

# Research Review

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Artificial Intelligence (AI) has a wide variety of applications. One of the fields that it is used extensively is computer games.

In some games, planning and searching techniques can be used to create challenging game player opponents.

One of the benefits of using a planning technique (on games), is that it decouples goals and actions, to allow different types of characters to satisfy goals in different ways. This would also facilitate layering simple behaviours to produce complex, observable behaviour, thus reducing the complexity of the game development. Finally, it allows the characters to use dynamic problem solving techniques [3].

In this review, we're going to look at STRIPS and some related techniques.

## STRIPS

STRIPS stands for **S**tanford **R**esearch **I**nstitute **P**roblem **S**olver.

It is an automated planning technique, developed by Richard Fikes and Nils Nilsson in 1971[1], that works by executing a domain and problem to find a goal[2].

In a nutshell [3]:

STRIPS was developed at Stanford University in 1970, and the name is simply an acronym for the STanford Research Institute Problem Solver. STRIPS consists of goals and actions, where goals describe some desired state of the world that we want to reach, and actions are defined in terms of preconditions and effects. An action may only execute if all of its preconditions are met, and each action changes the state of the world in some way. [Nilsson 1998, and Russell & Norvig 2002].

An instance of STRIPS is composed of:

- An initial state
- A specification of a goal state, which describes the desired state of the world that we want to reach
- A set of actions, which are defined by their preconditions and effects. The effects are described with a list of the modifications to the state of the world.

STRIPS can be applied to many different problems, not only gaming agents. As long as the world domain and problem can be described with a finite set of actions, preconditions, and effects [2], you can use it to solve it.

### **Action Description Language (ADL)**

ADL is considered an improvement over STRIPS, it was developed by Edwin Pednault, which has proposed it as an action language in 1986, after he observed that STRIPS could be improved if by allowing the effects of an operator to be conditional.

Accordingly to wikipedia [4]:

In terms of computational efficiency, ADL can be located between STRIPS and the Situation Calculus. Any ADL problem can be translated into a STRIPS instance (\*) – however, existing compilation techniques are worst-case exponential. This worst case cannot be improved if we are willing to preserve the length of plans polynomially, and thus ADL is strictly more brief than STRIPS.

(\*) Underline has been made by this author.

A more detailed comparison between STRIPS and ADL can be found at the wikipedia page.

### **Planning Domain Definition Language (PDDL)**

PDDL was developed by Drew McDermott and his colleagues in 1998, inspired by STRIPS and ADL among others, in an attempt to standardize AI planning languages [5], and indeed became quite spread across the AI community.

PDDL lets you write most of the code with English words, making it easy to read and understand.

[1] Wikipedia (<https://en.wikipedia.org/wiki/STRIPS>) - Accessed at 23/02/218

[2] Artificial Intelligence Planning with STRIPS, A Gentle Introduction (<http://www.primaryobjects.com/2015/11/06/artificial-intelligence-planning-with-strips-a-gentle-introduction/>) - Accessed at 21/02/218

[3] O. Jeff. Three States and a Plan: The A.I. of F.E.A.R. ([http://alumni.media.mit.edu/~jorkin/gdc2006\\_orkin\\_jeff\\_fear.pdf](http://alumni.media.mit.edu/~jorkin/gdc2006_orkin_jeff_fear.pdf)) - Accessed at 21/02/218

[4] Wikipedia ([https://en.wikipedia.org/wiki/Action\\_description\\_language](https://en.wikipedia.org/wiki/Action_description_language)) - Accessed at 23/02/218

[5] Wikipedia ([https://en.wikipedia.org/wiki/Planning\\_Domain\\_Definition\\_Language](https://en.wikipedia.org/wiki/Planning_Domain_Definition_Language)) - Accessed at 23/02/218