# 2020 Big Questions Research Guide and Brief

# Resolved: Mathematics was discovered, not invented

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# Topic Analysis

"We all use math every day: to predict weather, to tell time, to handle money. Math is more than formulas or equations; it's logic, it's rationality, it's using your mind to solve the biggest mysteries we know." Charlie Eppes, Numb3rs

Would mathematics exist if humans didn't? Since ancient times, humanity has debated whether mathematics was discovered or invented. Did we create mathematical concepts to help us understand the universe around us or is math that native language of the universe itself? In simple terms, if a tree falls in a forest, and no one is around to hear it, does it still make a sound? To help us understand this idea, we first need to understand the function and history of math as we know it. The ancient philosophers and mathematicians of Greece believed that not only was math alive, but that numbers were living creatures as well. In 5th century Greece, these early thinkers believed that numbers were both living entities and universal principles. They called the number "one" the Monette or the general of all other numbers and source of creation. To these thinkers, numbers were active agents in nature. They argued that mathematical concepts were as concrete and as real as the universe itself regardless of the understanding or conceptualization that humans gave them. In this regard, the creator of Euclidian geometry, Euclasites, writes that a bird or a fish is just as real to humans whether what human understands that a bird or a fish is, and math and numbers are just the same. They exist whether people realize the significance of them or not. Euclasites, along with others of his day, believed that nature itself was the physical manifestation of mathematical laws.

In more modern times, contemporary thinkers have posited that the existence of math might be intrinsic to the natural world, but that the categorization and way we delineate math into function and formula is in itself, an invention. They argue that numbers may or may not exist physically; mathematical statements do have truth values and are based on rules that human mathematics have created to explain those bounds.

Leopold Chronic, professor of mathematics in nineteenth century Germany, provided a belief that God created the natural numbers and then left creation of mathematics to fall on humans. His teachings state that divine power rationalizes all-natural order into a fundamental order that humans can relate to through the invention and filtering of knowledge. In short, he argues that although numbers might exist in the natural world, humans only understand the significance of the concepts through invention of ways to rationalize the world around us. Mathematician David Hilbert's lifetime work states that there was a push to establish mathematics as a logical construct. He and others who attempted to understand the world through this frame of thought saw mathematics as a deeply philosophical game. The father of non-Euclidean geometry believed that the existence of non-Euclidean geometry was hyperbolic and not a universal truth, but rather,

one outcome of using one particular set of game tools. Mathematician Arthur Wigan pointed out that humans clearly created mathematical theories and that these theories were developed in a vacuum, often with no view towards describing any physical phenomena. Counter to this, Albert Einstein once described math as the framework necessary to explain how the universe has been working all along. British mathematician Godfrey Hardy posited that none of his work would ever be found useful in describing any phenomenon in the real world without an applied end goal in mind and the discovery of things like Fibonacci sequences.

The next concept that we need to discuss is the word "invented." Many debaters will attempt to conflate this term with "created." Although at first sight, this might be a harmless juxtaposition of terms, we need to look at the true meaning of what is meant by the word "invent." The difference between create and invent is fundamentally based in how something comes into being. When used as verbs, create means to bring into existence out of nothing, without the prior existence of the materials or elements used, whereas invent means to design a new process or mechanism. Create is also adjective with the meaning: created, resulting from creation. Using this train of thought, to describe mathematics as having been created would be a slam dunk win for the negative as geometry or addition existed before humans had a conscious knowledge of such. When we look at it as though we invent something, we see that we are in fact designing processes to describe the process we see.

Running parallel is the concept of how we signify our "invention" of something. Generally, an invention is signified by the process of receiving a patent from a registered government agency that certifies that your creation has legal significance to you and is your property to do with as you see fit. Can we patent something that is natural such a life or a mathematical concept? According to the courts: yes, we can. Historically, patents have applied solely to inventions, granted as a reward for ingenuity and to encourage innovation. Naturally occurring items, like DNA, were exempt from such laws. In 1980, Ananda Mohan Chakrabarty, a scientist working for General Electric, filed an application for a patent on a bacterium that he had genetically modified so that it could consume oil. The US Patent Office rejected Chakrabarty's application stating that the bacteria were a product of nature. Chakrabarty sued, arguing that, by altering the organism, it was his skill and knowledge that made the bacterium valuable. In short, he had "invented" this specific bacterium. The case ended up before the Supreme Court, which ruled in favor of the engineer. "The fact that micro-organisms are alive is without legal significance for the purpose of patent law," the Court wrote. Chakrabarty's creation became the first life-form to receive a patent.

Patents have also been granted to people who have identified genes with mutations that are likely to increase the risk of a disease. Any scientist who wants to conduct research on such a gene—even on a small sequence of its DNA—has to pay license fees. The practical effect has been chilling. According to public health officials and academic leaders, it has stymied research into many types of diseases. Eric S. Lander,

president and founding director of the Broad Institute of Harvard and M.I.T wrote, "A patent on a product of Nature would authorize the patent holder to exclude everyone from observing, characterizing or analyzing, by any means whatsoever, the product of Nature". Debate about the law and legality of patenting life aside, the basic fact remains that natural things can be patented. In this regard, legally speaking, natural things like math can be invented. But at this point, the debate diverges. Just because something can be invented, does that not mean it can be discovered as well? Sir Isaac Newton discovered the law of gravity when he observed an apple falling from a tree. Although his principals of gravity and the math that were used to prove this theory correct were eventually recognized as his invention years later, did not discovery take place first?

Finally, we must take a look at how other cultures view the concept of math and the discovery or invention of such. The basic mathematics that form the foundation for our advanced forms of math, science, and exploration were all derived from learning in the Middle East in Arabia and in the East in China. In these locations, the concept of discovery and invention are different from that of the geographical West. In non-Western parts of the world, when something is derived, it is not the property of a person of a group, but it becomes part of the culture and philosophy of that society. It becomes patchwork in the quilt of their society. However, when you look at such items in Western academics, we know items by the name associated with their inventor. We know Newton for his work on gravity. We know Einstein for his work on relativity. We know of "Hawking radiation" from Stephen Hawking. In this regard, the concept of invention is a Western concept. In Eastern science and philosophy, the discovery of such is just that, a discovery. This can shape the debate as the resolution can put the affirmative and the negative on a direct clash with a West vs. East view of modern science and philosophy.

Furthermore, when we unpack the resolution further, we see that it has layers that can be peeled back. The first layer revolves around the resolution as it is written. As stated, it uses the phrase "mathematics." At first glance, it appears an easy definition of mathematics is known to every student as the subject of "math" and all of the classes that follow. However, in debate, we must look to what is not stated rather than what is. In this case, it does not state "all mathematics." If we assume a general definition of mathematics as concepts in the field of math, then, it might be possible for the negative to concede that the basic principles of math were discovered long ago, but that the recent discoveries in the field of math were made using new applications of these principals in new ways. This is a basic concept in invention. According to the US Patent Office, an invention can be a new application of an old product or idea. In this way, new ideas in math can be seen as inventions using the past discoveries of math.

The next layer is that the application matters in the concept of invention. Going back to the definitions of invention as per the US Patent Office, if we can apply old concepts in math to a new purpose in the field, then we have technically invented something that is new. Stephan Hawking said before his death that his work was made by standing on the shoulders of giants. What he meant by this quotation was that his theories

and ideas were created after using the work of previous math and science scholars to come up with new theories. In this way, he applied the principals of Einstein and this Theory of Relativity to crate the foundation of his Unified Theory of Everything. The numbers, concepts, and formulas were not new, but the way in which he complied them were.

The final layer is whether we can invent anything in the first place. In 1899, Charles H. Duell, former Commissioner of US Patent Office made the now famous quotation that "Everything that can be invented has been invented." At first, it appears that he was being cynical. However, a deeper interpretation of this leads us to see that he was lamenting on the fact that humans like to see themselves as the end all authority of the living world. We invent and create things because we seek to conquer the natural world around us. His perspective was that our inability to see the world as a larger place governed by larger forces than ourselves made us nearsighted. In his view, the fact that we believed anything that we claimed as our own as our invention denied the beauty of the natural world and the fact that a greater power (God) exited and lead us to the discovery. So in this regard, can we really invent anything or is everything already predetermined to be discovered in the real world and the only reason that we believe we invent thing is because of our hubris as mortal humans?

Each side can focus on several different arguments. Unlike other forms of debate where students argue which policy or concept is better, more moral, or what ought to be done, Big Questions is unique in that it asks students to consider whether a concept is true or false. The debate over what is true or false is going to be a point of contention, as the concept of what we know to be "true" or what we call "truth" is all a construct of human nature and understanding. How do we know what we know to be true and how do we prove it as such? To say that "pineapple is the best pizza topping ever" is a truth because there are those who would agree with that statement. Likewise, "Gravity makes things fall towards the floor" is a Truth because it is an observable fact. Next, we have the focus on whether the concepts of math as an invention or a discovery are culturally relative, as well as a concept that is true in some cultures can prove one side of the resolution true.

