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Contemporary Nativism Motivated by Mathematics

Annaliese Mugele
Hamilton College

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Part I: Introduction

As one learns more about the world, it becomes increasingly clearer that mathematics is worked into the fabric of it, an underlying factor in nearly everything involving life. In the study of philosophy, innateness immediately struck my interest, given its connection to mathematics. How we understand what we know, how we come to know it, and what we can know would be impacted if we reached a consensus on whether or not there is innate knowledge or structures inherently built into our minds. When one considers how we naturally learn and wonder about mathematics, it is clear that it is a different learning process than with other material. I remember thinking about infinity at a young age, only to academically learn about it in college. As one progresses in philosophical studies, it's evident that mathematics is often used as support in arguments. As innateness is one of the most classic philosophical issues, fascinating uses of mathematics can be found in these arguments as well.

My first exposure to innateness, and perhaps the most famous perspective put forth, is Locke's Tabula Rasa argument. This "blank slate" idea has now become archaic and even strong contemporary empiricists would not argue for it. There has been a shift in the empiricist-nativist debate in favor of nativism. Many contemporary nativist arguments are being published with fascinating, coherent ideas that can truly rival those of empiricists. I will focus on those contemporary nativist arguments that are motivated by mathematics. Part of the reason this debate has been going for so long is because of the huge implications that would follow about the nature and structure of the mature human mind if a conclusion was to ever be reached. The use of mathematics to successfully argue for innateness would not only be substantial for nativism, but also for society's understanding of mathematics. In this paper, I will summarize and analyze Locke's Tabula Rasa argument. Then, after providing brief historical background on the contemporary empiricist-nativist debate, I will compare Locke's Tabula Rasa argument to contemporary nativist arguments and highlight the prevalence and distinctive philosophical relevance of mathematics as a key focal feature of a number of these arguments.

Part II: Locke's Tabula Rasa Argument

In "Book 1: Innate Ideas Essay 1: An Essay Concerning Human Understanding," Locke is trying to uncover what the human condition allows us to know. He believes human understanding is intimately connected to his project. Inquiring about our understanding naturally leads to questions about the origin of ideas, and Locke defines ideas as whatever is the object of the understanding when a man thinks. He begins to try to uncover how ideas come into the mind.

He first focuses on innate ideas. Innate ideas are primary notions which the mind receives when it first comes into existence, and that it brings into the world with it. Colors, everyone would agree, are not innate because we cannot know about or imagine the color blue until we see it. Off the bat, he claims that it would be unreasonable to explain knowledge as innate when we could easily have come to know it in ordinary ways. Then he explicitly states that he believes none of our intellectual possessions are innate. Before considering another line of reasoning, Locke delves into an argument focusing on universal assent.

Locke's first major flaw is that he does not give a reason why he is exploring universal assent as the criterion for innateness besides stating that other people have used it. Furthermore, in his essay, he does not explore any other criterion. This clear disregard to form a complete argument almost entirely discounts his conclusions from the start.

Locke then explores the proposition that maxims are generally assented to as soon as they are proposed and the terms they are proposed in are understood. He responds by asking if quick agreement to a proposition is a clear mark of an innate idea. This cannot be the criterion. He agrees that a proposition is shown to be self-evident if it is promptly assented to by everyone who hears it and understands its terms, but self-evidence comes from a source other than innateness. Also, according to the innatists' principles, all these native beams of light, if they existed, would shine out most brightly in people who are not skilled in concealing things, showing that they have innate ideas. But, he claims, children, idiots, etc. know no general maxims. Their ideas are few and narrow, and only come from things they use the most in their lives which have strongly and frequently been impressed on their senses.

This is an interesting thought and opens up a deeper discussion. Should innateness be more apparent in some more than others, and if so, who? The answer to this question turns on whether or not innateness should be equal in everyone. I tend to believe it is. Therefore, I think that an "equal level of innateness" would suggest that it would not be more apparent in anyone. Furthermore, against Locke's point, there is no way to detect or quantify innateness, for if there was, the empiricist-nativist debate would be concluded.

He presents another argument: if there are any ideas – innate or not – in a mind at a time when the mind is not actually thinking of them, they must be in the memory. Locke claims that to have an idea be brought to the forefront of a conscious mind is for that idea to be remembered. To remember something is to perceive it with a consciousness that one has known before. So, if there were any innate ideas they must only be in the memory. Yet no one can remember an idea that they have never had experience with, for it goes against the definition of remembering.

