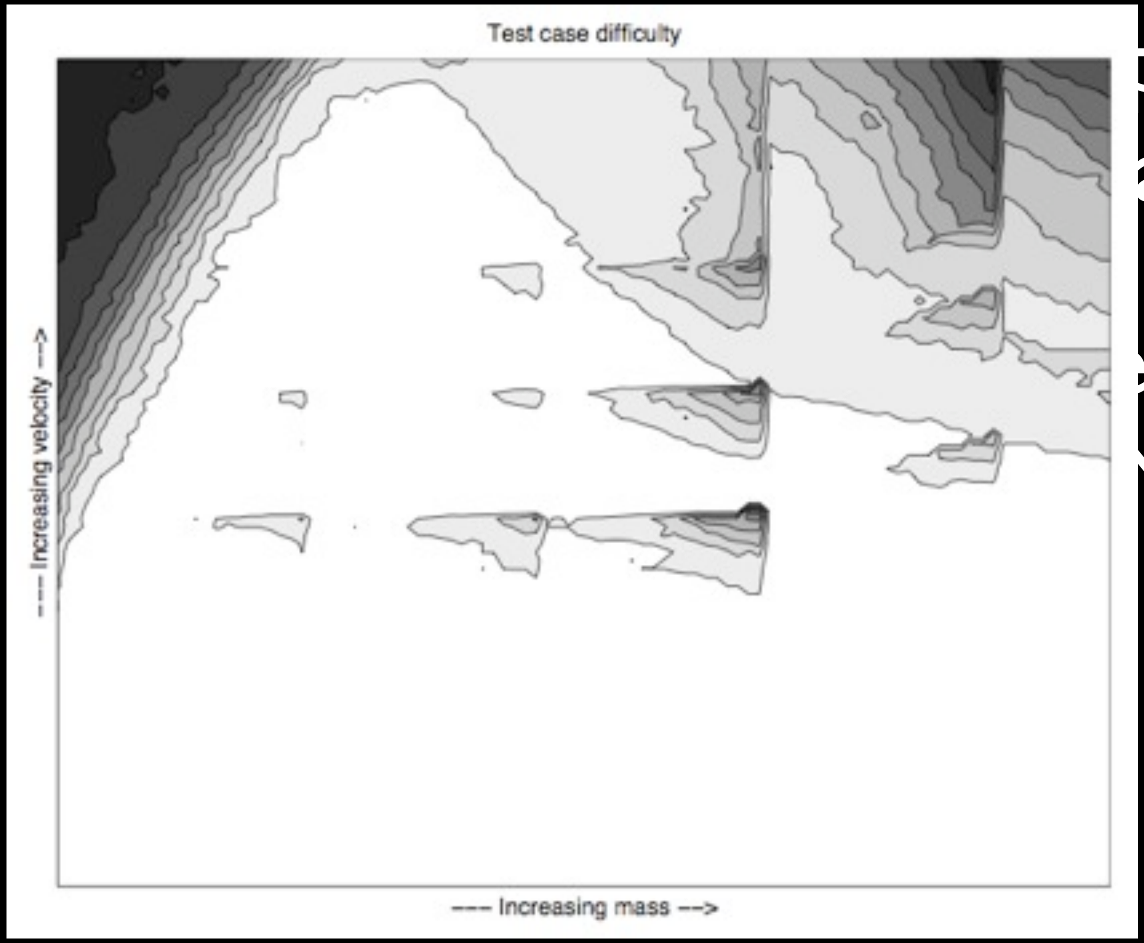

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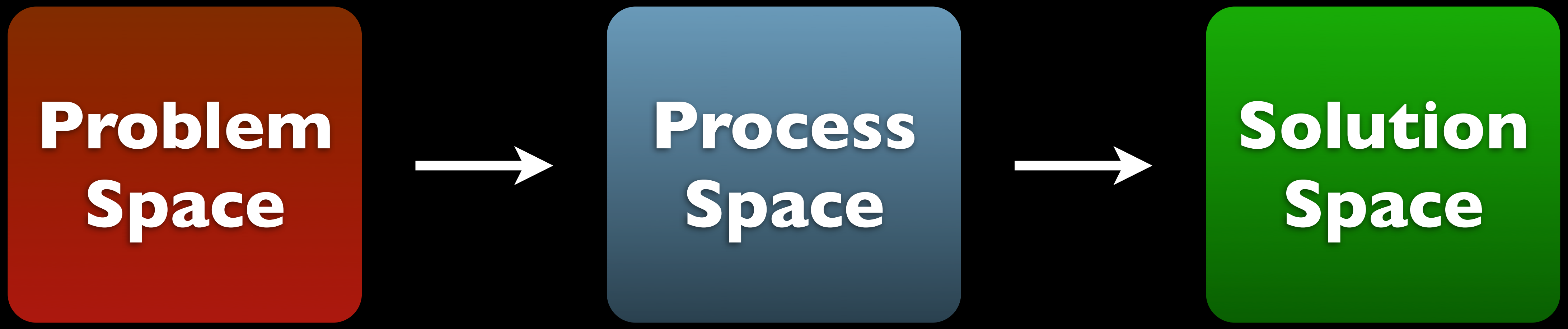

