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Engineering and compiling planning domain models to promote validity and efficiency.

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Summary: This paper postulates a rigorous method for the construction of classical planning domain models. We describe, with the help of a non-trivial example, a tool-supported method for encoding such models. The method results in an "object-centred" specification of the domain that lifts the representation from the level of the literal to the level of the object. Thus, for example, operators are defined in terms of how they change the state of objects, and planning states are defined as amalgams of the objects' states. The method features two classes of tools: for initial capture and validation of the domain model; and for operationalising the domain model (a process we call compilation) for later planning. Here we focus on compilation tools used to generate macros and goal orders to be utilised at plan generation time. We describe them in depth, and evaluate empirically their combined benefits in plan generation speed-up. The method's main benefit is in helping the modeller to produce a tight, valid and operational domain model. It also has the potential benefits of (i) forcing a change of emphasis in classical planning research to encompass knowledge-based aspects of target planning domains in a systematic manner, (ii) helping to bridge the gap between the research area of theoretical but unrealistic planning on the one hand, and "scruffy" but real-world planning on the other, (iii) a commitment to a knowledge representation form which allows powerful techniques for planning domain model validation and planning algorithm speed-up can be bound up into a tool-supported environment.

Keywords: planning; knowledge compilation; domain modelling
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