

## Research Review

### Important historical developments in the field of AI planning and search

In 1971, Fikes and Nilsson published a paper (Nilsson, 1971) where they presented STRIPS (Stanford Research Institute problem Solver), a novel problem-solver program that set the grounds for planning problems representations.

It consisted in searching a space of “world models” to find one in which a given goal is achieved. In STRIPS, a world model is represented by a set of well-formed-formulas, or wff, of the first-order predicate calculus. Operators are the basic elements from which a desired world model is built. For any world model, it is assumed that there exists a set of applicable operators that transform the world model into some other world model. The task of the problem solver is to find some composition of operators that transforms the initial world model into one that satisfies the goal conditions. The available operators are grouped together into families called schemata. For example, goTo operators for moving an agent from place a to place b is different to another operator indicating different positions, so all goTo operators whose members are obtained by replacing specific constants for the parameters ‘m’ and ‘n’, are grouped up in the schemata goTo(m, n). Each operator is defined by an operator description that consists in two parts: a description of the effects of the operator, and the conditions under which the operator is applicable. The effects of an operator are defined by a list of wff that must be added to the model and a list of wff that are no longer true and must be removed.

ADL (Action Description Language) is one of STRIPS improvements which helped it approach more realistic problems (Pednault, 1989). It was proposed in 1986 by IBM Research Staff member, Pednault. The main differences are that ADL doesn’t consider unmentioned literals to be false, but rather unknown, it also supports negative literals, and conditional effects as well as disjunctions in goals.

Still, there remained several constraints like the assumption that only one action could occur at any time; that nothing changed except as a result of the planned actions, and that actions were resolved instantaneously. Further advancements have focused on approaching these tasks, for example, Fox and Long’s paper on PDDL 2.1 (Long, 2003) introduced timed actions and continuous change, along other novel features, which allowed actions to become associated with a duration and plans with schedules which express at which time points actions are taken, allowing to determine makespans.

Although newer advances in the field of A.I. like Machine Learning, speech Recognition and Computer Vision have become central in the area, automated planning is still one of the major fields in A.I, with lots of real world applications (Uber is just an example of the power that automated planning can generate). It may be more discreet in social media, but I think its applications are more common in everyday life, and there’s no visible dead end to its plethora of potential applications in our fast changing world.

## Works Cited

Long, M. F. (2003). An Extension to pddl for Expressing Temporal Planning. *Journal of Artificial Intelligence Research*.

Nilsson, R. E. (1971). STRIPS: A New Approach to the Application of Theorem Proving to Problem Solving. *Stanford Research Institute*.

Pednault, E. P. (1989). ADL: exploring the middleground between STRIPS and the situation calculus.