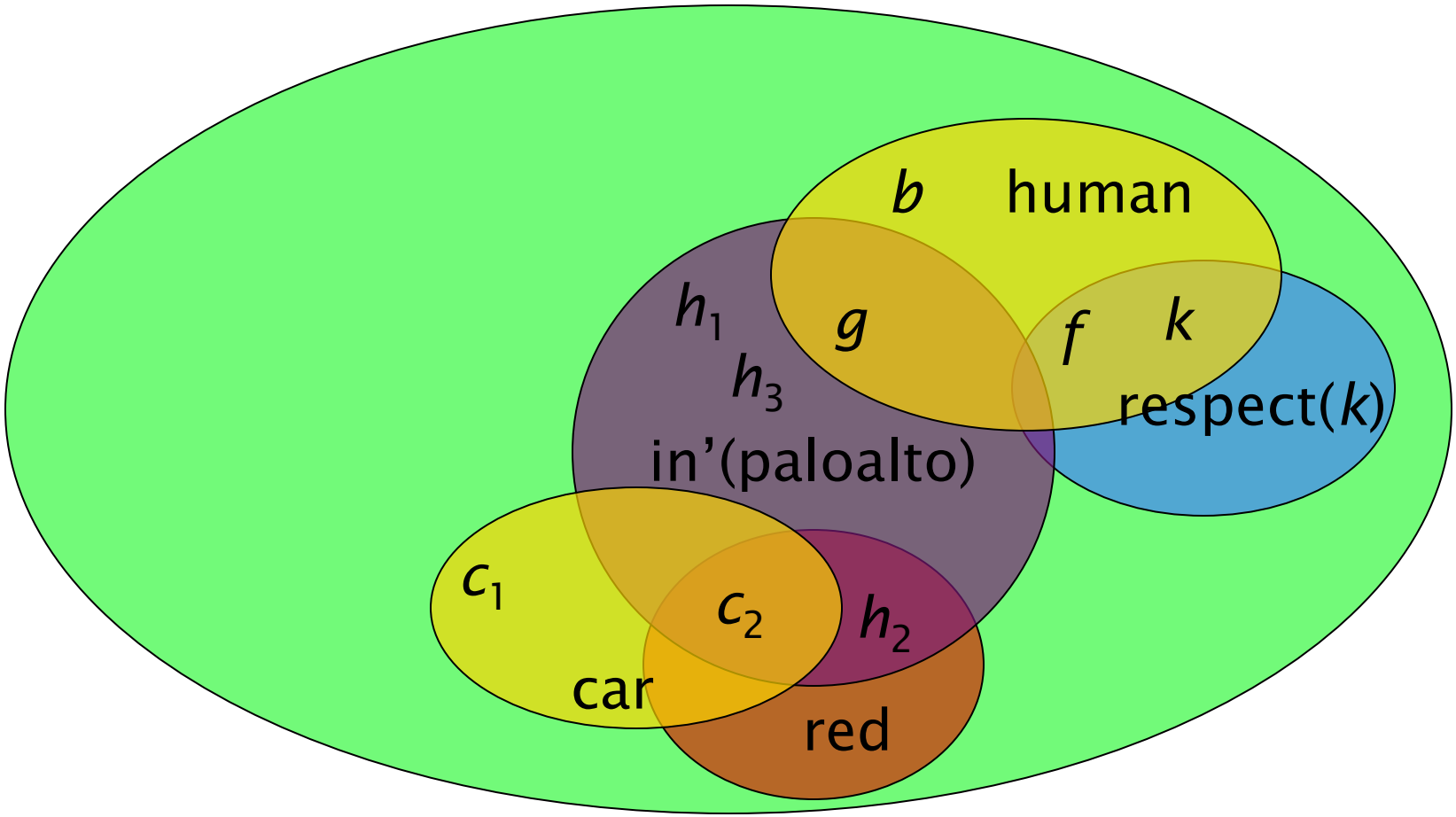
Model theory – A formalization of a "database"