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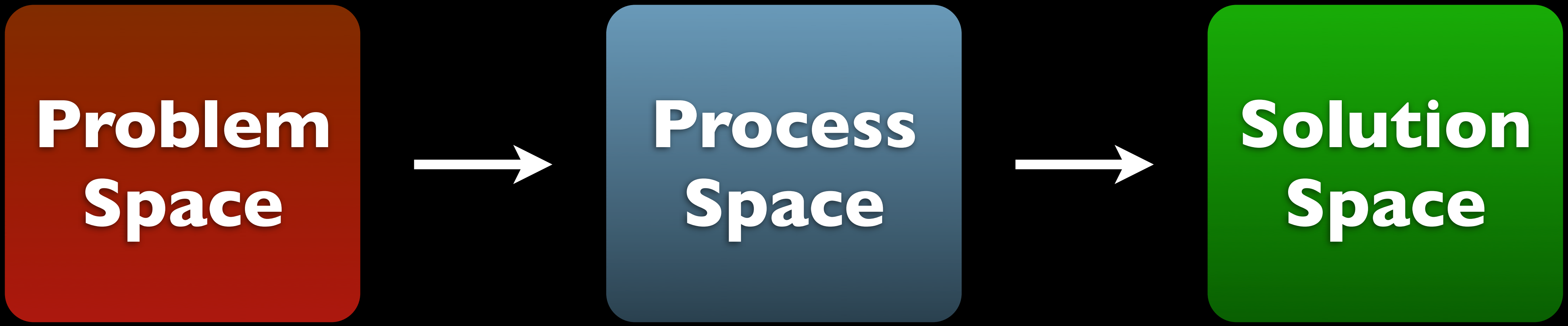

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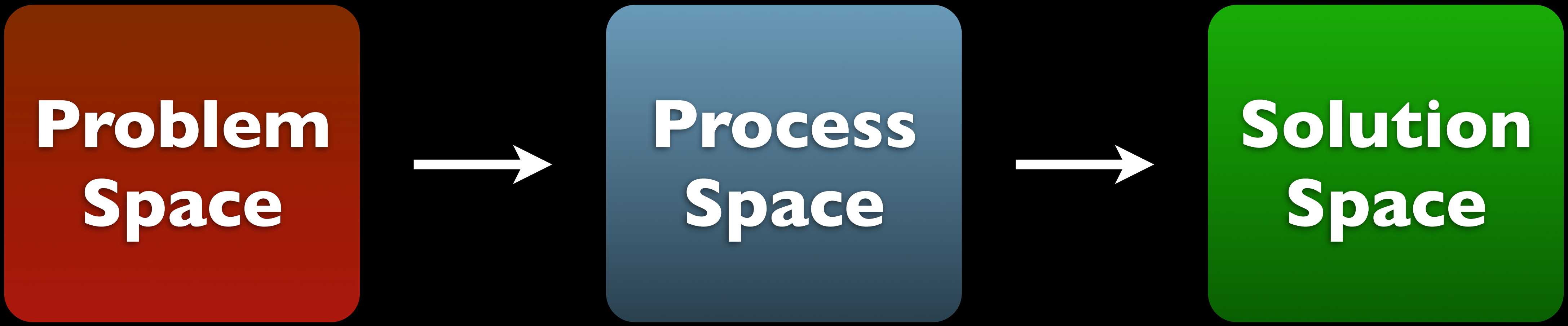

