

String Diagrams for Text

Preliminary list of minor corrections:

- At some point you
- pp.22+ (sidebars): Remove all basic categorical definitions from the thesis. If your readers are not already familiar with them, they already don't stand a chance.
- pp.23+: Introduce linear maps with Kronecker product instead of linear maps with direct sum.
- p.26: copiability of a box in \mathbf{Rel} (and in \mathbf{fHilb}) implies partial function. Remember that in mathematical tradition "function" means "total function", and "partial" must be explicitly stated.
- p.42: More citations are needed for QNLP.
- p. 43 (sidebar): Remove the statement "I did not know he was an alcoholic".
- pp.57+: The shaded highlights around wires should extend beyond the wires, otherwise they look like shaded regions in 2-categories.
- pp.60+ (sidebar): References such as "Internal Wirings" should go into the bibliography and be cited from there.
- pp.60+ (sidebar): There is a recurring typesetting issue when you have figures which act as examples/definition, whereby you get "Figure 1.10:", followed by a line-break and the bold heading of an example. This is confusing, because it looks like you forgot to include the description of the figure.
- p.65 (sidebar): In the definition text, "discrete fibration" should be "discrete opfibration". You also use "fibration" in other text around the thesis. You should be consistent in your nomenclature: either simplify everything to "fibration", or be precise everywhere using "opfibration".
- p.65: Morphisms carry information about their domain/codomain: much as you write φ_f , you should write Φ_f , without the explicit A annotation.
- p.66: I believe the condition can be simplified to the requirement that for all $f : FA \rightarrow B$ exists a unique $\varphi_f : A \rightarrow \Phi_f$ such that $F(\varphi_f \otimes id_C) = f \otimes id_{FC}$. This is akin to "complete" variants of certain properties, such as "complete positivity", where the property is presumed to be stable under tensor product with the identity.
- p.66: Give at least one interesting example where this property fails to hold, and briefly explain the consequences of the failure.
- pp.67+: Introduce some notation (e.g. curly braces) to indicate which groups of internal wires correspond to which external wires.
- pp.67+: Avoid situations where one of the internal wires is perfectly aligned with an external wire, as they might give the incorrect impression that it is the same wire inside and outside (e.g. second figure from the left in the middle row on p.67).
- p.69: You write $\overline{\mathbf{PGD}}^*$ instead of $\mathbf{\overline{PGD}}^*$ at the bottom of the page.
- p.69: The citation of arXiv:2201.11738 should be in the bibliography (example of a previous comment on all such citations).
- pp.69-70: Using the machinery of arXiv:2201.11738 is overkill for this. Reformulate the presentation explicitly using lists of objects, and don't worry about associativity/bracketing order: it is way too low level a concern for your work (and one which has been formally dealt with many moons ago).

- p.76: Make the equation chain longer and show the intermediate caterpillar steps of eating and spitting.
- p.77: Fix the "kinda-opfibration" nomenclature (Jules had a good name).
- p.81: Dashed magenta arrows on a salmon background are a bad idea. The fact that they sometimes originate from wires, in a thesis with all sorts of wiring notations, is more confusing still. Give them a de-saturated colour (e.g. grey) and keep them outside the wires and boxes, where they cannot be confused for wires themselves.
- pp.82-83: Same comment about inner wire grouping and curly braces.
- pp.92-150: Refer to detailed notes on Jules's copy.
- pp.92-150: The difference between dashed wires and dotted wires is hard to spot, and the use of dashed/dotted wires clashes with the use of dashed/dotted lines for boundaries. I would rather you use solid for all wires and reserve dashed/dotted for other kinds of lines. Perhaps you can use degrees of freedom in thickness and/or squigginess to convey difference in meaning for your wires?
- p.99: Remove the shading from the cells, because it might be confused with 2-categorical notation.
- p.128-129: The use of dotted wires to connect inputs-outputs clashes with the use of dotted wires on p.129.
- pp.143-146: The coloured lines with arrows are not wires in the sense of the other wires, and the argmax , $+$, $=1$, etc. boxes are not boxes in the sense of the other boxes. You should use different notations (e.g. make them transparent, dashed and/or desaturated) to more clearly distinguish them from the rest of the diagrams.
- p.159: I don't think you've explicitly said anything wrong here, but the naïve way you talk about continuous functions from the interval to the square might give the impression that you have not fully comprehended the pit of untold mathematical horrors you have just decided to dive into. Continuous lines can be nice, like the strokes you imagine, but they can also be extremely wild, e.g. they can be fractal and/or fill the whole square: you should explicitly acknowledge this.
- p.160-162: Most of the basic categorical structure of ContRel is trivially inherited from Rel , no need to check everything explicitly.
- p.163: The empty set is also copiable, but not a point.
- p.163: You should clearly remark here, for future use, that states with the dot are points (as opposed to states without the dot, which can be subsets).
- p.165: Again, there are coloured lines with arrowheads which are not actually wires but connect diagrammatic components as if they were. You should clearly distinguish the non-diagrammatic graphical elements from the diagrammatic ones.
- p.166-170: I like this part, but Jules had comments. If they are not in Jules's annotated version of the thesis, I'll send them through later.
- p.185: In the statement of the Lemma, you forgot some wires.
- pp.201-223: These pages contain several mistakes and presentation issues. We agreed that they are not necessary to the story, and you should drop them altogether. Keep the pictures from p.215 and p.221, for their conceptual value. You can also salvage some interesting ideas from Construction 3.5.31, but I would refrain from making a mathematical statement.
- p.227: Drop this page, as it depends on homotopies. Remove mentions of homotopies from other parts of the text (eg. p.229)

- p.230: The dot on the boundary of the circle surrounding the sub-diagram is a rather advanced piece of diagrammatic notation, which you didn't adequately introduce. Remove it.
- pp.251-255: to make it clear that this is meant to be a "sample exam", put a frame around it, to make the pages look like they were photocopied and included as samples.
- pp.257-268: Your thesis is super tidy and stylistically sophisticated: in comparison, your bibliography is a mess! Make sure that all entries are consistent in terms of the way the information is displayed, that DOIs and formal references are correctly rendered, that all authors have their names spelled out explicitly. Remove all unnecessary information (e.g. month of the year). Everything should have either a DOI, an arXiv reference, or a full link to the source, and those should all be clickable.

You already have the notes from Jules's annotated version of the thesis. I have some minor hand-written comments on my annotated version, which I will send through once I get back to London.