

## Report: Important historical developments in the field of AI planning and searching

Planning is one of the biggest fields in AI. If we want a computer to accomplish tasks it will need input data consisting of an initial state, the goal and actions to achieve the goal. Then a plan can be created, so a plan is a representation of a course of action. With the help of planning search can be reduced and goal conflict can be resolved.

### LINEAR PLANNING

In 1971 Richard Fikes and Nils Nilsson developed **STRIPS** – Stanford Research Institute Problem Solver. This was the first major planning system and it was used for Shakey, the robot from Stanford. Shakey became able to analyse the goals and create a plan existing on the given set of actions. STRIPS was composed of an initial state, a goal state and a set of actions. So this is the base for a lot of planning languages to describe a problems until nowadays like the Problem Domain Description Language – PDDL, a computer parseable, standardised syntax. In 1970s linear planning was used for planners. But soon it was figured out as incomplete. In order to get a complete planner interleaving of actions from different subplans within a single sequence must be allowed.

### INTERLEAVING

In 1975 the **NOAH** (Nets of Action Hierarchies) planner was introduced. This is a hierarchical non-linear planner. It uses a representation called procedural nets. It starts with generalised operators and refines them later, so it constructs partially ordered plans. At each level TOME (Table of multiple effects) summarises all propositions asserted or denies by more than one node in the net. NOAH uses critics to fix or improve plans. Critics are a set of procedures that watch the TOME for effects that move up against the goal. Critics can detect and fix those problems, for example eliminate redundancies.

But in the late 1990s faster methods emerged and partial order planner where no longer used.

### HEURISTICS

In 1999 Bonet and Geffner's **HSP** (Heuristic Search Planner) managed a state-space search for large planning problems. It is based on the idea of heuristic search. A heuristic search provides an estimate to the direct distance to the goal. In domain independent planning heuristics can be derived from the representation of actions and goals. A common way to derive a heuristic is to solve a relaxed problem, in order the runtime competitive. HSP provides an algorithm that transforms the problem into a heuristic search automatically by using the relaxed problem from the action schema provided.

### References

Norvig, Peter and Russel, Stuart: Artificial Intelligence: A Modern Approach, Chapter 10 Classical Planning  
<https://en.wikipedia.org/wiki/STRIPS>  
<https://bonetblai.github.io/reports/aips98-competition.pdf>