USING AND RE-USING PARTIAL PLANS*

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Partial (or default) plans are plans that are constructed or applied without insuring that all support for the operators used in the plan is present in the planner's world model. Despite the apparent carelessness in their construction and application, partial plans are responsible for much of the efficiency of human problem solving. The ability to use partial plans relaxes some of the stringent requirements for thoroughness in planning and allows the application of very general, existing plans to typical, but specific situations. A plan's initial degree of partialness (and ultimate success) depends upon the Planner's estimate of the hospitality of the execution environment and its depth of knowledge. Consequently, a quickly produced partial plan may succeed quietly or may fail to achieve the expected results.

If an ordinary plan fails, the typical execution monitor has few choices. It may re-execute the failed plan [1]; it may ask a human for assistance; or, it may give up. In contrast, the successful execution of a partial plan by a human being is often a multi-pass process. Recognizing this, we have implemented a system which responds to plan failure in a constructive manner. It attempts to modify the initial plan or Its execution strategy to achieve the given goal [3,A].

Our approach is to generalize and extend the hierarchical planning approach. The failed partial plan is used as a skeleton for further planning, the failpoint of the plan is used to select an initial strategy, and the search algorithm is generalized to provide several alternatives at each level. This contrasts with a typical hierarchical planner [2] which uses an outline plan as a skeleton. There is no indication of where the outline is deficient, and only one alternative at each level of planning, that is, to expand the plan to more detail. Our alternatives at each level include an ability to postpone additional planning, to interrupt the diagnostic/execution process to perform a validating experiment, to ignore selected items of information, and to expand the plan to more detail. The top level strategy is to modify and execute the initial partial plan, adding as little detail as possible.

Our system usually proposes another partial plan to replace a failed plan. The replacement plan may contain either additional detailed actions or an instruction to ignore the past failpoint while trying to execute the replacement plan. The latter represents a shift in strategy, focusing attention on the original goal instead of the current failpoint. Existing program debugging systems [3] shift attention to global problems only after a complete success locally. The technique is especially useful whenever the planner's world model is suspected of being inaccurate.

Partial plans are often sufficient plans. When they fail, they provide valuable information about what has succeeded so far. Our modified hierarchical planning approach is usually successful in changing a failed partial plan to a sufficient plan without unnecessary detail.

References

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