When it comes to the process of truth testing under this resolution, we find that there is still the debate over whether things can be "true" and 'True." Truth as it exists with a "t" are things that we know to be accurate and real according to our understanding of the world. These can change as we gain more knowledge and as we collect data. As our worldview changes, so does our "truth." In 1000, it was true that the Earth was flat. In 1600, it was true that the Earth was the center of the solar system. In 1900, it was true that the solar system was the only one with planets in the Universe. On the other hand, "Truth" as it exists today is that of what is the fundamental nature of the world. What exists as an absolute in this regard, it means what is static and real? Principals of mathematics fall into this category. Math seeks to explain the fundamental nature of reality and to quantify everyday experiences into numbers and equations that are things

that we can process and describe. The quest for the discovery of new equations and principals in math is an attempt to expand our understanding of the Universe and to prove the existence of reality. In his papers and interviews, philosopher Michio Kaku explains that mathematics is beauty in motion. Math creates the reality that we see and understand as real and true around us. He furthers that our presume of knowledge and an attempt to find the "Truth" through the taming of this force; through claiming invention over the basic principles that describe our world, and through attempting to "Venture down the rabbit hole" destroys this beauty. Thus, his conclusion is that our quest for truth as it pertains to the invention of further mathematical concepts is bad as it destroys the beauty of the world and limits our view of the world around us. Next, we have the focus on whether the concepts of math as an inventon or a discovery are culturally relative and whether is positive or negative. As stated earlier, in some cultures, concepts and equation are created for the benefit of society and thus not the property of or under the invention of any one person. However, in Western culture, we can in fact patent discovery and invention of natural items. We also have the debate over whether the quest for knowledge is good or bad. Do we presume the basic ideas that we can explore and develop, or do we let causality and happenstance take the driver's seat and guide human exploration and knowledge? This is a fundamental question that has been asked by philosophers for generations. How do we acquire knowledge, and can it be seen as a discovery or do we claim ownership through invention over our exploits? Finally, we look to the concept of progress. Does or is invention necessary for progress or is progress a natural occurrence that happens due to our discovery and exploration of the natural world around us? Furthermore, is this progress a positive or a negative attribute for society?

When debating this topic on the affirmative, it is going to be important to remember that the resolution binds you to defending the discovery of mathematics. As stated earlier, you may be able to defend that mathematics was not invented as well since the two may not be mutually exclusive. However, you need to prioritize that discovery happened first. On the affirmative, it will be key to defend that the mathematics existed even before people were aware that it existed and that it transcends all of our knowledge. One classic example is from the book Sphere by Michael Crichton. In this book, an alien ship is discovered far below the ocean and a team of scientists is sent to an undersea laboratory to study the ship. One of the main characters named Harry, a mathematician, states that math is the language of the universe. If alien life exists and they have learned how to travel from star to star, then he may be their best hope at communication. Aliens, he goes on to say, may not have any concept of our art, our music, war, food, color, or anything else that we as humans take for granted. However, for them to travel among the stars and engineer ships that are able to do such will require a deep understanding of math. In fact, unless the aliens are interdimensional, the law of physics and how we understand the universe are constant, and thus, our understanding of math will remain the only constant in our communication. Even if we don't at first understand our symbols or formulas, by a simple comparison of texts can we break this and find similarities and through that will we be able to communicate on a mathematically level with our new life form friends. Although science fiction, this exchange isn't far from the truth. In many

cultures we find here on Earth, we might have nothing in common. Our art and music and language might be completely different. However, our understanding of math and how it shapes our understanding of the world remains the same. When Europeans made contact with Chinese traders traveling on the Belt and Road to the Middle East, it was our understanding of math that helped us understand their culture. We may not have known what formulas they were using, but we understood the core concept that united us. Furthermore, the affirmative will need to keep a tight hold of the idea that just because we don't understand something or recognize something, that doesn't mean that it is not in existence. For those who are religious, I equate this to the belief in God. To believers, God has always existed and will continue to exist even if people do not choose to recognize this as a true fact. When they look out and see someone who does not believe, this does not make God any less real to them in the world nor does it diminish the significance of his existence. All it means is that to those individuals, they have yet to discover God. In short, God exists whether you believed or not. In a similar way, math exists whether we believe or not. Two plus two still equals four even if you are only a year old and don't know what the number "2" is. Two plus two still guides your life and will do so long past your understanding of it. Even things like complex calculus or physics exists even if you don't know what they are.

On the negative, you can take the legal approach. As stated earlier, the law is firm in the idea that you can take credit for naturally occurring things such life or genetics. In this regard, math can in fact be invented as well. Your defense of your stance on the resolution is that you can invent math and doing so does not harm the academic world as we know it. All it does is place a denomination on whether something is recognized. To further this, you can also argue the definition debate over what it means to "create" versus what it means to "invent" something. As stated above, invent can mean to devise a new way to look at and understand the natural world around us. We have invented math as it is necessary to understand the world around us. Einstein even defends this notion when he says that his math is a framework for understanding our reality. If it truly is needed to understand our reality, then it was invented to filter out the complex concepts that govern our presence in life so that it is easier for us to understand. Going back further into history, many philosophers and mathematicians of the Middle Ages believed that math was placed here by God to help us understand the natural world, but God set us on a path of creating new ways to understand his creation. In doing so, our understanding of math could be invented and modified to fit our needs and understandings of the world around us. Other modern mathematicians write that math certainly exists in the natural world; however, it is our invention of new ways to view and use this math for our societal benefit which categorizes it as an invention. This is equivalent to an inventor finding a new way to use something that has already been created. When White Out was invented, it was nothing more than white paint in a fingernail paint bottle, but by finding a new way to apply an already existing concept to make our lives better, something new was invented. New mathematical concepts can be invented from the past knowledge of others. Newton's work was reinvented by Einstein who had his work reinvented by Hawking, who is at this moment, having his work used by the next generation of great minds and

thinkers to better society. The negative can also play around with the definition of "create." Again, going back to the definition that we have been using, to create means to bring into existence from nothing. Although math might exist now, it is nothing without our reconviction. Two plus two equals four is a true statement, but until we understand this as a true statement, it does not exist. In modern philosophy, this is very similar to object permanence in children. To a six-month-old, you do not exist when you leave the room because they need to see you. When you walk back into the room, you are "created" in their mind and you exist. In math, I don't know what quantum mechanics is, but I know it governs how I move though space time. There are mathematical concepts that govern me even as I type this brief that have yet to be found. To me, they do not exist. Once they are found, they will appear into being and I will recognize the, even if I do not understand them. Thus, they were invented by definition.

# Further Reading and Teaching Resources


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# Sample Affirmative Case

Shakuntala Devi, Native American writer and math scholar once said, “Without mathematics, there’s nothing you can do. Everything around you is mathematics. Everything around you is numbers.” From this, we can extrapolate that the universal constant to our world, what we see each day, what we experience, what we live, and what we come to know, and love is all based on the fundamental rules of math. Numbers guide us, determine how fast our crops grow, how where each raindrop falls, and as every debater knows, how many minutes you need to microwave your coffee to get it from cold to hot. Math is our lives. So, when we are faced with the question of Resolved: Mathematics was discovered, not invented, I must firmly stand in the affirmation. Today, I will first, provide some definitions and observations to clarify my belief, second, by explaining how math has always existed in nature, how math governs the universe without human intervention, and through the Mathematical Universe Hypothesis, I will provide you with three main points that support my belief, and finally, I will leave you with some parting words to think about as this debate moves on.

First, to set forth some basic definitions for this debate.

The term “invent” as defined by the Cambridge Unabridged Dictionary means “to originate or create as a product of one's own ingenuity, experimentation, or contrivance.”

The term “discover” as defined by the same dictionary means “to see, get knowledge of, learn of, find, or find out; gain sight or knowledge of (something previously unseen or unknown).”

Taken together, the resolution is asking us whether the field of mathematics was created as per some human’s construction of ideas and work from nothing rather than whether the field previously existed and was learned about, observed, and then reported on and described. Going back to my opening quotations, math has always existed. It has governed our lives whether we

were aware of this fact or not. A five-year old is not aware of complex geometry or the quadratic equation but these rules and formulas still govern their lives just the same. A similar example is that of a new species of snake that a team of researchers finds in the rainforests of some remote country. This species of snake has never been seen before by humans. Just because it has not been seen before does not mean that team of researchers invented it. It is not an iPad or a robot that was made after years of experimentation and crafting in a laboratory. Rather, the animal was found and observed. It had existed all along whether people realized this fact or not. In short, it was discovered. In a similar way, math, as a state of nature existed previous to people learning about it. Once people were aware of its presence, it was discovered.

Now that I have established my definitions for today's debate, I will move on to my case. My first contention is that math as a construct is and has always existed in nature.