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“Preparing” for Decision

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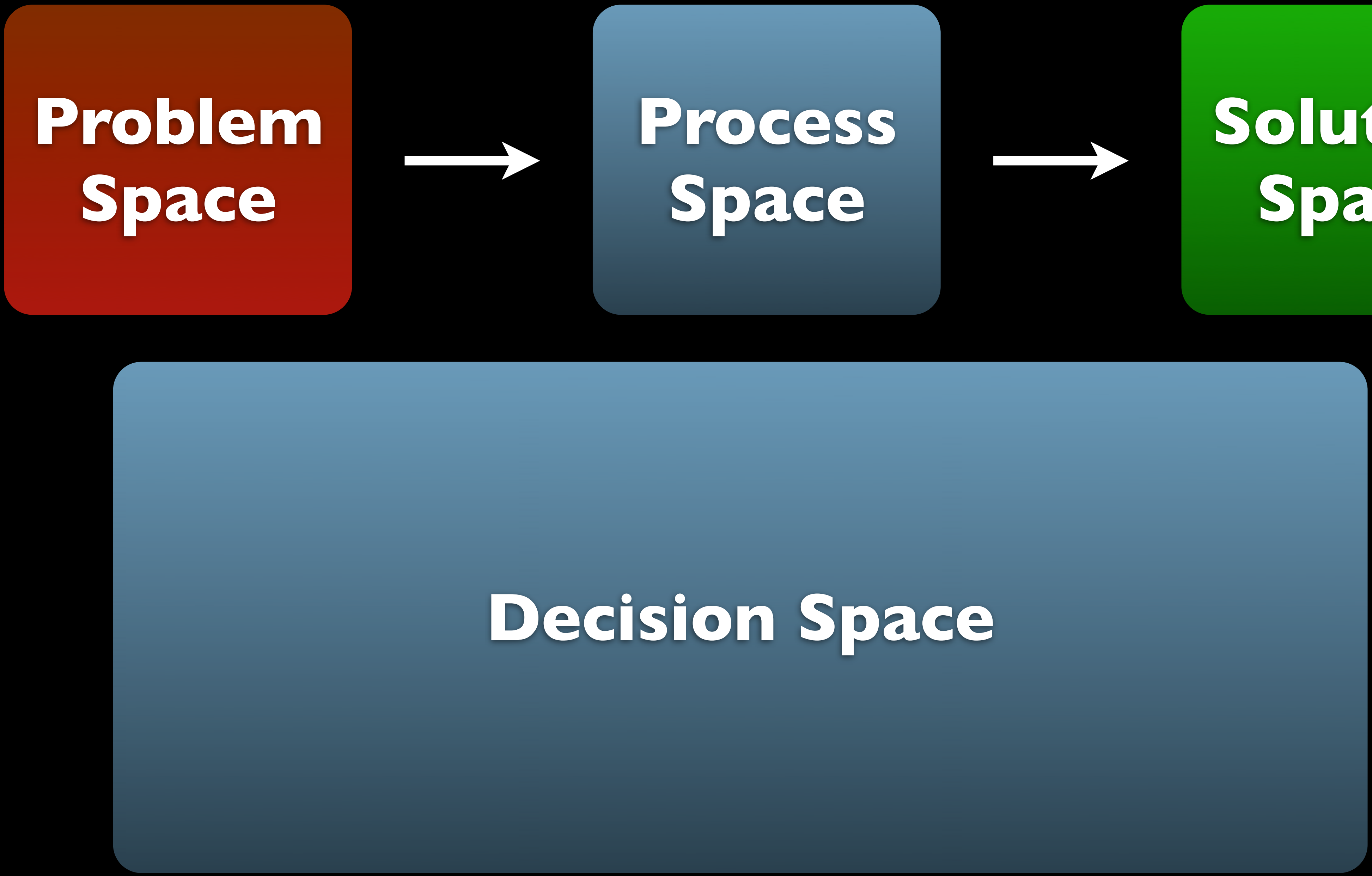

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Decision Space

Engineering Decisions

- Reasoning and justification involved is often:
  - Ill-defined
  - Ill-structured
  - Incomplete
  - Use Inconsistent and contradicting Information
  - Support not only logic, facts and probability but hunches, gut feelings, strange ideas

