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STRIPS: A New Approach to the Application of Theorem Proving to Problem Solving

In 1971 Richard E. Fikes and Nils J. Nilsson described a new problem solving program called STRIPS (Stanford Research Institute Problem Solver). STRIPS sought to represent the world as a set of formulas, which would take some initial world model to some goal state [1].

STRIPS uses first-order predicate calculus (first order logic, which we learned about in our lectures) to represent a world model which can be very complex. Fikes and Nilsson state that STRIPS adheres to following three points:

1. *An initial world model, which is a set of wffs describing the present state of the world.*
2. *A set of operators, including a description of their effects and their precondition wff schemata.*
3. *A goal condition stated as a wff.*

STRIPS constructs a search tree which consists of goal, subgoals, and models; it looks to extract differences between the initial world and goal state and finding the operators which are the most relevant to reducing these differences [1]. STRIPS improved on earlier planning frameworks by separating the theorem proving from the search through the space of world models, which meant that separate strategies for both could be implemented, resulting in better overall performance [1].

ADL and the State-Transition Model of Action

In 1987 Edwin Pednault proposed the Action description language (ADL). ADL sought to reconcile the notational and computational benefits of STRIPS with the expressive power of situation calculus [2]. There are a myriad of difference between STRIPS and ADL [3]:

1. *ADL can support positive and negative literals, STRIPS only positive.*
2. *Unmentioned literals are considered unknown, STRIPS considers unmentioned literals as false.*
3. *Conditional effects are allowed.*
4. *Equality is supported and support for types.*

PDDL -- The Planning Domain Definition Language

In 1998 Drew McDermott and his colleagues released the Planning Domain Definition Language (PDDL) manual. PDDL was forwarded as the “problem-specification language for the AIPS-98 planning competition [4].” However the overarching goal was to provide a common format so that comparisons would be made between different

systems, which would lead to greater re-use in research and faster progress. The authors state that PDDL “has roughly the the expressiveness of Pednault's ADL [10] for propositions, and roughly the expressiveness of UMCP [6] for actions.”

References

1. Richard E. Fikes, Nils J. Nilsson. STRIPS: A New Approach to the Application of Theorem Proving to Problem Solving.
2. Edwin P.D. Pednault. ADL and the State-Transition Model of Action. *J Logic Computation* (1994) 4 (5): 467-512.
3. https://en.wikipedia.org/wiki/Action_description_language
4. McDermott, Drew; Ghallab, Malik; Howe, Adele; Knoblock, Craig; Ram, Ashwin; Veloso, Manuela; Weld, Daniel; Wilkins, David (1998). "PDDL---The Planning Domain Definition Language". *Technical Report CVC TR98003/DCS TR1165*. New Haven, CT: Yale Center for Computational Vision and Control.