In Douglas Adams' science-fiction novel and book, "The Hitchhiker's Guide to the Galaxy", when the supercomputer is asked to calculate the meaning of life and the answer to what is the nature of the universe, after all of time, the answer was found to be 42. When asked to clarify, the computer replies that the answer is easy, the question is the hard part. When asked years later about this perplexing concept, Adams replied that the nature of the universe is already known, given the movement and position of every atom, we already know the nature of the universe. The hard part is finding the rules and formulas that united and govern us. They exist but they have yet to be found. Already, humans have started to unravel this matrix, albeit slowly. The same principles that lead to the discovery of the Higgs Boson were the same principles that were used to discover the planet Neptune which were the same principles that were used to design the aiming sights for early warship canons.

If you look around right now, you can probably spot a few numbers here and there. Because of our education system, many people equate mathematics with arithmetic. Yet mathematicians' study abstract structures far more diverse than numbers, including geometric

shapes. Do you see any geometric patterns or shapes around you? Try throwing a pebble and watch the beautiful shape that nature makes for the arc an impact. The trajectories of anything you throw have the same shape, called an upside-down parabola. When we observe how things move around in orbits in space, we discover another recurring shape: the ellipse. These two shapes are related: the tip of a very elongated ellipse is shaped almost exactly like a parabola.

Humans have slowly discovered many additional recurring shapes and patterns in nature, involving not only motion and gravity, but also areas as disparate as electricity, magnetism, light, heat, chemistry, radioactivity, and subatomic particles. These patterns are summarized by what we call our laws of physics.

My second main point is that numbers are a universal constant.  Equations aren't the only signs of math that are built into nature: there are also numbers. Unlike human creations like the page numbers in a book, numbers refer to the basic properties of our physical reality. For example, how many straws can you arrange so that they're all perpendicular to each other? Where did the number three come from? We call this number the dimensionality of our space, but why are there three dimensions rather than four or six or 23,443? There are also numbers encoded in nature that require decimals to write out. There's something mathematical about our Universe, and that the more carefully we look, the more math we seem to find. A perfect example of this is when we consider the “golden ratio” or phi. Phi can be defined by taking a stick and breaking it into two portions. If the ratio between these two portions is the same as the ratio between the overall stick and the larger segment, the portions are said to be in the golden ratio. This was first described by the Greek mathematician Euclid, though he called it "the division in extreme and mean ratio," according to mathematician George Markowsky of the University of Maine.

You can also think of phi as a number that can be squared by adding one to that number itself, according to an explainer from mathematician Ron Knott at the University of Surrey in the U.K. This ration governs everything from the spiral on a snail’s shell to the layout of a

sunflower's seeds, to the distance between locations in galaxies. When scientists added this knowledge onto the preexisting knowledge of the ratio, the Universe seemed to line up and order appeared from chaos. In doing so, nothing was invented but rather, the principal for perfection was discovered.

My final main point is the mathematical universe hypothesis. Our known reality is like staring into a fog. Even if you have your headlights on, you can only see so far. Turn up the brightness and you actually make the depth of vision worst. In a similar way, reality functions as the fog. The observable reality that we know, and experience is only a short fraction of what exists in all of the universe. In some ways, the harder we try to see through this fog to know all of reality, the harder it becomes to actually see. That is where the Mathematical Universe Hypothesis comes in. In this model, the reality we know is the fog. Our vision is limited by our ability to see through it because, as humans, our senses only allow us to experience a tiny fraction of the known universe. However, we can know the state of matter on the other side of the galaxy, we can see the fading light from the Big Bang, and we can predict the motion of parents and other heavily bodies through our understanding of the math that governs them. Furthermore, this principle state that the intrinsic nature of math transcends every atom in the universe and that whether we are aware of it or not, it has and always will exist. Going back to the opening example, the new species of snake that was discovered did not just appear when the scientists became aware of it, but rather it had always existed and was found through observation. As per my definition of "discover" our act of observation separates our discover from that of an invention. Finally, the hypothesis posits that invention of the fundamental laws can't exist because in order for these laws to be found, they first needed to exist. Invention happens from a starting point of zero. A blank slate. When the rules that govern the universe are already set, there is no zero.

Today, we have looked at the very fundamental rules and laws that govern our universe. We have explored the ways in which math has governed our lives. We have looked at both the philosophical as well as the scientific justifications for the discovery rather than the invention of math. Because of this, I strongly urge an affirmative ballot. Thank you.

# Sample Negative Case

Philosopher Bernard Baruch once stated that "Millions saw the apple fall, but Newton asked why." The very principles that govern our lives each day may be a natural occurrence, that is sure. Gravity existed before Newton. I will not deny that. However, only through experimentation and testing of hypothesis could we know the very nature of this principal. Like a person who invents a robot or a new computer chip, only through determination and imagination could we put the principles to paper; It is because of this and in this way that when faced with the question of Resolved: Mathematics was discovered, not invented, I must firmly stand in the negation. Today, I will first, provide some definitions and observations to clarify my belief, second, by explaining how math has always existed in nature, how math governs the universe without human intervention, and through the Mathematical Universe Hypothesis, I will provide you with three main points that support my belief, and finally, I will leave you with some parting words to think about as this debate moves on.

First, to set forth some basic definitions for this debate.

The term “invent” as defined by Webster’s Dictionary means “: to produce (something, such as a useful device or process) for the first time through the use of the imagination or of ingenious thinking and experiment.”

The term “discover” as defined by the same dictionary means “to see, get knowledge of, learn of, find, or find out; gain sight or knowledge of (something previously unseen or unknown).”

Taken together, when we invent something, we, through our imagination, determination, and will to learn about the natural world around us and to shape our own world, we can transcribe and translate the principals that govern our lives into things that we do understand. In this way, I will concede that math exists in nature. Two plus two equals four no matter your ability to

understand that concept. However, it to express this as an equation and to create means to teach this to others means that we have invented the principles to describe how our lives are governed.

Today, to show this, my first main point will be that the transcription of the principles that describe our lives justifies the title of "invention." As I stated in my introduction, the concept of gravity existed since the dawn of space and time. As gravity is one of the four fundamental forces that rules the universe, it has always been a part of our lives. However, the first person to question this principal was Newton. As we are taught in grade school, after observing an apple falling from a tree, Newton began his quest to show why the apple falls towards the Earth and not higher up into the branches. He tested each theory and hypothesis he created, reworking and transcribing each observation he made. After hundreds of models, he determined he needed a new form of math to show expressions. Thus, he wrote the first calculus textbook. After years of work, he published his book on the Laws of Gravity. In doing so, he through the use of math and observation, was able to show why the apple falls down. Although the principal existed before Newton and will exist long after, it was though his imagination and desire to know more about the world around him that lead to his work. Going back to my definition of what it means to "invent" we see that it is through the use of imagination and determination that one invents anything. Thus, principals are invented. When Einstein crafted his Theory of Relativity, Hawking's creation of his Black Hole Radiation Theory, or when the first early humans' sough to prove why two plus two equals four, we sought to simplify the natural world into principals that we could understand and teach to others. We invented new ways to of expressing this world, and thus, we invented math.

My second main point is that since you can publish and patent natural things and discoveries, it means you can invent them. In 1980, the Supreme Court ruled that a natural organism can be patented if it's discovery was the world of modification. The court wrote that through the imagination and ingenuity of the scientist, the lifeform came into being from never

having been in existence before. When we apply this theory to that of mathematicise, there are similar principals that are upheld by law. Claims and patents having a mathematical formula or an application of laws of nature are patent eligible if they improve a particular process. The Joint Strike Fighter program under which the US and other allied nations developed a fifth-generation single engine aircraft, F-35, for their Navy and Air force is the world's most expensive weapons program. The cost of the project is near $400 billion. The helmet mounted display (HMD) of F-35 is the most advanced HMD which provides unprecedented situational awareness to a pilot. A single HMD for an F35 aircraft costs $400k. Inventor Thales Visionix Inc sued US Department of Defense asserting the HMD of F-35 infringes claims 1–5, 11–13, 20, 22–26, 32– 34, and 41 of its '159 patent, directed to motion-tracking relative to a moving platform. Elbit Systems of America joined as a third-party defendant as it is the subcontractor that produces the HMDs. The Court of Federal Claims scrutinized the claims of 159 patents under the two-step Alice test and found that the claims are directed to the abstract idea of using laws of nature governing motion to track two objects and provide no inventive concept beyond the abstract idea. In this way, the courts granted that the natural fundamentals of math that existed, as they are applied and described, are a invention of the claim holder and thus, are property.

My third main point is that we shape nature and reality to describe our purpose, not the other way around. Cosmologist Max Tegmark believes that everything in the universe is part of a mathematical structure. All matter is made up of particles, which have properties such as charge and spin, but these properties are purely mathematical. Tegmark states that "If you accept the idea that both space itself, and all the stuff in space, have no properties at all except mathematical properties," then the idea that everything is mathematical "starts to sound a little bit less insane." This, in the view of Tegmark, leads to one big fining. Scientists could in theory predict every observation or measurement in physics if given enough time to shape a theory or a principal that fit the observations. Though testing and experimentation, we could craft a theory of everything.

