that a reasoning system be able to draw conclusions that follow from the premises, regardless of the world to which the sentences are intended to refer. But it is a good idea for a reasoning system to follow this principle in any case. Suppose we replace the "user" in Figure 6.11 with a camera-based visual processing system that sends input sentences to the reasoning system. It makes no difference! Even though the computer now has "direct access" to the world, inference can still take place through direct operations on the syntax of sentences, without any additional information as to their intended meaning.

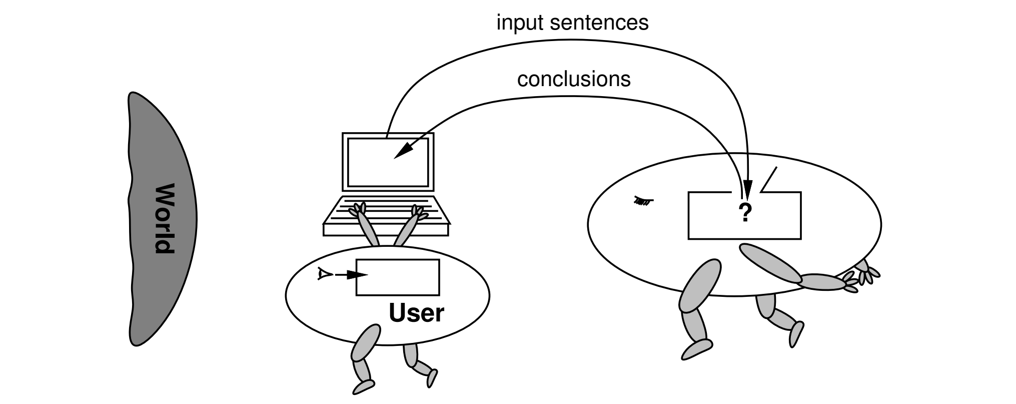
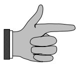


Figure 6.11 Sentences often refer to a world to which the agent has no independent access.

Models

MODEL

Any world in which a sentence is true under a particular interpretation is called a **model** of that sentence under that interpretation. Thus, the world shown in Figure 6.2 is a model of the sentence "$S_{1,2}$" under the interpretation in which it means that there is a stench in [1,2]. There are many other models of this sentence—you can make up a world that does or does not have pits and gold in various locations, and as long as the world has a stench in [1,2], it is a model of the sentence. The reason there are so many models is because "$S_{1,2}$" makes a very weak claim about the world. The more we claim (i.e., the more conjunctions we add into the knowledge base), the fewer models there will be.



Models are very important in logic, because, to restate the definition of **entailment**, *a sentence α is entailed by a knowledge base KB if the models of KB are all models of α.* If this is the case, then whenever *KB* is true, α must also be true.

In fact, we could define the meaning of a sentence by means of set operations on sets of models. For example, the set of models of $P \wedge Q$ is the intersection of the models of P and the models of Q. Figure 6.12 diagrams the set relationships for the four binary connectives.

We have said that models are worlds. One might feel that real worlds are rather messy things on which to base a formal system. Some authors prefer to think of models as *mathematical* objects. In this view, a model in propositional logic is simply a mapping from proposition symbols