CSC 191/291

Some Rules of Reasoning

The reasoning example we saw for "Robbie's self-model" showed particular logical reasoning examples (Robbie is not a person, Robbie is located somewhere, there is a dog), but without explicitly listing the mechanical rules we can use for such reasoning. Here are 4 very common inference rules, followed by another example:

$$\frac{\Phi,\ \Phi \Rightarrow \Psi}{\Psi} \quad , \quad \frac{\forall x.\ \Phi}{\Phi_{x/C}} \quad , \quad \frac{\Phi,\ \neg\Phi \vee \Psi}{\Psi} \quad , \quad \frac{\Phi[C]}{\exists x.\ \Phi[x]} \quad \text{premises} \rightsquigarrow \text{conclusion}$$

C is some constant

Can you see which rules we used for the Robbie examples?

An inference using 2 steps:

$$\frac{\text{Dog(Snoopy)},\quad \forall x.\ \text{Dog}(x) \Rightarrow \text{Has-Tail}(x)}{\text{Has-Tail(Snoopy)}}$$

Can you see which 2 rules have been used?

Horn clause form would use just one step (free variables are implicitly universal):

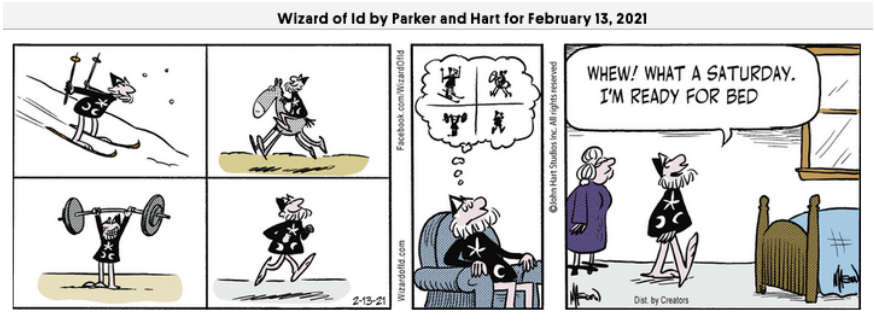
Dog(Snoopy)
Dog(x) ⇒ Has-Tail(x)
---------- *We unify variable **x** with constant **Snoopy***
Has-Tail(Snoopy)

Similarly, using clause form, a single resolution (cancellation) step suffices:

$$\frac{\text{Dog(Snoopy)},\quad \neg\text{Dog}(x) \vee \text{Has-Tail}(x)}{\text{Has-Tail(Snoopy)}}$$

Again, we unify as above (cf. rule 3, and the "Robbie" QA example)

These are *deductive rules* (as such completely reliable -- "sound"). But keep in mind that not all reasoning is deduction: We saw various ways of "jumping to conclusions" – in unsound, but generally useful ways; and recall special "analogue methods", for example for "conjuring up" images in the mind (and in computers, we can use computer graphics to store and manipulated such images).



Faulty self-modeling …