Argument Against Language
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Mathematics is often colloquially labeled as the language of the universe. It is utilized throughout all disciplines of science, ranging from astrophysics to quantum physics. Its usage among humans persists across all recorded history. Philosophers since antiquity and before proposed various ontologies for mathematical objects to better understand the underlying nature of numbers and how they are applied. The range of applications varies heavily and is widespread. Thus, a major reason for the overall quest to understand mathematical ontology is for tackling the puzzle of why any application exists and even incorporates mathematical objects and notions. Since mathematics has endless utility within scientific applications and aligns with aspects of the natural universe, there seems to be a need for math to exist. This sense of requisite for mathematics gives it a necessity, where it could be no other way – the universe requires mathematics. Recognizing where the necessity arises from is a critical challenge. Famously, to approach the challenge, the Ancient Greek philosopher, Plato, philosophized that numbers exist independently of humans and exist in a higher realm. Many modern mathematicians and philosophers encapsulated similar Platonic ideas. Subsequently, many philosophers associate *apriority* with mathematical notions as well. The *apriority*, generally meaning that mathematical knowledge is obtained or acquired independently of any experience, coincides with the necessity of mathematics. The oversimplified reason for the connection is that because mathematics is necessary for the universe to function, then grasping it cannot be done via experience. This paper will, therefore, be guided by the big question in the philosophy of mathematics of where the necessity and apriority of mathematics come from, but without the intent of answering it directly. Instead, this paper will specifically prioritize attacking a route some philosophers take to answer the mentioned question: the linguistic route. In general, linguistic approaches are not an appropriate or satisfactory basis for any mathematical theory/framework to address the overarching origin of necessity and *apriority* of mathematics. To defend this claim, two popular philosophies, logical positivism and Dummettean intuitionism, will be overviewed alongside the respective criticisms of each. The criticisms will mostly focus on the linguistic aspects of both; however, additional criticisms beyond linguistics can prove useful in finding a link between the flaws of linguistic frameworks concerning mathematics. A synthesis of said flaws unwraps weaknesses that linguistics frameworks have principally.

Prior to delving into the analysis, some concepts must be clarified. What is a linguistic framework exactly? Linguistic frameworks, sometimes labeled as a 'form of language,' depend on the usage of language. A language includes communicative methods, typically with structure and conventions that get conveyed through various means. This heavily differs from other frameworks in mathematics, such as the one used in Frege's program that relied on epistemic analyticity. Within a linguistic framework, the definitions and even axioms are meant to embody the semantics or underlying meanings of the language's vocabulary. The linguistic framework's ability to derive logical statements or create logical proofs relies on the behavior of the language. Any behavior is, again, dictated by the rules and axioms of the linguistic framework. This type of linguistic framework was the core description by Rudolf Carnap in his text titled "Empiricism, Semantics, and Ontology." Most logical positivists adopted this form, or very similar forms, of linguistic frameworks. Although Sir Michael Dummett's intuitionism has a linguistic-focused approach, it has differences and additional requirements that will be outlined in the respective section on Dummettean intuitionism. Nevertheless, his core argument was also based on the meaning of words and terms that incorporated the ability of logical derivation.

