Axioms in Situation Calculus

Possibility Axioms
Preconditions -> possible(action ,state)

Effect Axioms
Possible(action,state) -> changes that would result by taking action

Example: of both kinds of axioms in prolog

```
poss(go(X,Y),S) :-      at(agent, X, S),
                        adjacent(X,Y).
```

Example: effect axiom

```
at(agent,Y,result (go(X,Y),S)) :-       poss(go(x, y)),
                                        S).
```

Representing all the things that stay the same when perform a given action called the frame problem.

One solution: to try to use frame axioms:

example: at(object, X, result(go(X,Y),S)) :- at(object,X,S), not(agent(object)), not(held(object,S)).

If you have F fluents and A agents, you need O(AF) frame axioms to specify result of an action.
Another solution: use successor state axioms:

action is possible -> (fluent is true in result, state ⇔ actions made it true effect V it was true before and did not change

Theories of Belief

Goal: want logics that make it easy to express relationships like believes, knows, want, etc.

Example: believes(lois, X).
Example: believes(lois, flies(superman)).
In "real world" superman is Clark Kent
i.e., superman = clark
In "real world" lois doesn't believe clark kent can fly as lois doesn't know clark kent is superman

Solution commonly used is to introduce new operators (Square, Diamond) which can be placed in front of a formula
box(F) = in every world accessible to agent F is true (you know F is true)
diamond(F) = in some accessible world F is true (it is possible F is true)

In coming up with a calculus for such a set-up people think up various kinds of axioms for the square, diamond operators.

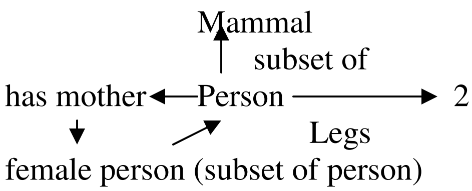
Example: Square(p) -> p
Example: P -> square(p) If I can see P is true, then you know that P is true
Example: Square(p) -> square(square(p)) If I know that P is true, then I know that I know that P is true.

These kinds of logics are called Modal Logics (above)

Semantic Networks
Used to represent categories of objects

Example: Categories of art book.

Semantic networks are usually drawn with some kind of graphical notation.



These graphical ideas can be translated into logical axioms and inference can be done on them.