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Research Review- Non heuristic linear planner

The roots of AI planning lie partly in problem solving through state-space search and associated techniques such as problem reduction and means-ends analysis. The earliest planning systems were non-hierarchical. This means that they made no distinction between more important and less important parts of the plan, so they could be bogged down dealing with unimportant details.

[1] STRIPS (Stanford Research Institute Problem Solver) is an automated planner developed by Richard Fikes and Nils Nilsson in 1971 at SRI International. Deciding whether any plan exists for a propositional STRIPS instance is PSPACE-complete. Various restrictions can be enforced in order to decide if a plan exists in polynomial time or at least make it an NP-complete problem.

[2] HACKER was meant as a model of skill acquisition. A skill is a set of procedures each of which solves some problem in its domain. If a procedure does not exist to solve the problem, a new one must be created. This approach held that achieving one subgoal and preventing another being accomplished is such a common problem, a system for skill aquisition should be able to debug the procedures it designs. If a subgoal interaction problem arises, it attempts to reorder the initial goals to find a solution.

[3] NOAH (Nets Of Action Hierarchies) is a consultant system that advises a human amateur in a repair task. An advantage of its hierarchical nature is that it can specify abstract plans for trained experts but could provide more explicit details for a novice. NOAH's hierarchy is formed by abstraction of problem-solving operators. It initially plans with generalized operators, and then refines them. NOAH uses *procedural nets* to represent procedural domain knowledge and declarative problem solving knowledge. (Procedural nets look rather like partially-ordered plans -- POD) There is a net for each level of abstraction in the plan. At each level in the plan, a *table of multiple effects* (TOME) summarizes all the propositions asserted or

denied by more than one node in the net. Interaction between subgoals could potentially occur if a proposition's value is changed by more than one node.

In conclusion, the problem with STRIPS was not in the level of generality of the indexing vocabulary that it used to access its initial plans and operators. The problem was instead in the type of vocabulary that it used. Many of the problems that arose because of STRIPS were addressed by two later theories, HACKER and NOAH. In particular, a way to avoid the combinatorics of a best-first search of a planning space of primitive operators was suggested in the form of hierarchical planning.

Reference:

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

http://ai.stanford.edu/~nilsson/OnlinePubs-Nils/PublishedPapers/strips.pdf

[2] HACKER: A Model of Skill Acquisition

http://dspace.mit.edu/handle/1721.1/6894

[3] NOAH: The Nonlinear Nature of Plans

https://www.ijcai.org/Proceedings/75/Papers/028.pdf