Although Locke's claims about memory are true, he seems to be implying that innate ideas would need to be in the conscious mind at all times, and this is a misunderstanding. Rather, an innate idea would be stored like any other kind of knowledge, not necessarily always being perceived. Memory in the context of knowledge is notably different than memory in the context of an experience. When a claim is made, all the learning that took place to reach that conclusion is not at once brought to the front of the mind. For example, to make the claim, "Dolphins and fish both live underwater" I do not recall when I first learned what these animals are or that they are different species. These are not thoughts I am consciously having but they are in my mind when I make that claim. Memory in the context of an experience, though, involves remembering as many details of the experience as possible and bringing those details into your conscious mind. Thus, I think Locke's argument here is more or less useless.

Locke concludes by putting a "chief emphasis" on the fact that we have to work for knowledge and cannot expect it to be handed to us. He even goes so far as to suggest that the notion of innate ideas and blind credulity make a person easier to be controlled and manipulated, especially to those in positions of power. Something Locke fails to address, that may affect his conclusion, is the distinction between intellectual ideas and intellectual structures. His arguments focus solely on intellectual ideas. This is understandable, though, given Locke's time period. Only relatively recently have we learned more about the structures of the mind and have gathered empirical evidence. So, it is fair that he did not consider them. This recent collection of empirical data has had large effects on the empiricist-nativist debate.

Part III: Historical Overview

Firstly, it is important to note what belief set defines one as an empiricist or a nativist. The authors of *The Innate Mind* believe that the core contrast between the two turns on the number, variety, and nature of the psychological structures that are posited to explain cognitive development from infancy to the mature state. More simply, the disagreement is over the nature of the psychological structures that are needed to explain the development of the mind. A nativist believes that the innate basis of the mind is rich and diverse while an empiricist believes that the innate basis of the mind is scant and uniform. As a result, a nativist will usually think that a child's mind is an extremely complex thing because of the large number of psychological structures. An empiricist, though, likely believes there are a few of these structures which are sufficient to generate the full richness of the human mind. Taking this stance, empiricists may argue two ways: the diverse mechanisms and information that nativists believe to be present is acquired through only the few general learning systems that they posit, or they may deny that the adult mind is as rich as nativists claim. As a result, there are arguments not only over the nature and structure of the mature human mind, but also the starting point of cognitive development. So, both nativist and empiricist views allow varying degrees of belief in the different types of independent structures that one may assert to be innate. This makes it possible for one to hold nativist beliefs about some parts of the mind and empiricist beliefs about others.

These degrees within each position lead to views on innateness being formed into a sort of spectrum. It has not always been that way though. Historically, empiricists have held very stark views of the mind. More recently, the debate has shifted significantly towards nativism. So, empiricists now argue for positions closer to the nativist end of the spectrum than their empiricist predecessors. Likewise, nativists now argue for even greater complexity within the psychological structures they posit. A reason for this shift may be the development of the accumulator model.

Laurence and Margolis, in their paper, "Linguistic Determinism and the Innate Basis of Number," which will be discussed later, say,

> This strongly suggests not only that the underlying system of representation lacks the precision of natural numbers but also that its representations are the mental magnitudes associated with the accumulator. . . The current consensus in psychology is that the accumulator is a ubiquitous cognitive system with an evolutionary ancient history. But to embrace the accumulator as part of the innate structure of the mind is to take a good step away from an empiricist model of numerical cognition (143).

This shift towards nativism serves as evidence of the strength of contemporary nativism. Despite this, empiricist thought continues to dominate Anglo-American universities.

This shift in the spectrum highlights the longevity of the debate over innateness. The longevity can be explained by considering the implications of a resolution. If a universally agreed upon conclusion came about, it would determine the nature and structure of the mature human mind. This would affect not only how we study the mind, but also how we educate society and how we may increase efficiencies in an array of subject areas.

Samuels points to three main indicators of the confusion of innateness in his essay "Is Innateness a Confused Concept?" He names three features that show there is confusion inherent in the discussion of the concept of innateness. These features are cross talk, fallacious argumentation, and failure of convergence. Fallacious argumentation refers to implausible and irrelevant objections and arguments sometimes added into debates. The failure of convergence is especially interesting because despite decades of research and mutually accessible data, there has been little convergence of opinion.

