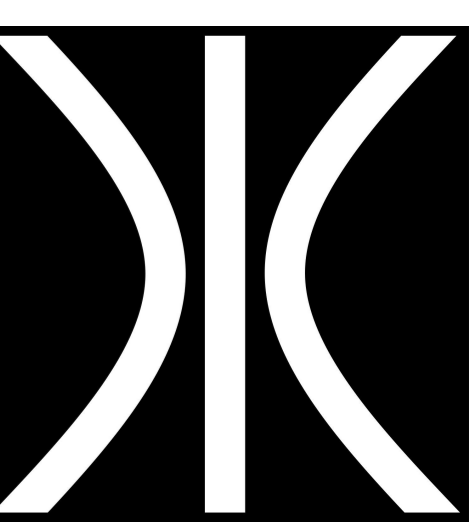




Integrating Preferences in Reactive BDI Agents

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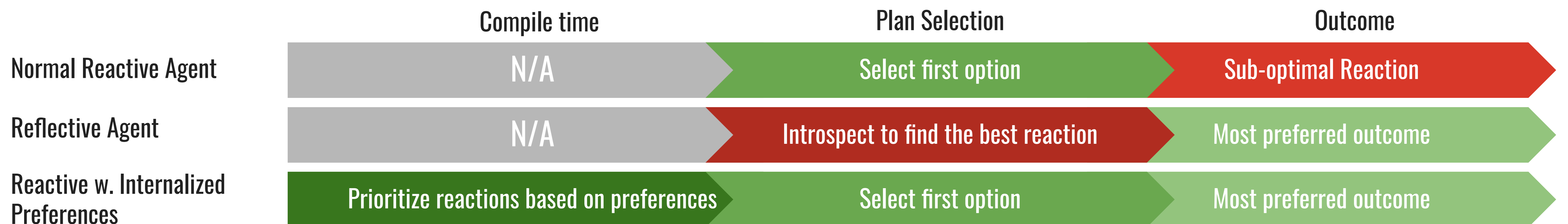


Introduction

This work is about internalizing explicit preferences into BDI agents whilst preserving their reactivity. as an example consider a person wants to buy some bread, Is it safe to say that everyone has a set of preferences over bread? But to buybread at the store:

- Do people get out all of their preferences about nutrition, taste, etc. and *reflect* on them to make their choice?
- Or do they already have an *internalized* idea of what type they prefer?

Reaction vs. Reflection vs. Internalized Reaction



Summary

- Implementations of belief-desire-intention (BDI) model of agency are generally reactive
- BDI agents typically do not support explicit preferences
- There are works that add preferences to BDI agents as a reflective step by modifying the BDI reasoning cycle
- We use CP-nets to represent the partial preferential ordering between states of the world
- This partial ordering is used to infer and internalize a sequential ordering into agent's procedural knowledge

Background.

BDI Agents, Plans and Primitive actions

BDI agents react to events based on their plans,

- A plan $+!g : c \Rightarrow p.$
 - is a means to achieve goal g
 - is achieved by performing the steps in p
 - p may contain both other goals or primitive actions

```
>> +!buy_bread => #buy_brown_bread.
>> +!buy_bread => #buy_white_bread.
```

- Primitive actions are described with their expected effects

```
>> #buy_brown_bread { => +health, -taste }
>> #buy_white_bread { => +taste }
```

Preference Language

- Conditional *ceteris paribus* preferences networks (CP-nets)
- CP-nets have the assumption that there is an implicit "all things equal" in human preferences expressions

"I prefer to be more healthy" + all else being equal
 "I prefer tasty food if I'm healthy" + all else being equal

```
>> health > ~health.
>> taste > ~taste : health.
```

Method and Example.

Step 1: Translation

Translate the agent script to a Discrete Event Calculus ASP program

Step 2: Plan outcomes

Use a solver (e.g. clingo) to solve the program to get the outcome of each plan

- 1st plan's outcome: health, ~taste
- 2nd plan's outcome: health, taste

Step 3: Prioritization

Reorder the plans based on their outcomes according to CP-net preferences

Result

```
>> +!buy_bread : health, ~taste
=> #buy_white_bread.
=> #buy_brown_bread.
```

Conclusion.

- This work builds upon our previous work on procedural preferences.
- This approach is done fully offline at compile time.
- The resulting script can be run with most off-the-shelf BDI frameworks (JASON,2APL,etc.).
- Explicit verbalized preferences improve re-usability and expressiveness of agent scripts.
- Prioritized procedural knowledge improves both readability, efficiency.
- The primitive action description and preferences are not part of the final script.

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