## TLA$^+$ Versus Ordinary Math

The TLA$^+$ language contains the following things that you probably didn't learn in school:

- The CHOOSE operator, which is known to mathematicians as Hilbert's $\varepsilon$. Although it was introduced about a century ago and is necessary for a practical formalization of mathematics, this simple operator is seldom taught in elementary math courses.

- Notation for long formulas. For a mathematician, a ten-line formula is long. Fifty-line formulas are common in specifications. TLA$^+$ allows you to write conjunctions and disjunctions as bulleted lists that makes such formulas easier to read.

- Notation for long specifications. I stole two simple ideas that programming languages use to help cope with long programs: (i) requiring variables to be explicitly declared (which helps catch errors) and (ii) allowing a specification to be split into multiple separate modules (which helps handle complexity).

- Simple temporal logic. Although it is well-accepted as a branch of mathematics, temporal logic is not simple, ordinary math. TLA stands for the Temporal Logic of Action, a temporal logic that underlies the semantics of a part of TLA$^+$. Fortunately, you need a good understanding of temporal logic only to formally specify liveness. For many systems, an informal specification of liveness is good enough. TLA$^+$ specifications that don't describe liveness use temporal logic in a trivial, completely ritualized way, with one occurrence of one temporal operator appearing at the very end.

I have used these concepts and notations of TLA$^+$ for quite a few years, and I have not felt the need to make any changes to them. (I have omitted from this hyperbook one construct, a way of writing quantified formulas, that I feel is not worth the space it takes to describe it.) While some of the decisions I made in the language are questionable, I have found no compelling reason to believe that the alternatives are better.

TLA$^+$ has recently been extended to allow writing formal proofs. Although mathematical notation has changed a great deal in the last few hundred years, the way mathematicians write proofs has not. The standard mathematical proof style is not suitable for writing formal proofs. (It's not even well suited for writing the informal proofs of ordinary mathematics.) The TLA$^+$ proof language is based on a way of writing informal proofs that I have used for many years. However, I don't have much experience writing formal proofs, so this part of the language may very well change.

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