

About Publishing Path Semantics

by Sven Nilsen, 2019

I written so much about path semantics that it is unreasonable to expect that all of it get published. One might think of this as a downside, but one can also think this as a luxury problem: There is a lot of material and one gets to pick out the piece that is mostly self-contained and introduces some new idea.

An obvious candidate is **probabilistic paths**, which might benefit from being published as an open problem to explain why it works and what the limits are. Currently, I know no person yet that has fully wrapped their head around this topic to a degree that they can confidently say that they understand it.

Furthermore, I believe that the fundamentals of path semantics is nothing new, just stringed together in a peculiar way. The axiom of path semantics is a restricted version of Leibniz' law to collections of symbols with some kind of order. On one side, you have the rigorous framework of reasoning where symbols must be associated in a specific way, on the other side, you have an informal and vast space of creativity. This creates the balance that makes path semantics suitable both as a tool for formalizing things and viewing parts of mathematics through a somewhat humanly comprehensive perspective.

It is very hard to argue why the building blocks of path semantics requires publishing to be reviewed for correctness, since they are already widely used in mathematics. Equations and commuting squares are not new. Some new syntax with an equivalent equational form does not introduce unsoundness, although it could be interesting to read. My argument here is that this might be published because the audience finds it *interesting*, not because they expect to find errors, but this depends on the audience.

Path semantics does not build on Type Theory, but derives it through creative use of symbols. Along the way some new rules are introduced as definitions, e.g. type membership, which means that the axiom of path semantics only implies Type Theory formally given these new rules. Formalizing this process is very hard and most of the gain is to learn the informal bootstrapping procedure, so I do not expect this process to be formalized anytime soon, due to high costs and low gains.

Path semantics does not build on Category Theory, because you can not really talk about anything in path semantics without defining it to some degree first. Category Theory assumes that there exists some abstract collection of objects called "categories" with the central property of composition of morphisms, or arrows between objects, which are fitted onto various patterns in mathematics and the real world. There is no requirement that objects in a category have a type, making it difficult to check some proof for consistency without being an expert. However, Category Theory works pretty well for doing mathematics and is invaluable to some people. Personally I have not used Category Theory for anything specific, but I have used it as inspiration to create an algorithm that mines equations from data. I also think that dualities such as co-categories are useful insights, so I consider myself a person that benefits a lot from Category Theory, even if I find it difficult to contribute to it.

I do not much theorem proving myself, except as a method of explaining things. I prefer to use an automated theorem prover when checking for correctness is needed. I do not follow mathematical journals or rely on a review process for correctness. My biggest problem is to define ideas formally in an expressive way, which is why I use path semantics. Personally, I have little gain from publishing, because I do not work that way, but I understand other people might do and I can learn from them.