

Ontology of the Alpine-Club World

- **Individuals** (represented in FOL by constants)

tony, mike, john, ann, ...
 alpine-club, polar-club, ...
 rain, snow, ...
 skis1, skis2, skis3, ...
 mtn-climbing-gear1, mtn-climbing-gear2, ...

- **Types** (i.e., expressed by “ x is a y ”, i.e., NP+be+NP)
 (represented in FOL by 1-place predicates)

Person, Club, Man, Woman, Weather, Skis, Skier, Mtn-Climber, Athlete, ...

- **Attributes** (i.e., expressed by “ x is y ”, i.e., NP+be+Adj)
 (represented in FOL by 1-place predicates)

Red, Tall, Rich, ...

- **Relations** (represented in FOL by n -place predicates, where $n > 1$)

Belong, Member, Likes, Married, ...

- **Functions** (represented in FOL by n -place function symbols)

the-skis-of, the-father-of, ...

- **Basic Facts** (represented in FOL by “literals”: atomic wffs or negations of atomic wffs)

Person(john)
 Man(john)
 Woman(ann)
 Club(alpine-club)
 Weather(rain)
 Skis(skis2)
 Skier(ann)
 \neg Mtn-Climber(ann)
 Married(ann, john)
 Skis(the-skis-of(ann))
 the-skis-of(ann) = skis2
 Belong(alpine-club, tony)
 Belong(alpine-club, mike)
 Belong(alpine-club, john)
 ...

• **Complex Facts**

1. $\forall x[\text{Belong}(\text{alpine-club}, x) \wedge \neg \text{Skier}(x) \supset \text{Mtn-Climber}(x)]$
2. $\forall x[\text{Mtn-Climber}(x) \supset \neg \text{Likes}(\text{rain}, x)]$
3. $\forall x[\neg \text{Like}(\text{snow}, x) \supset \neg \text{Skier}(x)]$
4. $\forall x[\text{Like}(x, \text{tony}) \supset \neg \text{Like}(x, \text{mike})]$
5. $\forall x[\neg \text{Like}(x, \text{tony}) \supset \text{Like}(x, \text{mike})]$
6. $\forall x \forall y[\text{Member}(x, y) \equiv \text{Belong}(x, y)]$
 – (a “full definition”)

and:

incomplete information:	$\text{Member}(\text{alpine-club}, \text{ann}) \vee \text{Member}(\text{polar-club}, \text{ann})$	
closure information:	$\forall x[\text{Person}(x) \supset x = \text{ann} \vee x = \text{mike} \vee x = \text{tom} \vee \dots]$	
terminological facts (general rules):	$\forall x[\text{Man}(x) \supset \neg \text{Woman}(x)]$	disjointness
	$\forall x[\text{Man}(x) \supset \text{Person}(x)]$	subtypes/supertypes
	$\forall x[\text{Person}(x) \supset \text{Man}(x) \vee \text{Woman}(x)]$	exhaustiveness
	$\forall x[\text{Married}(x, y) \supset \text{Married}(y, x)]$	symmetry (etc.)(*)
	$\forall x \forall y[\text{Member}(x, y) \supset \text{Person}(x)]$	type restriction
	$\forall x[\text{Member}(\text{polar-club}, x) \supset \text{Woman}(x)]$	type restriction

(*)Can we say the following in FOL?

- $\text{Symmetric}(\text{Married})$
- $\forall R \forall x \forall y[\text{Symmetric}(R) \equiv (R(x, y) \supset R(y, x))]$

Why?