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=> Possibilistic Reasoning

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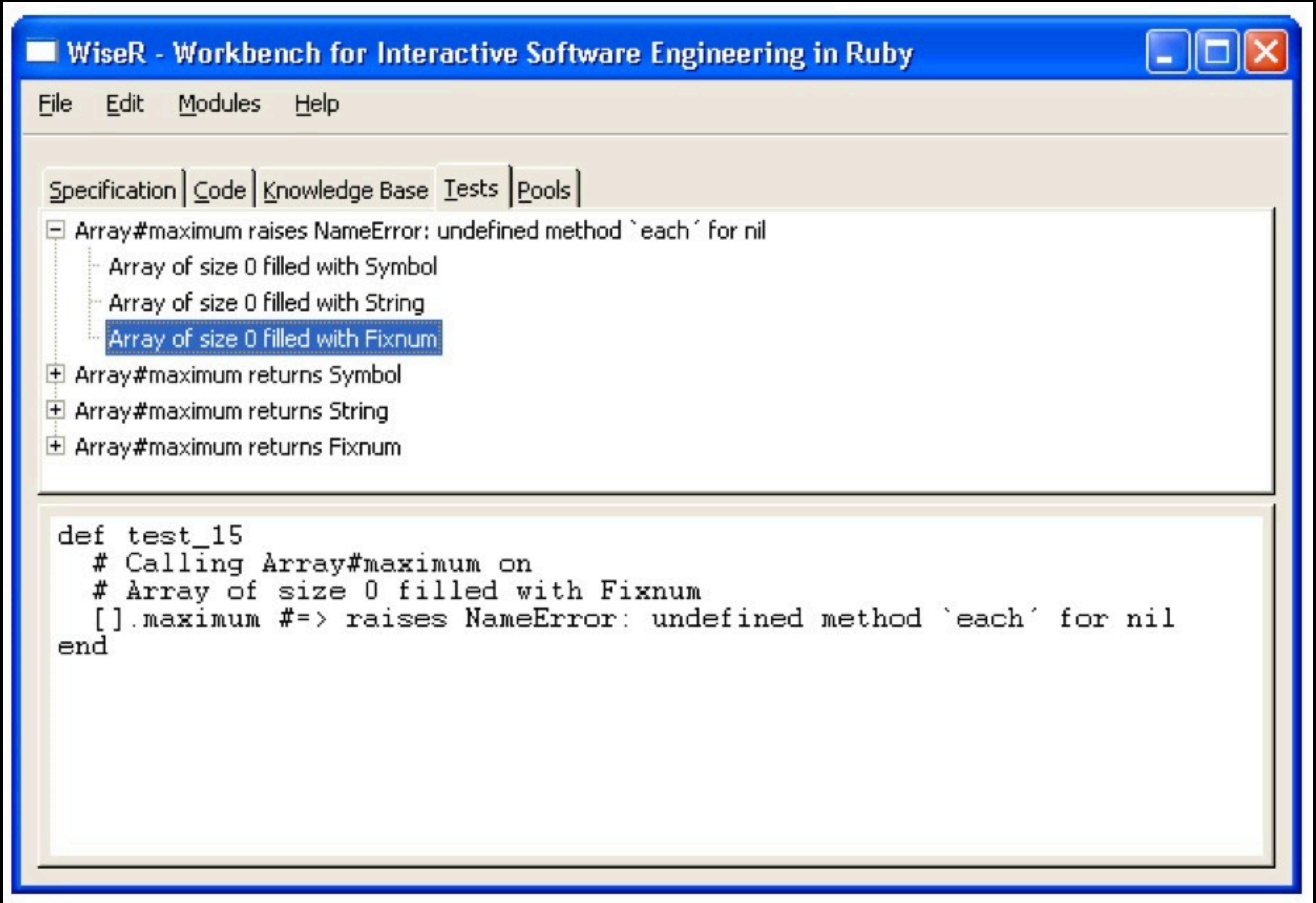
Which decisions/justification space can we search?


WiseR - Workbench for Interactive Software Engineering in Ruby
File
Edit
Modules
Help
Specification
Code
Knowledge Base
Tests
Pools

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  - Array of size 0 filled with Symbol
  - Array of size 0 filled with String
  - Array of size 0 filled with Fixnum
- Array#maximum returns Symbol
- Array#maximum returns String
- Array#maximum returns Fixnum

```
def test_15
  # Calling Array#maximum on
  # Array of size 0 filled with Fixnum
  [].maximum #=> raises NameError: undefined method `each´ for nil
end
```

