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String Diagrams for (Virtual) Proarrow Equipments

String diagrams for monoidal categories make computations tactile and intuitive affairs. Complicated diagram chases can be expressed in a few pictures and rediscovered with a shoelace. In this talk, I will extend the usual string diagrams for monoidal categories to (virtual) proarrow equipments with the hopes of bringing the diagrammatic method to formal category theory. I will then give some applications of the diagrams.

The proof that the string diagrams for equipments have invariant meaning under deformation builds off the analogous proofs of Joyal and Street [2] for monoidal categories, together with the work of Dawson and Paré [3] on tile orders and Dawson [4] on composition in double categories.

In his paper [5] on enriched category theory, Lawvere mentions that not only are the common objects of mathematics organized into categories, but they are often enriched categories in their own right. Using the diagrams, I will embed any virtual equipment into the virtual equipment of categories enriched in it. This extends Lawvere's claim by showing that as long as our objects of interest are organized into a virtual equipment, they are enriched categories of a sort.

References:

[1] David Jaz Myers, String Diagrams for Double Categories and Equipments, *Arxiv Pre-prints* arXiv:1612.02762 (2016) 1–37.

[2] André Joyal and Ross Street. The geometry of tensor calculus, I. *Advances in Mathematics*, 88(1) (1991) 55–112

[3] Robert Paré and Robert Dawson. General associativity and general composition for double categories. *Cahiers de Topologie et Gomtrie Diffrentielle Catgoriques*, 34(1) (1993) 57–79.

[4] Robert Dawson. A forbidden-suborder characterization of binarily-composable diagrams in double categories. *Theory and Applications of Categories*, 1 (1995) 146–155.

[5] William Lawvere, Metric Spaces, Generalized Logic, and Closed Categories, *Reprints in Theory and Applications of Categories* 1 (2002) 1–37.