Logical positivism, sometimes referenced as logical empiricism, was crafted to integrate a linguistic approach to directly answer the big question of where the necessity and *apriority* of mathematics originate from; however, it contains some fatal drawbacks. The program stemmed from elite philosophers in the Vienna Circle. The popular mathematical focus at the time was logicism, with one major contributor being Frege and his logicist program. Although logical positivism differed greatly from other logicist programs, like Frege's logicist program, by no longer primarily contributing logic to the necessity and *apriority* of mathematics, the logical positivist program, by in large, was logicist. Another key distinction logical positivists had from other logicist programs was their usage of the terms analytic and synthetic. Recall that Frege viewed it as an epistemic notion; contrarily, logical positivists labeled any proposition reliant on definitions of the symbols within the same proposition to gauge its validity as analytic. Logical positivists then considered synthetic to mean that any proposition's truth or falsehood is determined by facts of experience – meaning that synthetic statements had factual content based on empirical evidence. Thus, because of the logical positivists' definitions of analytic and synthetic, *apriority* had to be tied with it, where propositions are *a priori* if and only if they are analytic. The overall dilemma in relation to the aforementioned big question is that this requires mathematical truths to have no factual content. In order for a propositional truth to be factual, there must be empirical evidence to back up the proposition. Mathematics can never be synthetic. This makes sense partially from a human perspective. Consider an individual that theorizes some propositions for an unknown entity in the physical universe using mathematical models – imagine something 'black-boxy' like dark matter. A linguistic framework can give truth to the model, but mathematical truths will always lack factual content. When the individual actually experiences what dark matter's properties are and verifies their mathematics, they have experienced the non-mathematical knowledge synthetically. Therefore, the mathematics done would still have no factual content, but their scientific proposition would be synthetic and now factual. What if, in this example, the mathematics initially conceived in the linguistic framework was 'wrongly' done, meaning it was found to be incorrect based on empirical experimentation? Maybe some 'dark matter-like' object fundamentally transforms mathematical truth? One might think that the new mathematical truth derived would be synthetic, but logical positivists divert all ontological discussion with mathematics as external questions. Carnap even regarded them as "meaningless pseudo-questions." Shapiro wrote that logical positivists must have a sense of logical consequence before making claims of mathematical knowledge – which might also alleviate problems in the given scenario. Although the mentioned example can face criticism on its construction or setup, its purpose is to exemplify that the application of mathematical concepts has some metaphysical questions that require close attention and cannot be overlooked. Logical positivism completely ignores any metaphysical questions of mathematics which is a fatality to answer the big question. Finally, the major blow to logical positivism of this form was Gödel's incompleteness theorem. It loosely relates to the example scenario of some truths being unprovable from any linguistic framework, but more consequences will be covered in a later section. Overall, logical positivism fails to answer where the necessity and *apriority* of mathematics come from.

Dummettean intuitionism starkly contrasts with logical positivism due to its foundations in intuitionism/constructivism, but it has its distinct setbacks. Because intuitionism is based on mental constructions and is mind-dependent, all mathematics is a mental construction. Something that differentiates Dummettean intuitionism from other intuitionists, like L. E. J. Brouwer or Arend Heyting, is Dummett took a linguistic approach. Again, like logical positivists, Dummett's argumentation consisted of the meaning of logical constructs based on the language utilized. To briefly overview Dummettean intuitionism, some of its important aspects/components in relation to linguistics will be discussed. The first critical component is the manifestation requirement. The manifestation requirement is tightly bonded with language. It requires that language, and its users, dictate as a collective the meaning of terms and gauge correctness. The subsequent aspect of Dummettean intuition is verifiability or assertability. The conditions of how meanings are verified or asserted replace generic truth conditions from other mathematical philosophies. Next, an important component to cover is inferential semantics. Inferential semantics restricts sentences to act independently from each other. It enforces language users to learn the meanings of each part of language one by one. Finally, unlike logical positivists that ignored the ontology of mathematics outright, Dummett's intuitionism had an anti-realism perspective. It meant that his philosophical position rejected the existence of mathematical objects as concrete objects outside the mind or specifically language constructed by the mind. Dummettean intuitionism, then, clashes with realists like Plato mentioned earlier. A useful consequence is that Dummettean positions did not need to deal directly with inconsistencies that formalists had, for instance, caused by Gödel's incompleteness theorems. Because of anti-realism, there are no mathematical truths that the mind —and language— cannot construct. When trying to uniformize any truth, or anything in general, that leads to nonuniformity, Dummett calls it indefinite extensions. Hence why Dummettean intuitionists bypass the construction of Gödel sentences due to the mind's incapability of intuiting unknowable truths, whereas realists accept unknowable truths, alongside the problems faced with attempting to find uniformity for Gödel sentences. With all this considered, one drawback of Dummettean intuitionism is the binding of the manifestation requirement. Language's correctness may always face contention over definitions. Similar to the previous example scenario for logical positivists, meanings may constantly be remanifested with no concrete definitions when understanding shifts – possibly due to revolutionary discoveries. This may seem attractive to non-formalists against rigid structures. Yet, is the truth even true if it can become remanifested at any point? Overall, Dummettean intuitionists believe every truth is knowable while meanings' truths are contingent on the manifestation requirement.

