
RESEARCH REVIEW

Once upon a time, during the golden times in AI, in a planet full of problems, intellectual men appeared in a mission to conquer all the problems using an algorithm. Little did these men know that their problems solver algorithms became a critical part of the existence of Artificial Intelligence's field of planning and searching. If these men never existed, who knows what might have happened, maybe R2D2 and C3PO will be even more lost in their lost expeditions or the Terminator may have never found Sarah Connor. So, we see the efforts of these men are quite important and for that reason we will talk about their work as I will discuss some of the earliest key developments in the field of planning and search, from GPS to the language used for the project, PDDL.

A few years before the *Swinging Sixties*, two men were in a journey to learn more about human intellect. And in doing so, they've constructed an algorithm that was able to solve problems that require intelligence and adaptation. What grew out of this research was the General Problem Solver, or GPS. The GPS was a state-space search that was recursive in nature when solving problems, it separated the content of the problem from its technique to increase generality. This solver was intended to provide an essential set of procedures that could be used to accomplish an array of different types of problems. By using the means-end analysis, GPS broke down the general goal into smaller manageable sub-goals and then solve those sub-goals individually. Though GPS was supposed to be a general problem solver, it could only solve problems that are well-defined such as proving theorems, word puzzles, and chess. It couldn't solve real world problems due to the problem's complexity, it becomes lost in the combinatorial explosion. However, an influential problem solver was well on its way.

In the 1970s, Fikes and Nilsson from Stanford, developed a planner known as STRIPS (Stanford Research Institute Problem Solver). STRIPS was a problem solver that "attempts to find a sequence of operators in a space of world models to transform a given initial world model into a model in which a given goal can be proven true." (Fikes & Nilsson, 1971) The solver was designed as a planning module for the software in SRI's robot, Shakey. STRIPS adopted a GPS-like means-end analysis strategy in combination with theorem-proving methods to use much more complex and general objects in contrast to GPS and it also offered more powerful heuristics compared to any other theory-proving programs at the time. This solver was very significant that even today variations of this solver is used in domains such as Game Planning.

In the year of 1987, a man by the name of Edwin Plaut, an IBM Researcher specializing in Data Abstraction, proposed a language that was considered as an advancement of STRIPS known as the Action Description Language, or ADL. This solver relaxed some of the STRIPS' restrictions to encode more realistic problems. And through the inspiration of the STRIPS and ADL along with other planning algorithms, Planning Domain Definition Language (PDDL) was born. PDDL expresses the "physics" of the problem domain such as possible actions, what the predicates are, structure of the actions and its effects. This language standardized the planning languages and has been used since 1998 by the International Planning Competition ever since. PDDL has gone through several

revisions and is now currently on 3.1, there are also many variations of this language that are used throughout the world.

To conclude, planning and search in AI has come a long way and still isn't perfect. Many bright minds have been working on these for decades and will keep working on them for years to come to achieve human like intellect. Without the work of the men and women who have contributed their lives into their research, we wouldn't have come close to where we are now. So, thank you, to all these bright minds and to the Udacity community and other educational institutions that keep these men's work alive and going so that we may advance humanity.

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