In short, we could invent a theory. Someday, Tegmark goes on to say scientists will probably be able to describe even consciousness using math.

Today, I have shown that math exists in nature absent humans, but it is only through observation and experimenting that we can know the nature of what we are seeing, because we can place a legal claim and patent on mathematical principals and gain rewards for our work, and because we invent math to shape our understanding of the known universe that I justify that math was invented and not discovered and I stand in firm negation of the resolution. Thank you.

# Affirmative Evidence

# Math was discovered- General

## The formulas we have might have been invented but math is a constant

Peter Biello, Cordelia Zars, 6-8-2016, "Granite Geek: Was Math Discovered or Invented?," No Publication, https://www.nhpr.org/post/granite-geek-was-math-discovered-or-invented

When we talk about "math," are we talking about the characters we use to represent it on paper or are we talking about the abstract idea behind those characters?

The way we represent it on paper, to a certain extent, is trivial. It's the abstract idea that's interesting. The essence, the power, the beauty of mathematics is that it is abstraction. The ultimate abstraction. And I would argue that it is the greatest art form that's been created by humans. It's the thing that separates us from the beasts of the fields. Doing abstract, pure mathematics is a human activity that no non-humans do. Crows can count, for example, but there's no evidence that there's a quadratic equation lurking in the head of anything other than human beings.

How would knowing math was conclusively invented or conclusively discovered change how humanity understands itself and the world?

If NASA sent out a space craft and it went around the back of an asteroid and discovered all of the plutonic solids, which are what the Greeks thought were the absolute forms that circle and a sphere aspire to, lurking there on the back of an asteroid, that would change our concept of the universe. But I don't think that's going to happen. So in general, I think you can safely say this is an argument to chew over, but it probably won't change much. But it is really interesting to think about.

## Math is an a priori skill inherent to humans that can't be invented

Leibniz And, "Is Mathematics Invented or Discovered?," Bubble, https://www.thebubble.org.uk/culture/philosophy-religion/mathematics-invented-discovered/

In this article I will argue that mathematical knowledge is not a posteriori, that is, it is not invented but discovered. According to Plato, mathematical entities are abstract and exist independently, outside of space and time and are thus only knowable a priori (Brown, 2001). Kant argued that mathematical knowledge is synthetic a priori, a view that was later much challenged as a priori judgments were seen as synonymous to analytic judgments (Barker, 1964). The above views were supported by Leibniz and Frege, as well. Quine's 'seamless web', however, objects the possibility of a priori mathematical knowledge and considers all knowledge to be a posteriori (McDermott, 2001). Armstrong argued on similar grounds that mathematical knowledge is a posteriori. Nevertheless, I believe that these objections can be met. Kitcher's (1983) challenge on the possibility of a priori mathematical knowledge will also be assessed, to demonstrate the distinction between the abstract Platonic Form of mathematical entities and the way they are perceived.

As stated by Plato's ontological realism, mathematical entities correspond to Plato's Theory of Forms. Mathematical entities, like Forms, are abstract, acausal, eternal and indestructible (Shabel, 2005). As existing outside of space and time, they are not part of the empirical world and are therefore only knowable a priori. Brown (1999), a Platonist, argued for ontological realism on the following grounds: $\pi$ or prime numbers are not part of the physical world. Only the physical world can be experienced. Therefore, the knowledge of $\pi$ or prime numbers is not a matter of experience. This does not mean that numbers are not real, however; they are just non-physical. For Brown, one cannot consider whether the sentence '7>3' is true if she does not first accept the existence of numbers '7' and '3' as already existing entities, in the form of Platonic Ideas. Similarly, Leibniz referred to mathematical entities as 'eternal truths' and considered monads, partless and sizeless entities, to be the ultimate constituents of reality, thus impossible to be known through experience (Hall, 1980).

Frege, adopting a foundationalist view, argued that a proposition's apriority depends on its justificatory grounds, which depend on further propositions which, if are 'primitive' and 'fundamental' – meaning that they have no further proofs themselves – then the original proposition is a priori (Demopoulos, 1997). The above idea is based on the existence of acausal and eternal mathematical entities, which exist independently of our empirical contact with them. In fact, Kant argued that the presuppositions of mathematical knowledge are knowable without any particular experience (Bigelow, 1998), but with him being less abstract about the relation of mathematical entities to space. He considered mathematical entities to be knowable through space which is "prior to and independent of our experience of empirical spatial objects" (Shabel, 2005, p. 44). However, Kant, in contrast with Frege, did not consider space to be a noumenon but a phenomenon. Space is how our senses represent what we perceive. In this way, Kant gave rise to synthetic a priori knowledge.

## A realistic position on math is that it was discovered and not invented

Leibniz And, "Is Mathematics Invented or Discovered?," Bubble, https://www.thebubble.org.uk/culture/philosophy-religion/mathematics-invented-discovered/

The above views have not been unquestioned however. Quine's challenge refers to the implications of the relation between mathematics and other natural sciences. By adopting a coherentist view, Quine, in contrast with Frege's foundationalist view, regarded beliefs to be interconnected with each other. In his view, nothing is knowable a priori because all beliefs constitute a 'seamless web' which only responds to sensory stimulation, thus it's only knowable a posteriori (Shabel, 2005). The reason, Quine says, that mathematical entities seem to be a priori is that they lie at the center of the 'seamless web', where it is difficult to directly observe them, as they only appear to us through other natural sciences. In fact, this is the only way they exist, according to Quine-Putnam's indispensability argument. (McDermott, 2001). However, this idea can generate a counter-argument to Quine's 'seamless web'. Mathematics seems to only appear to us through their representation in the physical world, and the natural sciences (Brown, 1999). Hence, adopting a Kantian viewpoint, mathematics is the underlying structure of natural sciences which become knowable through mathematics. It would be unfair, then, to merely say that mathematics and other natural sciences are equally interconnected in Quine's 'seamless web'. Frege's view that there are some foundationalist beliefs in the web, particularly mathematics, which allow natural sciences to become knowable, seems more plausible.

A second objection is Armstrong's a posteriori realism. For Armstrong, everything, including universals, is physical. Mathematical entities, and relations between them, are physical as well (Bigelow, 1998). Thus, mathematical knowledge is a posteriori. However, mathematical entities are not a part of the material world. We may use the number 12 to refer to everyday objects, but the number 12 per se is not part of our empirical world, for its existence does not depend on whether there are material entities to represent it. The number 12 in the statement 'There are 12 apples', for example, is merely a representation of the Platonic Form of number 12. Examples of representations of extremely big numbers are the estimated number of atoms in the observable Universe (1080) and Shannon's number, the estimated number of possible chess games (10120) (Shannon, 1950). It would be absurd and naive, however, to believe that the number 10120 'became physical' and 'started existing' when chess was invented, but the number 10130 is non-existent since it does not represent anything in the material world yet. Therefore, since numbers and mathematical properties do not need to be represented or be applied in the physical world in order to exist, they are not knowable by experience and are only knowable a priori.

Challenges to the view that mathematical knowledge is a priori were also concerned with the fallibility and certainty of a priori mathematical knowledge. Kitcher (1983) equates certainty with apriority and argues that propositions are true only because we stipulate them to be so. But since, Kitcher argues, humans can be fallible, propositions cannot be certain and therefore not a priori. However, fallibility and certainty are not incompatible with apriority. When we refer to mathematical concepts, we are describing them, not stipulating them. Describing with 'the mind's eye', as Brown (1999) calls experience which does not involve the senses, does not guarantee certainty. It is also fallible, as sense experience is. But it is describing mathematical entities that is fallible, not the non-spatial Platonic Form of mathematical entities.

Kitcher (1983) considers that the realist idea of mathematics is one and the same with how it is applied and represented in the material world. We can falsely represent mathematics in the material world, but this does not affect their abstract form. For example, angles of a triangle, according to Euclidean geometry, always sum up to 180o. This was thought to apply to our three-dimensional material world. If we measure a triangle to be 181o we do not say that the theory is wrong, but that we have described it incorrectly (Ayer, 1964). This highlights the distinction between how we describe objects and their abstract form. Einstein's general theory of relativity, however, showed that our three-dimensional space is spherical and demonstrated that the sum of angles of a triangle do not add up to 180o on a spherical object. This does not, however, constitute a challenge for the notion of a priori. It only shows that we can be fallible when describing mathematical entities, without at the same time affecting their apriority (Shabel, 2005). What only changes when we change our perception of mathematical entities, is how we describe them.

Furthermore, advancements in quantum mechanics may question some of our most deeply held notions, which seem unchallenged, for example that the proposition "p^¬p" is a contradiction. The principle of quantum superposition challenges this proposition by demonstrating that it is possible for an electron to be in multiple states simultaneously. The most known example of quantum superposition is "Schrödinger's cat" thought experiment where it is theorized that the cat in question can be both alive(p) and not alive(¬p) simultaneously. Again, this cannot challenge the abstract Form of the proposition but only the way we perceive it.