The criticisms that both logical positivism and Dummettean face are established thus far in the paper; though, taking a closer look and synthesizing the problematic natures of both can contribute to the overall criticism of linguistics/language as an approach to the big question of necessity and apriority of mathematics at hand. By synthesis, it means that both programs share similar flaws. The flaws due to language must be prioritized to isolate language as a major contributor to weakening both logical positivism and Dummettean intuitionism. Three glaring issues come to mind due to the prioritization of language: language's human-centric dependency, the limitations of language as a tool for mathematics, and the computational limitations of linguistic frameworks. The following sections will cover each issue in greater detail.

What stands out in any discussion of language is the dependency on humans. When language is the basis of a mathematical theory or program, it tends to be expressed in human language. No other species discovered have utilized the same language structures as us humans. Does the necessity or *apriority* of mathematics need a conscious being with complex language? The overall consequence might be that rather than language being the reason for the necessity and *apriority* of mathematics, human-like entities are the real answer to the question. Although logical positivism is not intuitionistic, it puts major emphasis on the language utilized by humans. On the other hand, Dummettean intuitionism requires mental constructions that construct language. Apparently, the languages constructed are based on human minds rather than, perhaps, elephant or dolphin minds. It forces other beings to adapt to human-centric mental constructions, therefore depending on human-produced languages. When basing entire philosophies around language, a possible risk is that the entire philosophy can crumble due to the hypothetical scenario of nonlanguage-speaking beings that are noncommunicative. Picture an extraterrestrial entity as such that has no concept of language but clearly develops tools utilizing mathematics. Or, in an even more extreme case, imagine no human-like creatures exist in the first place. Then the question of language dictating the necessity and *apriority* of mathematics gets thrown out entirely. A possible solution to the human-centric problem is to base linguistic frameworks as generally as possible without a human bias. It requires a much deeper understanding of linguistics as a whole with respect to all sentient beings[*], but it would avoid fragile frameworks.

A more attractive outlook for language should be that it remains just a tool or utility for humans. Language has an innate reliance on sentient entities. Therefore, it does not adequately respond to where the necessity of mathematics comes from and how it gets applied to the physical universe. The purpose of languages should be to convey the truths of mathematics, not that the truths of mathematics are derived from within the language itself. Language must be limited to expressing truths since doing so completely solves the fragility of dependence on language-speaking entities. It fixates the truths of mathematics and gives it a stronger, more rigorous rigidity as a necessity. Another pressing factor of language is that it must be learned. Additionally, one can argue that learning some language within linguistic frameworks itself makes any mathematical term or truth no longer *a priori* when inserting the semantics of mathematics within the words of a language. An individual needs to conform to a certain understanding, similar to Dummettean intuitionism. These understandings are sometimes unnatural. In the wild, away from modern society, individuals do not conform to certain mathematical truths produced by others. Again, even the learning process relies on some connection to other language-speaking entities. It consistently appears that language is not what gives mathematics necessity or *apriority,* but rather the users of language and those that can capably learn the language and which linguistic frameworks apply in different use cases are giving the language its needed traits. Formal or nonformal approaches away

[*] A caveat of utilizing the term 'sentient being' is that the term commonly depends on a living organism; however, the usage of language by artificial intelligence (AI) poses the question of whether such technologies are possibly 'sentient.' Such a discussion is outside the scope of this paper. Let 'sentient being' simply represent an entity conscious of the underlying semantics of language it utilizes. Whether or not AI has such a capability is unimportant here.

from language do not suffer from confusion as such. So, linguistic frameworks to solve the big question have a barrier that needs overcoming.