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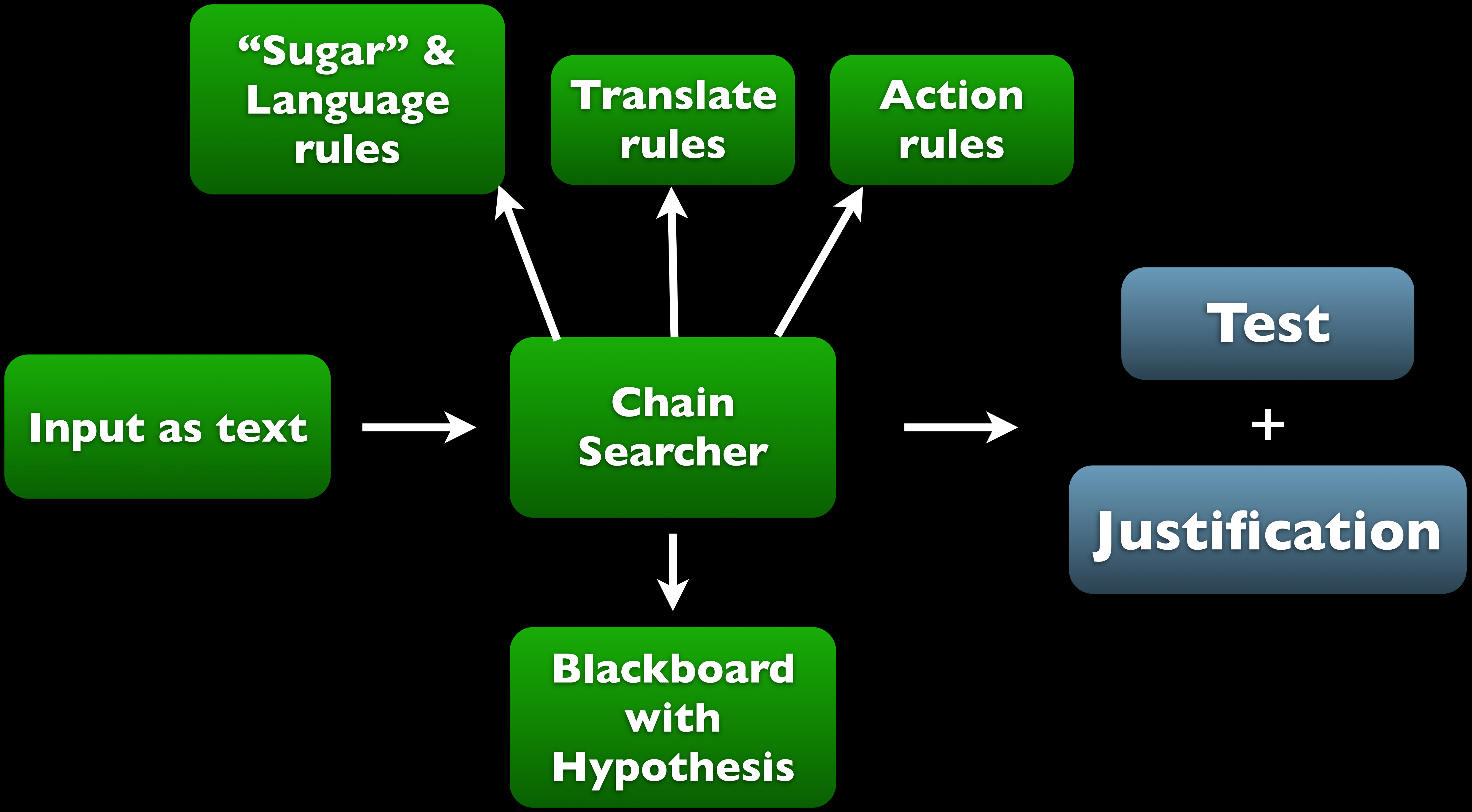
triangle is a method

I want to test triangle

Possibilistic Reasoning



So, now what?

- Consider not only:
  - Which artefact am I searching for? and
  - Which activity do I support? but
  - Which engineering decision am I supporting? and
  - Can I more directly support that decision?
- Since benefits are:
  - Help engineers explore not only artefacts and info
  - Less assumptions means less missed (as long as we can make some progress) opportunities and "errors"

Extra

Normalized Compression Distance

- Conditional Kolmogorov Complexity K(X|Y)
- Cilibrasi: Use a compression algorithm, C!

$$NCD(x,y) = \frac{C(xy) - \min\{C(x), C(y)\}}{\max\{C(x), C(y)\}}$$

- Non-negative number 0<=NCD<=1+e, where e depends on how good C approximates K