Through Plato's ontological realism, I have demonstrated the similarities between Plato's Forms and mathematical entities: abstract, non-spatial and non-temporal. 'Eternal truths', as Leibniz calls them. However we perceive them or describe them to be, the eternal nature of mathematical entities remains unchanged. Frege's foundationalist view on apriority of mathematical knowledge seems plausible as mathematics is itself the primitive entity on which other non-primitive entities, namely natural sciences, rest on. This is in contrast to Quine's coherentist 'seamless web' in which mathematics is unfairly undermined and considered equal to other non-abstract and fallible natural sciences. Responding to Armstrong's a posteriori realism it was argued that mathematical entities do not need a material world in order to exist. With Kitcher's anti-realist view on certainty and fallibilism I distinguished between our description of mathematical entities and their abstract Platonic Form, managing, with all the above considered, to show that mathematical knowledge is not a posteriori, but a priori.

## Math has developed and matured over history

Which Unknown, "Home," Story of Mathematics - A History of Mathematical Thought from Ancient Times to the Modern Day, https://www.storyofmathematics.com/

The history of mathematics is nearly as old as humanity itself. Since antiquity, mathematics has been fundamental to advances in science, engineering, and philosophy. It has evolved from simple counting, measurement and calculation, and the systematic study of the shapes and motions of physical objects, through the application of abstraction, imagination and logic, to the broad, complex and often abstract discipline we know today.

From the notched bones of early man to the mathematical advances brought about by settled agriculture in Mesopotamia and Egypt and the revolutionary developments of ancient Greece and its Hellenistic empire, the story of mathematics is a long and impressive one.

The East carried on the baton, particularly China, India and the medieval Islamic empire, before the focus of mathematical innovation moved back to Europe in the late Middle Ages and Renaissance. Then, a whole new series of revolutionary developments occurred in 17th Century and 18th Century Europe, setting the stage for the increasing complexity and abstraction of 19th Century mathematics, and finally the audacious and sometimes devastating discoveries of the 20th Century.

Follow the story as it unfolds in this series of linked sections, like the chapters of a book. Read the human stories behind the innovations, and how they made – and sometimes destroyed – the men and women who devoted their lives to… the story of mathematics.

## New math concepts might be invented but the idea of mathematics was discovered

Simons Foundation, 12-22-2014, "Mathematicians Make a Major Discovery About Prime Numbers," WIRED, https://www.wired.com/2014/12/mathematicians-make-major-discovery-prime-numbers/

In May 2013, the mathematician Yitang Zhang launched what has proven to be a banner year and a half for the study of prime numbers, those numbers that aren't divisible by any smaller number except 1. Zhang, of the University of New Hampshire, showed for the first time that even though primes get increasingly rare as you go further out along the number line, you will never stop finding pairs of primes that are a bounded distance apart — within 70 million, he proved. Dozens of mathematicians then put their heads together to improve on Zhang's 70 million bound, bringing it down to 246 — within striking range of the celebrated twin primes conjecture, which posits that there are infinitely many pairs of primes that differ by only 2.

Now, mathematicians have made the first substantial progress in 76 years on the reverse question: How far apart can consecutive primes be? The average spacing between primes approaches infinity as you travel up the number line, but in any finite list of numbers, the biggest prime gap could be much larger than the average. No one has been able to establish how large these gaps can be.

"It's a very obvious question, one of the first you might ever ask about primes," said Andrew Granville, a number theorist at the University of Montreal. "But the answer has been more or less stuck for almost 80 years."

This past August, two different groups of mathematicians released papers proving a long-standing conjecture by the mathematician Paul Erdős about how large prime gaps can get. The two teams have joined forces to strengthen their result on the spacing of primes still further, and expect to release a new paper later this month.

Erdős, who was one of the most prolific mathematicians of the 20th century, came up with hundreds of mathematics problems over his lifetime, and had a penchant for offering cash prizes for their solutions. Though these prizes were typically just $25, Erdős ("somewhat rashly," as he later wrote) offered a $10,000 prize for the solution to his prime gaps conjecture — by far the largest prize he ever offered.

Number theory formulas are notorious for having many "logs" (short for the natural logarithm), said Terence Tao of the University of California, Los Angeles, who wrote one of the two new papers along with Kevin Ford of the University of Illinois, Urbana-Champaign, Ben Green of the University of Oxford and Sergei Konyagin of the Steklov Mathematical Institute in Moscow. In fact, number theorists have a favorite joke, Tao said: What does a drowning number theorist say? "Log log log log … "

Nevertheless, Rankin's result is "a ridiculous formula, that you would never expect to show up naturally," Tao said. "Everyone thought it would be improved on quickly, because it's just so weird." But Rankin's formula resisted all but the most minor improvements for more than seven decades.

Terence Tao of the University of California, Los Angeles, said this is the first Erdős prize problem he has been able to solve.
Many mathematicians believe that the true size of large prime gaps is probably considerably larger — more on the order of (log X)2, an idea first put forth by the Swedish mathematician Harald Cramér in 1936. Gaps of size (log X)2 are what would occur if the prime numbers behaved like a collection of random numbers, which in many respects they appear to do. But no one can come close to proving Cramér's conjecture, Tao said. "We just don't understand prime numbers very well."

Erdős made a more modest conjecture: It should be possible, he said, to replace the 1/3 in Rankin's formula by as large a number as you like, provided you go out far enough along the number line. That would mean that prime gaps can get much larger than in Rankin's formula, though still smaller than in Cramér's.

The two new proofs of Erdős' conjecture are both based on a simple way to construct large prime gaps. A large prime gap is the same thing as a long list of non-prime, or "composite," numbers between two prime numbers. Here's one easy way to construct a list of, say, 100 composite numbers in a row: Start with the numbers 2, 3, 4, … , 101, and add to each of these the number 101 factorial (the product of the first 101 numbers, written 101!). The list then becomes 101! + 2, 101! + 3, 101! + 4, … , 101! + 101. Since 101! is divisible by all the numbers from 2 to 101, each of the numbers in the new list is composite: 101! + 2 is divisible by 2, 101! + 3 is divisible by 3, and so on. "All the proofs about large prime gaps use only slight variations on this high school construction," said James Maynard of Oxford, who wrote the second of the two papers.

The composite numbers in the above list are enormous, since 101! has 160 digits. To improve on Rankin's formula, mathematicians had to show that lists of composite numbers appear much earlier in the number line — that it's possible to add a much smaller number to a list such as 2, 3, … , 101 and again get only composite numbers. Both teams did this by exploiting recent results — different ones in each case — about patterns in the spacing of prime numbers. In a nice twist, Maynard's paper used tools that he developed last year to understand small gaps between primes.

The five researchers have now joined together to refine their new bound, and plan to release a preprint within a week or two which, Tao feels, pushes Rankin's basic method as far as possible using currently available techniques.

The new work has no immediate applications, although understanding large prime gaps could ultimately have implications for cryptography algorithms. If there turn out to be longer prime-free stretches of numbers than even Cramér's conjecture predicts, that could, in principle, spell trouble for cryptography algorithms that depend on finding large prime numbers, Maynard said. "If they got unlucky and started testing for primes at the beginning of a huge gap, the algorithm would take a very long time to run."

James Maynard of the University of Oxford wrote the second paper proving Erdős' conjecture on large prime gaps. Tao has a more personal motivation for studying prime gaps. "After a while, these things taunt you," he said. "You're supposed to be an expert on prime numbers, but there are these basic questions you can't answer, even though people have thought about them for centuries."

Erdős died in 1996, but Ronald Graham, a mathematician at the University of California, San Diego, who collaborated extensively with Erdős, has offered to make good on the $10,000 prize.

Tao is toying with the idea of creating a new prize for anyone who makes a big enough improvement on the latest result, he said.

In 1985, Tao, then a 10-year-old prodigy, met Erdős at a math event. “He treated me as an equal,” recalled Tao, who in 2006 won a Fields Medal, widely seen as the highest honor in mathematics. “He talked very serious mathematics to me.” This is the first Erdős prize problem Tao has been able to solve, he said, “So that’s kind of cool.”

The recent progress in understanding both small and large prime gaps has spawned a generation of number theorists who feel that anything is possible, Granville said. “Back when I was growing up mathematically, we thought there were these eternal questions that we wouldn’t see answered until another era,” he said. “But I think attitudes have changed in the last year or two. There are a lot of young people who are much more ambitious than in the past, because they’ve seen that you can make massive breakthroughs.”