Finally, the process of language being utilized in the first place gets limited by the language itself and how linguistic frameworks compute meaning. Certain linguistic frameworks may not compute or convey certain semantics of other languages. Logical positivists can utilize varying linguist frameworks and add to others; however, the justification process in logical positivism for choosing the proper framework does not exist. They reject the task of providing justification since they deem it nonmathematical. Furthermore, Dummettean intuition adjusts languages based on the manifestation requirement, but as mentioned before, it struggles to find a concrete language that never needs adjusting. Overall, the big constraint, then, for language as a whole is choosing the sole best language. How can language solve where the necessity and *apriority* of mathematics come from if no concept of 'the most truthful language' exists? Additionally, the number of sentences possible in most natural languages is infinite.[†] Yet, both biologically and technologically, we are limited to the constraints of the physical universe. In terms of our mind, we have a finite number of neurons and a finite number of years to live. Combining all language-capable entities' time from the start of the universe until some endpoint, there will always be a sentence with mathematical truth that language will not cover. This type of argumentation is anti-realist because it restricts mathematics to the finite realm; however, the same argument can be extended to mathematics beyond the physical universe where numbers are real. In both cases, language is incapable of capturing some mathematical truth, making it unsatisfactory to solve the big question.

In fairness to logical positivists, like philosophers from the Vienna Circle, and Dummettean intuitionists, like Dummett, some likely counterarguments to the claim against language answering the highlighted big question is necessary. It was argued that language makes it seem as though the necessity and *apriority* of mathematics require beings that utilize language. A Dummettean intuitionist can take the stance that the beings behind the language are, indeed, the precondition to where mathematics gets its necessity and *apriority*. Also, Dummettean intuitionists can reject the restriction of mathematics from the start of the universe to the end of it by asserting that such an attempt is assuming something indefinitely extensible as definite – never mind it ignoring the underlying threat of some mathematical truth impossible to grasp finitely. However, a logical positivist can never have such a stance. Recall that logical positivists reject any notion of modality and disregard ontological questions outside linguistic frameworks as meaningless questions that should be ignored. A firmly traditional logical positivist would be against indulging in a conversation like so, but for argument's sake and to be charitable to logical positivists, some viewpoints can be hypothesized. For instance, to counteract the point of learning language as possibly *a posteriori*, logical positivism asserts that language has no factual truth, and henceforth the unnatural learning process would make something synthetic besides the mathematical truth obtained. This is enough to affirm the *apriority* portion of the big question, but it is unappealing

[†] If numbers are infinite, and sentences include numbers, then there are infinite sentences. Consider the sentence "X + Y is not equal to 0." where X and Y are both not equal to zero. Informally, one can imagine that the given sentence can be manipulated endlessly in an infinite set of sentences with different combinations of X and Y.

to example scenarios, such as the one outlined in the logical positivist section ('dark matter-like discovery'), for responding fully to the necessity of mathematics.

Utilizing language seems appropriate at face value for giving mathematics necessity and *apriority*. Emphasis needs to be put on 'face value' because implementing linguistic frameworks has underlying problems that this paper uncovered. Although only a small sample size of two linguistic-based mathematical philosophies was depicted, the point of language's shortcomings in the philosophy of mathematics to answer the big question of where the necessity and apriority of mathematics come from has been exemplified thoroughly. However, if the problematic nature of language in mathematics does not entirely sway mathematicians away from linguistic frameworks, the paper's goal is to, then, advocate such individuals to carefully utilize language and warily tackle its shortcomings. The next steps would involve finding some perfect language as discussed to fit the mold of every linguistic framework, generalizing language to be less human-centric, or disregarding language as the sole contributor to where the necessity and *apriority* of mathematics come from.