AI Planning and Search

Planning can be defined as "a sequence of actions that will achieve a goal" (AIMA 2nd Edition, pg. 375). An important development was the Graphplan algorithm by Blum and Furst in their 1997 paper "Fast Planning Through Planning Graph Analysis". This algorithm begins by constructing a Planning Graph with constraints built-in to reduce the search time. From the initial conditions, the algorithm then searches through the Planning Graph for a valid plan in increasing lengths. This algorithm was a success because it brought about unprecedented performance of Graphplan (Jussi Rintanen and Jorg Hoffmann, *An overview of recent algorithms for AI Planning*, pg 1).

Along with this development, Kautz and Selman introduced satisfiability planning in 1996, a break from the deduction approach. Satisfiability refers to "finding a model of a set of axioms" (Kautz and Selman, 1996 at pg. 1). In other words, the goal test is "the satisfiability of a logical sentence" instead of "proving a theorem" (AIMA 2nd Edition, pg. 402). A key advantage of satisfiability is the ability to specify conditions in intermediate states of the Planning Graph. In addition, it is also "easy to state arbitrary constraints on the plan" (Kautz and Selman, 1996 at pg. 2).

Subsequently, Bonet and Geffner introduced the use of heuristics into forward and backward planning in their 2000 paper "Planning as heuristic search". Unlike normal search problems where the heuristic is given, Bonet and Geffner proposed a heuristic extracted from the representation of the problem in a Planning Graph (Bonet and Geffner, pg. 6). This is done by looking at a 'relaxed' problem, which means to ignore the preconditions when calculating the plan length from the current state. The Heuristic Search Planner made "state-space search practical for large planning problems (AIMA 2nd Edition, pg. 411).