# Truth Good

## Truth is essential for autonomy

**Chemerinsky, Erwin.** Legion Lex Professor of Law at the University of Southern California Law Center, CASE WESTERN RESERVE LAW REVIEW, 1991, P. *750.*

More importantly, Professor Schauers analysis ignores the values of autonomy and choice. Truthful information allows individuals to make their own decisions about what to believe and how to act. A person should be able to decide whether to admire George Washington, Abraham Lincoln, Franklin Roosevelt, and Elizabeth Cady Stanton based on accurate portrayals. Similarly, people should be able **to** decide whether **to** smoke or drink based on correct information concerning the health effects and where to place their money based on truths about the stability of banks. Professor Schauer also argues that information yields power. False information disempowers; it denies individuals the ability to make choices about the decisions in their lives. Professor Schauer simply ignores the importance of truth for individual autonomy. Honest, open public dialogue, dialogue that might help individuals and society discover their best interests, is prevented by the falsehoods.

## Truth is key to knowledge and freedom

**Teson, Fernando R.** Professor of Law at Arizona State University, VIRGINIA JOURNAL OF INTERNATIONAL LAW ASSOCIATION, Spring, 1993, p. 680.

In contrast, liberals regard free intellect as the engine of human progress, and intellectual integrity as an unconditional ethical commitment - rather than a political value to be weighed against others. Honesty for the Kantian is part of the categorical imperative to respect other rational beings by not using them manipulatively as means to other ends. The liberal commitment to rational discourse encompasses both science and morality. If we abandon it, as radicals urge, we jeopardize not only the path to knowledge and scientific progress, but also our most precious freedoms.

## Truth is necessary for informed decision making

**Chemerinsky, Erwin.** Legion Lex Professor of Law at the University of Southern California Law Center, CASE WESTERN RESERVE LAW REVIEW, 1991, pp. *750-751.*

The same arguments can be made against Professor Schauer's contention that ignorance is often better than knowledge. Although at times ignorance may be bliss, Professor Schauer gives no weight **to** the right of the people to know about government and other matters of public concern. Professor Schauer also fails to recognize the importance of knowledge **to** people who wish **to** exercise their autonomy by making informed choices about their lives. For example, it might be better if the government did not acknowledge that airport metal detectors cannot identify plastic explosives. In fact, terrorists might be best deterred if the Federal Aviation Administration falsely publicized the technical ability to detect such weapons. This, however, would deny the right of people to decide whether **to** fly based on an accurate appraisal of the risks. As argued earlier, the ultimate exposure of the truth might undermine the credibility of all government declarations concerning airplane safety.

## Truth has inherent value

**Bjorhum, Eric.** Boston College Law School, GEORGETOWN JOURNAL OF LEGAL ETHICS, Summer, 1996, p. 1121.

Before launching into an analysis of my next maxim, I would like to offer a "proof" for the inherent value of truth in law. This simple proof follows from some of my earlier comments about skepticism. Assume that truth has no inherent value in law. Then we must accept one of two conclusions: either truth is instrumentally good, or it has no value whatsoever -- not even instrumentally. This second conclusion is easy to refute, because we have already seen that some belief about truth is necessary for the legal system to function, e.g., the legal system must claim to assign blame, not arbitrarily, but for things that happen in the world. The first conclusion is more difficult. Yet if we accept it, we must accept that lack of truth, or lying, could be just as good instrumentally (depending on the circumstance), and this I do not think we are ready **to** accept. We have already seen that lying is logically and empirically flawed. Thus, the original premise was wrong, and therefore its opposite must be true -- truth is at least its own inherent good. In the legal system, much of the apparatus is constructed around the search for truth.

# Falsehoods Bad

## Falsehoods cause harm when the truth is found

**Chemerinsky, Erwin.** Legion Lex Professor of Law at the University of Southern California Law Center, CASE WESTERN RESERVE LAW REVIEW, 1991, p. 749.

If people falsely are encouraged to believe that the bank has their money on hand in reserves, there is a real risk of a bank run when depositors learn that they have been deceived. Similarly, there is a potential for serious backlash if people learn that they have been misled regarding the race of prominent Americans. Indeed, people will come **to** distrust anything said by those attempting **to** advance racial equality. If people learn that they were deceived concerning the effects with regard **to** badness of smoking and drinking, they might then distrust all information concerning the adverse health effects of these practices. Spreading falsehoods to serve greater truths risks undermining those truths once the falsehoods are uncovered.

## Truth overrides all other concerns like protecting feelings

**Marshall, William P.** Galen J. Roush Professor of Law at Case Western Reserve University Law School, GEORGIA LAW REVIEW, Fall, *1995,* p. 21.

A second potential argument in support of the truth justification rests upon the contention that transcendent truth might exist, and therefore, the search for truth is not necessarily futile. Certainly, if truth does exist, its importance is, virtually by definition, ultimate. Thus, even if the search for truth holds almost no possibility of success, the importance of truth is so great that its pursuit may still be seen as invaluable.

## Promoting falsehoods is paternalistic

**Chemerinsky, Erwin.** Legion Lex Professor of Law at the University of Southern California Law Center, CASE WESTERN RESERVE LAW REVIEW, 1991, p. *750.*

There is a tremendous paternalism to this argument: believing he knows what the greater truths are, Professor Schauer decides that others would benefit by believing falsehoods. This view, that deception is permissible to serve a greater good, is frightening. There are no standards **to** guide the implementation of this utilitarian analysis or the determination of which falsehoods are justified. Professor Schauer seems to say little more than that falsehoods are permissible whenever they might make people better off in some way. His argument provides no stopping point for these lies and fails to recognize the dangers of deception.

## No official agent should sell falsehoods

**Chemerinsky, Erwin.** Legion Lex Professor of Law at the University of Southern California Law Center, CASE WESTERN RESERVE LAW REVIEW, 1991, pp. *75 1-752.*

Thus, the question has to be faced as to who should decide when others are better served by lies or ignorance. Professor Schauer attempts to avoid this question by recognizing the dangers in creating an institution that would determine this for society. Even if no such institution is established, the question still has to be faced as to who shall decide when deception is acceptable. Should the government be able to decide when the people are better off with lies about its activities? History shows that government officials often will lie or suppress information to serve their own self-interest and rationalize their behavior by saying it serves the publics good. Should corporations or professionals be able to decide when we are better off being deceived? Again, history and experience teach that we are better off insisting on truth than trusting others to protect our interests through lies.

# Cultural Relativism Good

## STANDARDS AND VALUES ARE RELATIVE TO THEIR CULTURES

Tracy E. Higgins, Associate Professor of Law - Fordham University, HARVARD WOMEN'S LAW JOURNAL, Spring, 1996, P. 92.

The debate over the universality of human rights is almost as old as the movement toward universal human rights standards **in** international law. Following World War II, as the Universal Declaration of Human Rights was being drafted, the Executive Board of the American Anthropological Association (AAA) warned that the Declaration would be "a statement of rights conceived only in terms of the values prevalent in the countries of Western Europe and America." The Board added that "standards and values are relative to the culture from which they derive" and thus "what is held to be a human right in one society may be regarded as anti-social by another people."

## CULTURAL RELATIVISM IS OF HIGH VALUE IN THEORY AND SUBSTANCE

Culliton, Fulbright Grantee, Washington College of Law Valedictorian, OAS Grantee -Inter-American Institute for Human Rights, CASE WESTERN RESERVE JOURNAL OF INTERNATIONAL LAW, Spring/Summer, 1994, p. 193

Cultural relativism has high value, in both theory and substance, when used as a tool **to** overcome imperialism and ensure that international policymakers listen to, respect, and include the decisions and values of people from less-powerful nations. It can also be used as a tool to enlighten Western or Northern peoples to the benefits of other cultures.

## RELATIVISM IS SKEPTICAL ABOUT THE EXISTENCE OF UNIVERSAL NORMS

Tracy E. Higgins, Associate Professor of Law . Fordham University, HARVARD WOMEN'S LAW JOURNAL, Spring, 1996, p. 96.

Generally speaking, however, cultural relativists are committed **to** one or both of the following premises: that knowledge and truth are culturally contingent, creating a barrier to cross-cultural understanding; and that all cultures are equally valid. Combined with the empirical observation of cultural diversity worldwide, these two premises lead to the conclusion that human rights norms do not transcend cultural location and cannot be readily translated across cultures. The two premises of cultural relativism deprive human rights advocates of both a transcendent justification for human rights standards (i.e., notwithstanding disagreement, human rights exist as a product of the human condition) and a hope for consensus (by bridging the barriers of cultural difference). Cultural relativism raises the possibility that the category "human" is no longer sufficient **to** enable cross-cultural assessment of human practices or the actions of states.

## RELATIVISM SIMPLY SHIFTS THE FRAMEWORK OF MORAL EVALUATION

Allan F. Hanson, Professor of Anthropology at the University of Kansas, TIKKUN, November 21, 1995, p. 63.

D'Souza's argument that relativist-inspired antiracism has impeded progress toward racial equality is not simply inflammatory; it is intellectually untenable. It does not hold water even if one accepts his notions about relativism. In his view, a relativist would argue that evaluations of cultural institutions should be made only from within. But it does not follow that the outcome of all such internal judgments will be favorable. It is commonplace for communities, applying their own standards, **to** debate the morality or effectiveness of certain customs and institutions and ultimately **to** reject them.

