Towards Improving the Comprehension of HTN Planning Domains by Means of Preconditions and Effects of Compound Tasks

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Motivation	Formal Framework	Inferred Precs and Effects	Study
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Motivation			

Tools and techniques to assist the process of engineering HTN planning domains are rare.

User study: Can inferred preconditions and effects improve comprehensibility of domains?





Motivation	Formal Framework	Inferred Precs and Effects	Study
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STRIPS Planning			

A STRIPS planning domain $\mathcal{D}=(F,A)$ and problem $\Pi=(\mathcal{D},s_I,g)$ consists of

- a finite set of facts F,
- actions $a = (prec, add, del) \in A$,
- an initial state $s_l \in 2^F$ and a goal description $g \subseteq F$.

 \rightarrow A sequence of actions $\langle a_0 \dots a_n \rangle$ is a solution to Π if and only if it is applicable in s_I and results in a goal state.



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T.o. HTN Planning			

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- A a set of primitive tasks.
- *C* a set of compound tasks.
- $T = A \cup C$.





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• $tn_I \in T^*$ the initial task network.

A solution must:

• be a refinement of *tn*₁,



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- $tn_I \in T^*$ the initial task network.
- $M \subseteq C \times T^*$ the methods.

- be a refinement of tn_I,
- only contain primitive tasks,



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- only contain primitive tasks,
- be applicable in s_I, and
- lead to a goal state.



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	Formal Framework	Inferred Precs and Effects o	Study ●000
Main Hypothesis			

Hypothesis: Presenting inferred preconditions and effects of compound tasks increases the understandability of an HTN planning domain.



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Study design			

Online study consisting of

- Questions concerning demographic data and prior knowledge
- A short tutorial on HTN planning
- Question about self assessment
- Presentation of a robot arm-movement HTN planning domain
- Questions concerning the state after "execution" of the presented compound tasks
- Self assessment of perceived difficulty and text field

200 Participants

- Treatment group: questionnaire that contains inferred preconditions and effects of compound tasks
- Control questionnaire without extra information

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Results			

- Number of mistakes as measure for how well domain was understood
- A directed Wilcoxon rank-sum test indicated that the number of mistakes was smaller for the treatment group (with inferred preconditions and effects) (Mdn = 6) than for control group (Mdn = 8), W = 5724, p = .03.



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Discussion			

Mean self-reportet difficulty was rather high

 \rightarrow Could have decreased beneficial effect of preconditions and effects

Ideas for future studies:

- Improve tutorial
- Changes concerning population sample

