Formally Representing Uncertain Knowledge about Objects

by Sven Nilsen, 2017

Path semantics relies on a precise meaning using functions as building blocks. Many real world objects, like people, are too complex to be thought of as having a definite state. Here I suggest a way to work around this limitation to describe uncertain knowledge about objects in path semantics.

Instead of modeling the world as if people are divided into discrete units of persona, one can imagine the type `person` as a greater and complex ensemble of configurations that individuals are a subset of, but not in the sense that you can construct the underlying representation. Individuals are functions, but without an implementation, because they are embodied in the real world that is complex beyond any mathematical construction:

Alice : person → bool
Bob : person → bool

Although this allows modeling the world as if people are divided into discrete units, it permits formally reasoning about such objects in a context *where it is known that these objects are complex*.

smart : person → bool

Instead of doing this:

smart(_ : [Alice] true) = true

We will constrain the function by `[Alice] true` and then tell how frequently this function returns `true` and `false`:

$\exists_p$smart{[Alice] true} := \(x : bool) = x(0.8)

Here I use `x(0.8)` as a shorthand for `if x { 0.8 } else { 1 – 0.8 }`.

Notice that this excludes the possibility that `a : [Alice] true` is a unique value for `a`. If that was the case, then the `smart` function would return either `true` or `false`, but never both. This means that an individual is not a unique value of type person, but a subset of a more complex ensemble of configurations. In a sense, an individual is necessarily more than just a person. We can not know exactly what an individual is, because the object is embodied in an external and complex world.

When we talk about smart people `a : [smart] true` we are including 80% of Alice configurations as a person. By definition, the subset of configurations that corresponds to smart people, and the subset of configurations that corresponds to Alice, are not subsets of each other, nor entirely separable. This is true as long we assign a probability between one and zero to Alice being smart. While what we mean by “smart” depends on the context, the interpretation of an individual as a subset of configurations does not change.