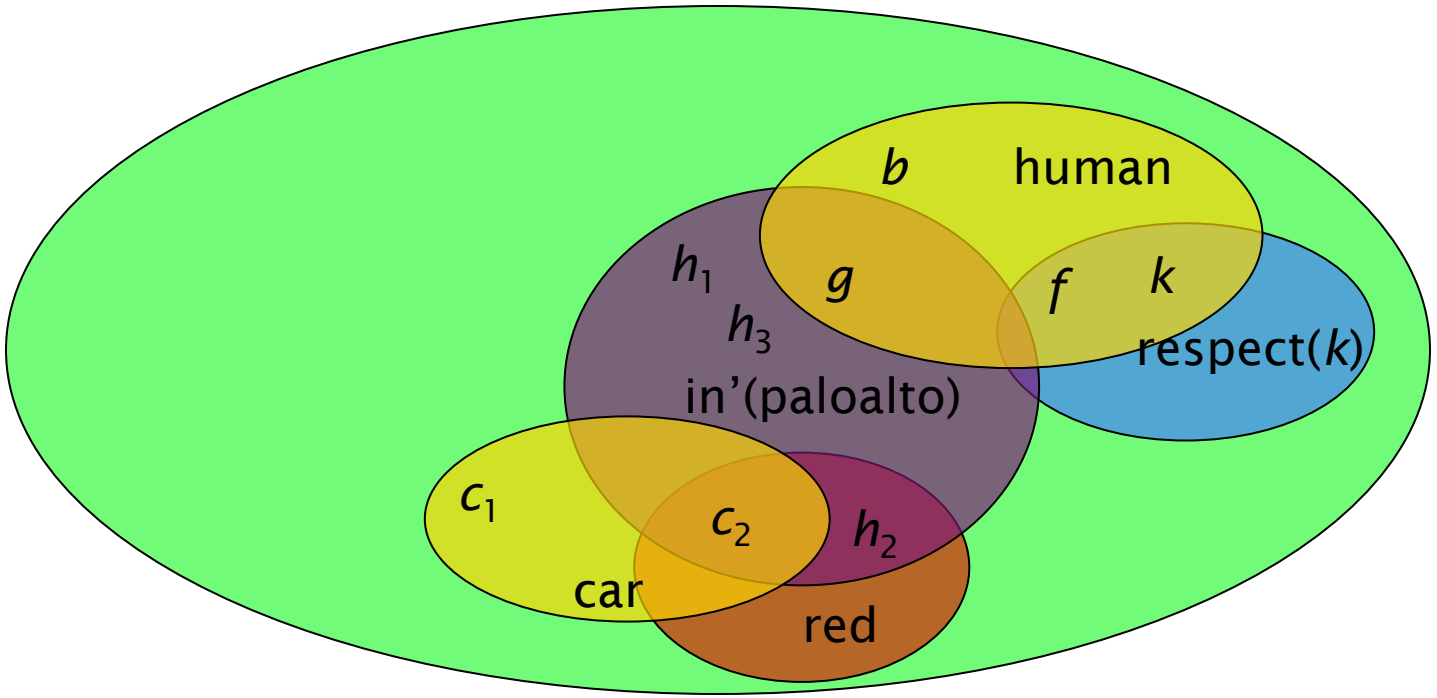
Properties

Curried multi-argument functions

$$[\![\textbf{respect}]\!] = [\![\lambda y.\lambda x.\textbf{respect}(x,y)]\!] = \begin{bmatrix} f \mapsto \begin{bmatrix} f \mapsto \mathbf{0} \\ k \mapsto \mathbf{1} \\ b \mapsto \mathbf{0} \end{bmatrix} \\ k \mapsto \begin{bmatrix} f \mapsto \mathbf{1} \\ k \mapsto \mathbf{1} \\ b \mapsto \mathbf{0} \end{bmatrix} \\ b \mapsto \begin{bmatrix} f \mapsto \mathbf{1} \\ k \mapsto \mathbf{0} \\ b \mapsto \mathbf{0} \end{bmatrix} \end{bmatrix}$$

$$[\![\lambda x.\lambda y.\textbf{respect}(y)(x)(b)(f)]\!] = \mathbf{1}$$

Quiz question



- Which individuals are the red things in Palo Alto?
- Who respects kathy (*k*)?

Adding more complex NPs

NP: A man ~> ∃x.man(x)

S: A man loves Mary

~> * love(∃x.man(x),mary)

- How to fix this?

A disappointment

Our first idea for NPs with determiner didn't work out:

"A man" ~> ∃z.man(z)

"A man loves Mary" ~> * love(∃z.man(z),mary)

But what was the idea after all?

Nothing!

∃z.man(z) just isn't the meaning of "a man".

If anything, it translates the complete sentence

"There is a man"

Let's try again, systematically…

A solution for quantifiers

What we want is:

"A man loves Mary" ~> ∃z(man(z) ∧ love(z,mary))

What we have is:

"man" ~> λy.man(y)

"loves Mary" ~> λx.love(x,mary)

How about: ∃z(λy.man(y)(z) ∧ λx.love(x,mary)(z))

Remember: We can use variables for any kind of term.

So next:

λP(λQ.∃z(P(z) ∧Q(z))) <~ "A"