

# Historical developments in the field of AI Planning and Search

Planning is explicit deliberation process that chooses and organizes actions by anticipating their outcomes and **AI Planning** is computational study of this deliberation process.

**Planning** and **Search** deal with reasoning about goal-directed behavior. Search plays a key role, for example, in chess-playing programs such as Deep Blue, in deciding which move (behavior) will ultimately lead to a win (goal).

Following are three major advancements in planning which impacted AI:

## STRIPS:

In 1971, Richard Fikes and Nils Nilsson developed new approach for problem solving.

**STRIPS** (**S**tanford **R**esearch **I**nstitute **P**roblem **S**olver) is an automated planner which has many interesting features like Theorem improving techniques, to reason about state at point in the plan.

**Shakey the robot** was the first general-purpose mobile robot to be able to reason about its own actions. While other robots would have to be instructed on each individual step of completing a larger task, Shakey could analyze commands and break them down into basic chunks by itself. The **STRIPS** planner it used was conceived as the main planning component for the software it utilized. As the first robot that was a logical, goal-based agent, Shakey experienced a limited world.

## A\* Algorithm:

**A\*** (pronounced as "A star") is a computer algorithm that is widely used in **pathfinding** and **graph traversal**, the process of plotting an efficiently directed path between multiple points, called "nodes". It enjoys widespread use due to its performance and accuracy. However, in practical travel-routing systems, it is generally outperformed by algorithms which can pre-process the graph to attain better performance, although other work has found A\* to be superior to other approaches.

Shakey had to find its way around, so several shortest-path algorithms were developed. One, called A\* by its creators, Peter Hart, Nils Nilsson, and Bertram Raphael, had two very desirable properties. It can be rigorously proved that (a) it always finds the shortest path, and (b) that it does so while considering the smallest possible number of alternatives. In nonmathematical shorthand, we can say that it always works and it's computationally efficient.

## Hough transform (Computer Vision)

The initial project plan did not call for intensive research in computer vision. Rather, the plan was to integrate existing computer vision techniques into the experimental test bed. But, as it turned out, very little technology was available, so a focused effort in computer vision was started. One important result of this work was the invention of what could be called the modern form of the Hough transform for finding lines in images (Duda and Hart 1972). This result came about by combining two concepts that on the surface appear unrelated. The first idea is contained in a patent by Paul Hough, in which he described a transform from points in an image plane to straight lines in a transform space. Intersecting lines in the latter correspond to collinear points in the form. But a problem of infinite slopes arises that makes this transform computationally unwieldy

## Relationship in all Three inventions:

In **Shakey the Robot** software major part was **STRIPS** and **A\* Algorithm** was used to find the shortest path while **Hough transform** was used to process image data and find out intersection lines.

### References:

<http://ai.stanford.edu/~nilsson/OnlinePubs-Nils/General%20Essays/Shakey-aimag-17.pdf>  
<https://www.youtube.com/watch?v=aqchoJMMg2Y&index=8&list=PLwJ2VKmefmxpUJEGB1ff6yUZ5Zd7Gegn2>  
[https://en.wikipedia.org/wiki/Shakey\\_the\\_robot](https://en.wikipedia.org/wiki/Shakey_the_robot)  
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