Nativists and empiricist views can differ in a few key ways, and a philosophical stance can even exist as a combination of the two. The debate between these camps over innateness has failed to come to a conclusion for a long time. Despite this, the spectrum between the two camps has shifted, indicating that there has been progress made by contemporary nativists. Let's now explore examples of this progress, focusing on arguments that use the tool of math.

Part IV: Contemporary Nativist Arguments: (A) "Where Integers Come From"

Two strong contemporary nativist papers that use mathematics as the foundation of their innateness are "Where Integers Come From" by Alan Leslie et al. and "Linguistic Determinism and the Innate Basis of Number" by Stephen Laurence and Eric Margolis. In this section, I will simultaneously summarize and defend these arguments.

Alan Leslie et al.'s argument is one of the most cohesive accounts for the foundation of integers being innate, I believe, we have available. The authors posit that the basis of our natural number concepts is the innate representation "S" that recursively defines the positive integers and the concept of next. They reach this conclusion by using recent empirical research on cognitive features. This research adds strength to the authors arguments that a philosopher could not have had in Locke's era. To reach this conclusion, the authors do work to understand the basis of our quantitative representations and then search through possible explanations. They finally put forth and support their own proposal.

The authors first explore number words and their role in this search. They immediately highlight that the use of "one," "two," and "three" means *exactly* one, *exactly* two, etc. In this way natural number words are quite different than color terms, which refer to a range of values. Count numbers are not vague in the way that "blue" indicates blue-ish. They conclude by claiming that when preschool children identify that the meaning for a given lexical item may be a numerical value –during an activity such as counting – they expect that word to denote some positive integer value. If the restricted hypothesis space that preschool children were accessing was made up of real numbers, there is an infinitesimal chance of selecting a positive integer. This is because in the real numbers, the chance of selecting "2" is one in infinity, because there are infinitely many real numbers. So, if this was the case, then there would never be language for natural numbers, for the odds of selecting natural numbers are so small they approach zero.

I think that this point is especially interesting. Most properties of objects come in the form of a range, such as color, height, and angle. The count of a set, certainly a property of it, is always a discrete integer number. It is worthwhile to explore why numerical values are different. Everyone, including children, understand counts in the form of whole numbers. One does not count "2.1, 3.5, 6.7" even though these numbers are increasing. Furthermore, even if the numbers were evenly spaced, there is no apparent reason to count "1, 2, 3" opposed to "1.5, 2.5, 3.5." One can see that if the possible values for count numbers were any of the real numbers, it has been proved by the law of excluded middle, there is virtually no chance natural numbers would be selected.

Next, Leslie et al. elaborate on the importance of the exact equality of integers. Two measurements of the same continuous physical quantity will be the same twice only by error because it is impossible in principle to determine the value of a continuous quantity with exact precision. On the other hand, counting is a fundamental use of integers, and we depend on the resulting cardinal value of a count to be able to be found again when recounting. This is a, not often noted, but important fundamental difference between real and natural numbers.

A pivotal piece of the argument revolves around magnitude representations. A magnitude representation refers to the brain representing numbers not as discrete symbols but as continuous quantities. The authors cite evidence that leads us to the conclusion that there exists an underlying representation in the form of a noisy real-valued magnitudes. The best-developed model of the magnitude representation is the "accumulator" model of Meck and Church (1983). This will be an important model that they cite throughout the rest of the paper.

Note that the best way to attack these authors' conclusions would be to attack their assumption of the use of this model. Looking ahead to the second paper I will discuss, we can find other evidence for the validity of this model. Laurence and Margolis cite the accumulator model as the "current consensus in psychology," and without going into talk of Kuhn and paradigm shifts, it is best to accept the current model within the scientific discipline.

The accumulator can measure continuous time intervals (in "run" mode) or count discrete entities (in "event" mode). The accumulator model alone, though, makes it hard to see why our basic number concepts should be integers rather than reals. One issue is that there is nothing in the account that explains why each discrete value added to the accumulator should equal exactly one rather than some real number, possibly varying around one. Similarly, accumulated values will be noisy and never equal to exact integer values. The values stored in memory will be noisy and continuously variable. Any numerical observations that a learner makes in the course of quantifying will take place in a vocabulary of the reals. This could explain the "noisy" nature of color words. The authors conclude this section wondering if the accumulator magnitudes can be translated into or constrained to integer values.

