Symbiosis and Ourobiosis

by Daniel Fischer, William Alexander Morris, Sven Nilsen, 2021

In this paper we discuss two partial equivalence relations with opposite polarity.

A partial equivalence relation[1] `f : $T^2$ → 𝔹` has the following properties:

- Symmetry ∀ x, y { f(x, y) = f(y, x) }
- Transitivity ∀ x, y, z { f(x, y) ∧ f(y, z) => f(x, z) }

The search for such relations is important in Avatar Extensions[2],
since they form models of the Product Witness and the Loop Witness[3].
These models might help finding a constructive formalization of the core axiom in Path Semantics[4].

Through a discussion between Daniel Fischer, William Alexander Morris and Sven Nilsen,
we came up with these two ideas for partial equivalence relations:

- Symbiosis[5]: When two different species have net benefit from long term interaction
- Ourobiosis: When two different species eat each other

These two ideas are made abstract and simplified to serve as models in Avatar Extensions.
The specific version of symbiosis which is mutualistic is simply referred to as “symbiosis”.
Ourobiosis is a made up term which is inspired by ouroboros[5].

One key insight is that when two species have an symbiotic relationship, each species has a transitive relation to itself through the other. The net benefit to the second species contributes indirectly to the net benefit of the first species. Therefore, there exists an abstract self-symbiotic relation when having a symbiotic relation to another species. However, in isolation, there is no such self-symbiotic relation. This means symbiosis is symmetric and transitive, but non-reflexive.

Another key insight is that when two different species eat each other, either species has a transitive relation to itself through the other. By the first species eating the second species, who ate the first species, the first species is indirectly eating itself. Therefore, there exists an abstract self-ourobiotic relation when having an ourobiotic relation to another species. However, in isolation, there is no such self-ourobiotic relation. This means ourobiosis is symmetric and transitive, but non-reflexive.

Symbiosis and ourobiosis might be thought of as two different relations that have same laws,
but charged with opposite polarity. In a 2x2 game theory matrix, they form two Nash equilibriums[6] on the diagonal in which neither agent can change their course of action independently, while staying rational. Here is a simple example of a such payoff matrix, where Nash equilibriums have gray color:

	A1	**B1**
A2	+1/+1	-1/-1
B2	-1/-1	+1/+1

References:

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