# CULTURAL RELATIVISM IS NOT AN UNDESIRABLE VALUE

## CULTURAL RELATIVISM IS NOT RESPONSIBLE FOR RACISM

Allan F. Hanson, Professor of Anthropology at the University of Kansas, TIKKUN, November 21, *1995,* p. 63.

D'Souza's most preposterous argument is that relativism is responsible for contemporary racism, in both its Black and white varieties. The white racist reasons from a relativist set of assumptions, says D'Souza: Every culture is equally valuable and entitled to respect, including "white culture." Therefore, white people have as much reason to cherish their culture as anyone else. A thing of unique value, white culture merits protection against inroads from other cultures. Immigration, integration in neighborhoods and schools, and multiculturalism should be resolutely opposed as alien threats to white cultural distinctiveness. Replace the word "white" with "Black" in the foregoing sentences, and you have D'Souza's rendition of Black racism and the promotion of racial separation found in some versions of Afrocentrism and the teachings of the Black Muslims. The claim that these forms of racism draw their inspiration from cultural relativism is outlandish. Racism in all its forms encourages an essentialist focus, valorization of one's own culture above all others. Nothing could be more opposed to cultural relativism, which encourages an open, expansive approach to all cultures.

## THE FEMINIST CRITIQUE OF CULTURAL RELATIVISM EXCLUDES WOMEN

Tracy E. Higgins, Associate Professor of Law - Fordham University, HARVARD WOMEN'S LAW JOURNAL, Spring, 1996, p. 101.

In addition **to** criticism from cultural relativists, this cross-cultural approach to women's oppression has not been immune from criticism within the feminist community. Such cross-cultural analysis depends upon very broad assumptions about women's lives and experiences and therefore raises important empirical questions regarding the extent **to** which women's oppression is similarly constituted across cultures. It also raises issues about the formulation of those empirical questions themselves. An essentialist approach generally begins with the experiences of white, middle-class, educated, heterosexual women. Such an approach tends to attribute commonly shared forms of oppression to gender and specific forms of oppression **to** other sources such as race, class, or sexual orientation. Consequently, an essentialist approach risks becoming a least common denominator approach, allowing relatively privileged women's experiences to define the feminist agenda. This tendency, in turn, creates division among women. In short, when feminists aspire to account for women's oppression through claims of cross-cultural commonality, they construct the feminist subject through exclusions, narrowing her down to her essence. And, as Judith Butler has observed, "those excluded domains return **to** haunt the 'integrity' and 'unity' of the feminist 'we'."

## THE CRITIQUES OF CULTURAL RELATIVISM ARE MISGUIDED

Micaela deLeonardo, anthropologist, THE NATION, April 8, 1996, p. 25.

The attack on cultural relativism, then, is of a piece with the entire New Rightist program: the hypocritical attempt to rewrite the American morality play, to lay claim to virtue through focusing on the mote in Others, eyes while ignoring the beam in one's own. Certainly, moral principles are important. But claiming that "cultural relativism tells us there are no ultimate moral principles" is a canard. All that most of the practitioners of my benighted discipline have ever advocated is the attempt, from the bedrock of one's own enculturation, **to** empathize with the moral logics of others.

## RELATIVISM OPENS OUR EYES TO DEEP, HIDDEN ASSUMPTIONS

Tracy E. Higgins, Associate Professor of Law - Fordham University, HARVARD WOMEN'S LAW JOURNAL, Spring, 1996, p. 108.

Joan Williams has explained the advantage of abandoning universalist arguments as follows: A steadfast refusal **to** appeal in any context **to** objective moral certainties has, in my view, more than epistemological significance. It offers us a chance to step back and examine the structure of our form of life, to assess the hidden costs of our ideals. How the ideal of universal brotherhood is inevitably hemmed in by the arbitrary lines that people draw to define, and ultimately to limit, the scope of their moral responsibility.

# Knowledge Good

## KNOWLEDGE IS THE BEST SOURCE OF POWER

Alvin Toffler, Author, POWERSHIFT, 1990, p. 16.

Of the three root sources of social control, therefore, it is knowledge, the most versatile, that produces what Pentagon brass like to call "the biggest bang for the buck." It can be used to punish, reward, persuade, and even transform. It can transform enemy into ally. Best of all, with the right knowledge one can circumvent nasty situations in the first place, so as to avoid wasting force or wealth altogether.

## HIGHEST-QUALITY POWER STEMS FROM KNOWLEDGE

Alvin Toffler, Author, POWERSHIFT, 1990, p. 15-16.

The highest-quality power, however, comes from the application of knowledge. Actor Sean Connery, in a movie set in Cuba during the reign of the dictator Batista, plays a British mercenary. In one memorable scene the tyrant's military chief says: "Major tell what your favorite weapon is, and I'll get it for you." To which Connery replies: "Brains."

## KNOWLEDGE IS THE ULTIMATE ESSENCE OF POWER

Alvin Toffler, Author, POWERSHIFT, 1990, p. 18.

Knowledge itself, therefore, turns out to be not only the source of the highest-quality power, but also the most important ingredient of force and wealth. Put differently, knowledge has gone from being an adjunct of money power and muscle power, to being their very essence. It is, in fact, the ultimate amplifier.

## RELATIONSHIPS AMONG KNOWLEDGE, VIOLENCE AND WEALTH DEFINE POWER

Alvin Toffler, Author, POWERSHIFT, 1990, p. 16.

To assess the different contenders in a power conflict—whether a negotiation or a war—therefore, it helps to figure out who commands access to which of the basic tools of power. Knowledge, violence, and wealth, and the relationships among them, define power in a society.

# KNOWLEDGE PROVIDES PROTECTION FROM POWER

## KNOWLEDGE PROVIDES PROTECTION FROM POWER

Alvin Toffler, Author, POWERSHIFT, 1990, p. 20.

Today, in the fast-changing, affluent nations, despite all inequities of income and wealth, the coming struggle for power will increasingly turn into a struggle over the distribution of and access to knowledge. This is why, unless we understand how and to whom knowledge flows, we can neither protect ourselves against the abuse of power nor create the better, more democratic society that tomorrow's technologies promise.

## KNOWLEDGE IS NOT EXCLUSIVE TO ELITES

Alvin Toffler, Author, POWERSHIFT, 1990, p. 20.

But a last, even more crucial difference sets violence and wealth apart from knowledge as we race into what has been called an information age: By definition, both force and wealth are the property of the strong and the rich. It is the truly revolutionary characteristic of knowledge that it can be grasped by the weak and the poor as well.

## KNOWLEDGE IS A THREAT TO THE POWERFUL

Alvin Toffler, Author, POWERSHIFT, 1990, p. 20.

Knowledge is the most democratic source of power. Which makes it a continuing threat to the powerful, even as they use it to enhance their own power. It also explains why every power-holder—from the patriarch of a family to a president of a company or the Prime Minister of a nation—wants to control the quantity, quality, and distribution of knowledge within his or her domain.

# HUMAN EXPERIENCE PRODUCES KNOWLEDGE

## TRUTH OF KNOWLEDGE IS ROOTED IN RESULTS OF SOCIAL PRACTICE

Mao Tse-Tung, Former Chairman of the Chinese Communist Party, FOUR ESSAYS ON PHILOSOPHY, 1966, p. 4.

The Marxist philosophy of dialectical materialism has two outstanding characteristics. One is its class nature: it openly avows that dialectical materialism is in the service of the proletariat. The other is its practicality: it emphasizes the dependence of theory on practice, emphasizes the dependence of theory on practice and in turn serves practice. The truth of any knowledge or theory is determined not by subjective feelings, but by objective results in social practice. Only social practice can be the criterion of truth. The standpoint of practice is the primary and basic standpoint in the dialectical-materialist theory of knowledge.

## KNOWLEDGE DOES NOT EXIST APART FROM PRACTICE

Mao Tse-Tung, Former Chairman of the Chinese Communist Party, FOUR ESSAYS ON PHILOSOPHY, 1966, p. 9.

All knowledge originates in perception of the objective external world through man's physical and sense organs. Anyone who denies such perceptions denies direct experience, or denies personal participation in the practice that changes reality, is not a materialist. That is why the "know-all" is ridiculous. There is an old Chinese saying, "How can you catch tiger cubs without entering the tiger's lair?" This saying holds true for man's practice and it also holds true for the theory of knowledge. There can be no knowledge apart from practice.

## PRODUCTION IS THE PRIMARY SOURCE OF KNOWLEDGE

Mao Tse-Tung, Former Chairman of the Chinese Communist Party, FOUR ESSAYS ON PHILOSOPHY, 1966, p. 1-2.

In a classless society every person, as a member of society, joins in common effort with the other members, enters into definite relations of production with them and engages in production to meet man's material needs. In all class societies, the members of the different social classes also enter, in different ways, into definite relations of production and engage in production to meet their material needs. This is the primary sources from which human knowledge develops.