Accepting the accumulator model and the assumption of an underlying representation of numbers in the form of a noisy real-valued magnitudes, the authors explore what this connection to integer values could be. It is very tempting to turn to language and number words. I would have hypothesized that the solution lies here. The authors show that it does not and then turn to a different understanding of object perception. Yet, this account fails to explain the connection as well. In the following paragraphs I will summarize those arguments.

Looking at language, the authors work through an argument situated on the fact that it is tempting to say that we learn number words constrained to integer values because physical objects are typically the things that get counted with the number words. But, whatever the discreteness of a “whole” object means, it does not disclose a number. So, even in the co-presence of objects and the count words, children would entertain non-integer-values for the meaning of the count words and would never consider an integer value as a candidate referent. So, language does not solve the issue at hand.

Now the authors turn to the concept of “object files,” which accounts for a missing link in traditional accounts of object perception. Object files are temporary object representations that interface between sensory information and long-term semantic information. There is an indexing function, which is like a folder labeled with spatiotemporal coordinates that point at the object it refers to. There is also a function of having further information added, taken away, or changed. These are the papers within the folder, each having some property “written” on it. An object file may or may not contain a feature bundle, but it must at least have an index. So, can object indexes represent numerosity? No. Children may be able to detect numerosity changes simply by distinctly remembering each individual in the set, but all this does is demonstrate their commitment to object permanence. Sets of object files do not and cannot refer to the numerosity that they instantiate. Because the first step in the proposed bootstrap is flawed in this way, we are lead down a path of question begging if we continue. The indexing function of object files provides no help at all in understanding where integers come from. Furthermore, the authors come to the conclusion that there is no account on hand which shows how a young child can inductively construct integer representations where none where available before.

The largest take away from these failed solutions is that an emphasis needs to be placed on computational compatibility. Computational compatibility refers to the fact that symbols are not numerical unless they enter into arithmetic processing. So, in any explanation for how the mind represents numbers, there must also be an explanation for how the symbols that represent continuous values and discrete values can be used within the same athematic system. A problem with any hypothesis that posits a special discrete representation for the integers, a representation that is fundamentally different from and unrelated to the representation of continuous quantities, is the problem of computational compatibility.

Finally, the authors bring about their own proposal. They propose that the basis of our natural number concepts is the innate representation S that recursively defines the positive integers and the concept next. The basis of these concepts cannot be a system of continuous magnitude representations, accumulator or connectionist, noisy or not, without a system that can represent exactly the value 1. Moreover, the integer representation becomes calibrated to accumulator magnitudes, allowing integer calculation and magnitude estimation. What natural language cannot do is determine or teach anew the meanings of integer concepts. These meanings are known in an important sense innately: namely as generated by S and perhaps even calibrated against the magnitude representation.

In addition to accumulator magnitudes and object indexes, the authors believe that we should assume the existence of a third representational system which represents only integer values. In this proposal, the accumulator model serves a role not as the end-all-be-all source of integers but as the main mechanism for rapid understanding of numerical calculation and estimation. So, the integer representation and the continuous magnitude representation have to be computationally compatible. The authors propose that both the accumulator magnitude representations and the integer representations have to be innately specified.

Look to a speedometer as an example of real and natural numbers calibrated to each other. Both have ordinal structure, but only the integers support a well-defined notion of "next number." This notion of next is integral to our basic number intuitions. The accumulator model has a decent way to pick out the next mental magnitude. This "next" mental magnitude you get is the same as when you add "1" to the mental continuous magnitude you have. This next magnitude, though, is not excused from the fact that two measured continuous magnitudes will never be the same. So, any two samplings of "next" numbers will never be exactly equal. But, it is argued that the mechanism for deciding whether one mental magnitude is greater than another should be assumed to have a function of "effectively equal." This brings the conversation back to the question of exact equality and away from discrete ordering. An accumulator-continuous magnitude counting mechanism with an "effectively equal" operation will be able to discretely order the magnitudes it generates, and this will solve that problem.

But there is more to the idea of "next number" than just ordering and exactness. We must look to the fact that any greater value does not work. The "next" integer value can only come about by adding "1." In the accumulator model, it is specified that the count value to be added is effectively equal to 1. Notice that no other value besides 1 works as a multiplicative identity element.

