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Examining the Relationship Between Internal and External Mathematical Explanations

Mathematical explanations come in two general varieties: mathematical explanations of mathematical facts and mathematical explanations of physical facts, henceforth called internal and external explanations respectively. The debate in internal explanations boils down to identifying and understanding the difference between a demonstration of a mathematical fact, and an explanation of said fact. Meanwhile, the debate within external explanations attempts to determine whether or not mathematics can genuinely explain physical, non-mathematical phenomena.

One important question that has received little attention is how internal and external mathematical explanations relate to each other, if at all. It seems clear that if one type of explanation is related to the other it would be external explanations that would depend on internal explanations. Mark Steiner (1978) was the first to propose such a relationship. Steiner claimed that an external explanation is such that if you 'remove the physics' from the explanation, what remains is an internal explanation of a mathematical truth. The suggestion here is that external explanations owe some of their explanatory power to the existence of a good internal explanation.

In this paper I will survey several different theories on internal explanation and examine whether or not Steiner's suggestion of dependence is tenable. Recent accounts of external explanation seem to assume that there is an intimate relationship between internal and external explanation. I aim to show that such an assumption is unjustified as not all accounts of internal explanation are suitable for such a dependence.