

1. There are specific facts of mathematics, let's call them "patterns" (a.k.a., forms). Examples: value of e , Feigenbaum's constant, facts of number theory and topology, symmetry of $SU(2)$, amplituhedron, etc.

2. There are many specifics which are surprising, and forced on you, once you choose some basic assumptions (very few – just logic, apparently) → you "get more out than you put in". Start with set theory and get the specific value of e !!

3. for some such patterns P ,

- there are aspects of physics and biology that are *explained* by recourse to the specifics of P . If you ask "why" long enough, you end up in the Mathematics department.
- in contrast, there is no aspect of the physical world (physical events/laws), and no amount of history (biological selection), that explain/set the properties of P
- if P 's facts were different, biology and physics would be different.
- it doesn't work in the reverse: there is nothing you can change in the physical world to make P be different.

- therefore, causality flows from these forms to the physical world (not in the temporal sense)

- these facts play important instructive roles.

- therefore, they cannot be ignored if you want to understand evolution, bioengineering, etc. Physics is constrained by them; biology exploits (is enriched by) them.

4. Therefore

- physicalism is a non-viable theory: there are facts that are simply not "in" the physical world in any useful sense of "physics". Pythagoras knew this already. Let's call the space of possible properties of P 's "the Platonic Space".

5. Skeptical position: we cannot assume that low-agency models of math encompass all the residents of this Space. Some may be better described by behavioral science tools.

- therefore, some of the patterns that ingress into physics and biology may be "kinds of minds".

- therefore, Dualism is viable. We already knew it was true in physics and biology; this suggests it's also relevant in cognitive science.

6. Optional hypotheses: (optimistic metaphysical claim)

- P is drawn from a distribution that's not a random collection but a structured space
- therefore, we have a research program: map the space, understand relationship between interface and which P it channels.

7. Skeptical position: we cannot assume that biological materials, evolutionary search, etc. have any monopoly on hosting those patterns.

- therefore, perhaps algorithms/robots should be searched for surprising ingressions that are not just complexity or unpredictability, but well-understood cognitive competencies.