This line of thought brings about the realization that mapping integers to mental magnitudes numbers is constrained by formal considerations in a way that mapping from real numbers to mental magnitudes is not. This constraint, along with the need for computational compatibility, imposes a system of natural units on mental magnitudes. The intervals on the mental number line that correspond to successive increments map discrete quantity to mental magnitudes. Furthermore, these intervals must be exactly equal to the interval that functions as the multiplicative identity, namely 1.

I have never thought of 1 like this before. Working heavily with math, the uniqueness and importance of 1 has always stood out, but the connection between the difference between "next" orderings of integers and the fact that it is the multiplicative identity element is new to me. This makes sense though, and with independent thought it becomes clear that a system of arithmetic reasoning will not work if this is not the case.

The authors propose that there is a minimal mechanism that will generate the entire integer series and support arithmetic inference. They suggest an integer generator that, similar to the accumulator model, functions as a mechanism of domain-specific learning. Secondly, this integer generator has the function that the values it generates can be calibrated to the accumulator model, taking care of the issue of computational compatibility. Thirdly, it allows an unbounded set of discrete values to be represented, either providing or learning a notational system with an unbounded set of symbols. Also, it only represents integer values. Finally, it must guarantee an ordering of values under the aforementioned "next" relation. These requirements can be summarized in the following assumptions given by the authors:

1. There is at least one innately given symbol with an integer value, namely ONE=1.
2. There is an innately given recursive rule S(x) = x + ONE.
3. There is a regular grid that is commensurate with, and can be calibrated to, the accumulator values.

The authors then touch on the importance of compact notation, where the symbols do not grow to the size of the integer they represent. Additionally, it is important to note that the addition operation, identity relation, algebraic variables, and recursive capacity must also be innately realized.

I find this proposal to be very convincing because it makes sense and covers everything necessary in the least extensive requirements for innateness. This, I believe, makes it highly plausible. Furthermore, the authors admit that this proposal can only be put forward in a tentative voice for obvious reasons. We cannot know the truth of the innateness of mathematics, all we can do is postulate. This is a very respectable fact to include.

Part IV: Contemporary Nativist Arguments: (B) "Linguistic Determinism and the Innate Basis of Number"

The second paper I examined was "Linguistic Determinism and the Innate Basis of Number" by Stephen Laurence and Eric Margolis. Laurence and Margolis note the emerging consensus as favoring empiricists and weak nativists, who consider natural numbers a cultural construct such as writing and agriculture, while suggesting strong nativism, the opposing thesis, is wrong. The authors believe that a particular study by Peter Gordon had a large impact on the shift toward this consensus. It was a high-profile cross-cultural study of number concepts among the Pirahã tribe in the Amazon. In their paper, they look at the implications of Gordon's study and argue that Gordon's experiments don't give support for either view and therefore they do not diminish the prospects for strong nativism. In addition, they provide a brief sketch of their own views which fall under those of strong nativism.

Laurence and Margolis also discuss the aforementioned accumulator model in their section on the history of nativist theorizing. On the accumulator model, they say, "So while the accumulator may represent numerical quantity, it lacks the precision that is integral to the natural numbers" (142) and also "The current consensus in psychology is that the accumulator is ubiquitous cognitive system with an evolutionarily ancient history" (143). In this historical section, the authors also talk about object-indexing system which Leslie et al. explored.

The authors briefly sketch their own approach to a strong nativist proposal for the basis of natural numbers. They posit that one of the core systems supporting natural number concepts is an innate number module which contributes a small set of representations that correspond to the first few integers – 1, 2, 3, and maybe 4. The representations have exact numerical content, yet it is minimal. The number modules are numerical representations in the sense that they serve to detect collections of specific sizes. They need not contain an understanding of the quantitative relations among small collections or knowledge of mathematical facts and functions. The authors suggest that the number modules do not even need to be understood as ordered.

This view is quite different that the one put forth by Leslie et al. mainly due to its complexity. Laurence and Margolis's proposal features the use of object-indexing or a similar system, which as you can recall, Leslie et al. ruled out of possibility. Looking deeper, though, remember that Leslie et al. ruled out the use of an object-indexing system because instead of detecting numerosity changes with numbers, it simply highlighted a commitment to object permanence. Laurence and Margolis's view controls this symptom of an object-indexing system. They require their innate number modules to be numerical representations in the sense that they serve to detect collections of specific sizes. Therefore, their argument stands up against Leslie et al.'s argument against object-indexing as a solution.

