The important thing to remember is that *if the axioms correctly and completely describe the way the world works and the way that percepts are produced, then the inference procedure will correctly infer the strongest possible description of the world state given the available percepts.* A complete specification of the wumpus world axioms is left as an exercise.

7.8 PREFERENCES AMONG ACTIONS

So far, the only way we have to decide on actions is to write rules recommending them on the basis of certain conditions in the world. This can get very tedious. For example, generally it is a good idea to explore by moving to OK squares, but not when there is a glitter afoot. Hence our rules for exploring would also have to mention glitter. This seems arbitrary and means the rules are not **modular**: *changes in the agent's beliefs about some aspects of the world would require changes in rules dealing with other aspects also.* It is more modular to separate facts about actions from facts about goals, which means our agent can be reprogrammed simply by asking it to achieve something different. Goals describe the desirability of outcome states, regardless of how achieved. We discuss goals further in Section 7.9.

A first step is to describe the desirability of actions themselves, and leave the inference engine to choose whichever is the action that has the highest desirability. We will use a simple scale: actions can be *Great*, *Good*, *Medium*, *Risky*, or *Deadly*. The agent should always do a great action if it can find one; otherwise, a good one; otherwise, a medium action; and a risky one if all else fails.

$$\begin{aligned}
&\forall\, a,s \;\; Great(a,s) \;\Rightarrow\; Action(a,s)\\
&\forall\, a,s \;\; Good(a,s) \wedge (\neg\exists\, b \;\; Great(b,s)) \;\Rightarrow\; Action(a,s)\\
&\forall\, a,s \;\; Medium(a,s) \wedge (\neg\exists\, b \;\; Great(b,s) \vee Good(b,s)) \;\Rightarrow\; Action(a,s)\\
&\forall\, a,s \;\; Risky(a,s) \wedge (\neg\exists\, b \;\; Great(b,s) \vee Good(b,s) \vee Medium(b,s)) \;\Rightarrow\; Action(a,s)
\end{aligned}$$

ACTION-VALUE

A system containing rules of this type is called an **action-value** system. Notice that the rules do not refer to what the actions actually *do*, just how desirable they are.

Up to the point where it finds the gold, the basic strategy for our agent will be as follows:

- Great actions include picking up the gold when found and climbing out of the cave with the gold.
- Good actions include moving to a square that's OK and has not yet been visited.
- Medium actions include moving to a square that's OK and has been visited already.
- Risky actions include moving to a square that's not known to be deadly, but is not known to be OK either.
- Deadly actions are moving into a square that is known to contain a pit or a live wumpus.

Again, we leave the specification of the action values as an exercise.