Additionally, notice that Laurence and Margolis do not necessitate their number modules to be understood as ordered. The ordering of the integers seems to take place innately in a neural network they posit where the 2 output node can inhibit the 1 output node and the 3 output node can inhibit both the 1 and 2 output nodes. They are not asserting that this is the only way to use their proposed number modules. How would ordering fit into another scenario? We cannot know from what we are given in this paper. So, while the notion of "next" does not seem to bare huge importance in this proposal, remember that it is more or less the foundation of Leslie et al.'s proposal. It is easy to think the most important use of a number is to determine the numerosity of a set, but the numerosity of a set is useless information if you do not have the capacity to compare it to another numerosity. The ability to order and compare numbers is where their value lies, not simply in labeling a property of a set. Thus, Laurence and Margolis's proposal falls short of Leslie et al.'s because they do not account for the significance of "next."

There are other things to object to in their proposal. First, it is odd to require so many innate natural numbers. The authors give no reason for why 1, 2, 3, and maybe 4 are innate or why the innateness of 4 is not decided. They also believe that from these numbers, we are able to detect the importance of 1 in our numerical system, namely the fact that it separates each natural number and is the multiplicative identity element. I think that three or four natural numbers are not enough to lead us to that conclusion or detect any pattern.

Second, to posit that these number modules are innately precise and have the feature of being understood to be a representation of a number of things in a set is a lot to ask. I think innateness is better understood as explaining things we cannot seem to explain in the simplest way possible. This is not that. If we have no way of knowing what is innate and what is not innate, I think that we should be striving to form nativist theories that use as little innate pieces of knowledge necessary. Note that this would not be weak nativism because I still believe that concepts for specific natural numbers cannot simply be learnt or a product of culture.

For those reasons, I believe that although Laurence and Margolis's view in conjunction with their proposed neural network cover all the necessary components, it falls short of a concise simplicity that may be the most important part of a nativist theory. Thus, Leslie et al.'s proposal remains the more likely.

Part V: Relevance and Prevalence of Mathematics

I believe that mathematics, specifically the set of natural numbers, is relevant and prevalent in the discussion of nativism because it is a likely candidate for innate knowledge as well as for the use of innate structures. Children grasp the idea of infinity more quickly than they do of fractions (Leslie 138). Why is it that "counting forever," or infinity, comes naturally to children, while division into parts needs curriculum and examples such as pizza pies? This speaks not only to the high importance of integers over real numbers for the debate about innateness, but also to the importance of mathematics in this debate. Children have a curiosity about inaccessible pieces of mathematical knowledge such as infinity or a perfect triangle, but at the same time have difficulty grasping fractions and long division. Our relationship with mathematics is unique because of this.

By means of mathematics, philosophers have been able to develop sophisticated and compelling notions about the nature of innateness. How can children grasp infinity or a perfect triangle, concepts we can never experience, yet come to on our own accord? We have found no answer. The elusiveness as well as the concreteness of mathematics makes it a wonderful candidate to support nativism over empiricism.

Part VI: Conclusion

The nativist-empiricist debate has been going on for hundreds of years, and for good reason. If a conclusion was reached, it would have implications across the board ranging from our cognitive understanding, neurological development, and how we go about education. Furthermore, it is only in recent years that we have been able to have empirical evidence about our neurological structures as well as a greater collection of data from psychological, sociological, and neurological studies. As a result, the academic debate has shifted towards nativism, despite Anglo-American universities continuing to lean towards more empirical works.

I tend to lean towards nativist views and believe Leslie et al.'s paper "Where Integers Come From" puts forth the best proposal for how we acquire our concepts of integers. After exploring many proposed solutions, they settle on a set of three assumptions requiring innateness. Comparing this to Laurence and Margolis' paper in support of a strong nativist proposal for our acquisition of integers, Leslie et al.'s argument continued to hold up as a better suited solution. Leslie et al.'s argument is so important because it can serve as an argument for the existence of innateness in general, using mathematics to do so.

Mathematics often is used as a key feature in arguments in either camp because it underlays almost everything we do with a surety and concreteness that nothing else gives. At the same time, though, it is mystifying how we come to these concepts so easily, some of which, such as infinity and a perfect triangle, we can never experience.

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