## KNOWLEDGE IS GAINED THROUGH PRODUCTION

Mao Tse-Tung, Former Chairman of the Chinese Communist Party, FOUR ESSAYS ON PHILOSOPHY, 1966, p. 2.

Above all, Marxists regard man's activity in production as the most fundamental practical activity, the determinant of all his other activities. Man's knowledge depends mainly on his activity in material production, through which he comes gradually to understand the phenomena, the properties and the laws of nature, and the relations between himself and nature; and through his activity in production he also gradually comes to understand, in varying degrees, certain relations that exist between man and man. None of this knowledge can be acquired apart from activity in production.

## "Education" is merely exposure to facts. This style of education dehumanizes debaters; only the affirmative style of education truly generates knowledge.

**Freire 1979** Paulo Freire (Brazilian educator and theorist of education). *Pedagogy of the Oppressed*. Chapter 2. http://www.marxists.org/subject/education/freire/pedagogy/ch02.htm

Education thus becomes an act of depositing, in which the students are the depositories and the teacher is the depositor. Instead of communicating, the teacher issues communiqués and makes deposits which the students patiently receive, memorize, and repeat. This is the "banking" concept of education, in which the scope of action allowed to the students extends only as far as receiving, filing, and storing the deposits. They do, it is true, have the opportunity to become collectors or cataloguers of the things they store. But in the last analysis, it is the people themselves who are filed away through the lack of creativity, transformation, and knowledge in this (at best) misguided system. For apart from inquiry apart from the praxis, individuals cannot be truly human. Knowledge emerges only through invention and re-invention, through the restless, impatient, continuing, hopeful inquiry, human beings pursue in the world, with the world, and with each other.

## Western thought can't achieve universality and excludes acknowledgement of the subaltern

Grosfoguel, Ramón, University of California, Berkeley, Decolonizing Post-Colonial Studies and Paradigms of Political-Economy: Transmodernity, Decolonial Thinking, and Global Coloniality
2011 TRANSMODERNITY: Journal of Peripheral Cultural Production of the Luso-Hispanic World, School of Social Sciences, Humanities, and Arts, UC Merced
http://escholarship.org/uc/item/21k6t3fq

The first point to discuss is the contribution of racial/ethnic and feminist subaltern perspectives to epistemological questions. The hegemonic Eurocentric paradigms that have informed western philosophy and sciences in the "modern/colonial capitalist/patriarchal world-system" (Grosfoguel 2005; 2006b) for the last 500 hundred years assume a universalistic, neutral, objective point of view. Chicana and black feminist scholars (Moraga and Anzaldúa 1983; Collins 1990) as well as Third World scholars inside and outside the United States (Dussel 1977) reminded us that we always speak from a particular location in the power structures. Nobody escapes the class, sexual, gender, spiritual, linguistic, geographical, and racial hierarchies of the "modern/colonial capitalist/patriarchal world-system". As feminist scholar Donna Haraway (1988) states, our knowledges are always situated. Black feminist scholars called this perspective "afro-centric epistemology" (Collins 1990) (which is not equivalent to the afrocentrist perspective) while Latin American Philosopher of Liberation Enrique Dussel called it "geopolitics of knowledge" (Dussel 1977) and, following Fanon (1967) and Anzaldúa (1987), I will use the term "body politics of knowledge." This is not only a question about social values in knowledge production or the fact that our knowledge is always partial. The main point here is the locus of enunciation, that is, the geo-political and body-political location of the subject that speaks. In Western philosophy and sciences the subject that speaks is always hidden, concealed, erased from the analysis. The "ego-politics of knowledge" of Western philosophy has always privilege the myth of a non-situated "Ego". Ethnic/racial/gender/sexual epistemic location and the subject that speaks are always decoupled. By delinking ethnic/racial/gender/sexual epistemic location from the subject that speaks, Western philosophy and sciences are able to produce a myth about a Truthful universal knowledge that covers up, that is, conceals who is speaking as well as the geo-political and body-political epistemic location in the structures of colonial power/knowledge from which the subject speaks. It is important here to distinguish the "epistemic location" from the "social location." The fact that one is socially located in the oppressed side of power relations does not automatically mean that he/she is epistemically thinking from a subaltern epistemic location. Precisely, the success of the modern/colonial world system consists in making subjects that are socially located in the oppressed side of the colonial difference, to think epistemically like the ones on the dominant positions. Subaltern epistemic perspectives are knowledge coming from below that produces a critical perspective of hegemonic knowledge in the power relations involved. I am not claiming an epistemic populism where knowledge produced from below is automatically an epistemic subaltern knowledge. What I am claiming is that all knowledges are epistemically located in the dominant or the subaltern side of the power relations and that this is related to the geo- and body-politics of knowledge. The disembodied and unlocated neutrality and objectivity of the ego-politics of knowledge is a Western myth. René Descartes, the founder of Modern Western Philosophy, inaugurates a new moment in the history of Western thought. He replaces God, as the foundation of knowledge in the Theo-politics of knowledge of the European Middle Ages, with (Western) Man as the foundation of knowledge in European Modern times. All the attributes of God are now extrapolated to (Western) Man. Universal Truth beyond time and space privileges access to the laws of the Universe, and the capacity to produce scientific knowledge and theory is now placed in the mind of Western Man. The Cartesian "Cogito ergo sum" ("I think, therefore I am") is the foundation of modern Western sciences. By producing a dualism between mind and body and between mind and nature, Descartes was able to claim non-situated, universal, God-eyed view knowledge. This is what the Colombian philosopher Santiago CastroGómez called the "point zero" perspective of Eurocentric philosophies

(Castro-Gómez 2003). The "point zero" is the point of view that hides and conceals itself as being beyond a particular point of view, that is, the point of view that represents itself as being without a point of view. It is this "god-eye view" that always hides its local and particular perspective under an abstract universalism. Western philosophy privileges "ego politics of knowledge" over the "geopolitics of knowledge" and the "body-politics of knowledge." Historically, this has allowed Western man (the gendered term is intentionally used here) to represent his knowledge as the only one capable of achieving a universal consciousness, and to dismiss non-Western knowledge as particularistic and, thus, unable to achieve universality. This epistemic strategy has been crucial for Western global designs. By hiding the location of the subject of enunciation, European/Euro-American colonial expansion and domination was able to construct a hierarchy of superior and inferior knowledge and, thus, of superior and inferior people around the world. We went from the sixteenth century characterization of "people without writing" to the eighteenth and nineteenth-century characterization of "people without history," to the twentieth-century characterization of "people without development" and more recently, to the early twenty-first-century of "people without democracy". We went from the sixteenth-century "rights of people" (Sepúlveda versus de las Casas debate in the University of Salamanca in the mid-sixteenth century), to the eighteenth century "rights of man" (Enlightenment philosophers), and to the late twentieth century "human rights." All of these are part of global designs articulated to the simultaneous production and reproduction of an international division of labor of core/periphery that overlaps with the global racial/ethnic hierarchy of Europeans/non-Europeans. However, as Enrique Dussel (1994) has reminded us, the Cartesian "Cogito ergo sum" was preceded by 150 years (since the beginnings of the European colonial expansion in 1492) of the European "ego conquistus" ("I conquer, therefore I am"). The social, economic, political and historical conditions of possibility for a subject to assume the arrogance of becoming God-like and put himself as the foundation of all Truthful knowledge was the Imperial Being, that is, the subjectivity of those who are at the center of the world because they have already conquered it. What are the decolonial implications of this epistemological critique to our knowledge production and to our concept of world-system?

# CAUSALITY IS NECESSARY TO MAKE GOOD POLICY

## CAUSALITY IS NECESSARY TO DETERMINE GOOD POLICY

Jerald Hage and Barbara Foley Meeker, Professors at the University of Maryland, SOCIAL CAUSALITY, 1988, p. 1

Why should we be concerned with the problem of causality? One answer, we suggest, is that success of social intervention policies and the consequent credibility of social science depends on our knowing what the mechanisms are by which one variable changes another variable. We cannot make changes without understanding the reasons for a change having one effect rather than another, and the conditions under which the change we want may occur. We have, therefore, practical as well as theoretical interest in the "why" of social life.

## CAUSALITY IS KEY TO MAKING POLICIES

Jerald Hage and Barbara Foley Meeker, Professors at the University of Maryland, SOCIAL CAUSALITY,

1988, p. 2

A good causal theory will produce interesting empirical research hypotheses and statistical analyses and also social intervention policies. A poor (or nonexistent) causal theory will make empirical research and statistical analysis difficult to interpret, and lead to (at best) ad hoc and accidentally effective social intervention polices.

## CAUSALITY IS NECESSARY FOR EFFICIENT POLICIES

Jerald Hage and Barbara Foley Meeker, Professors at the University of Maryland, SOCIAL CAUSALITY, 1988, p. 33

Another reason why causality is so important is the need to develop better and more effective social intervention strategies that focus on social processes. This will lead to more credibility for the social sciences as well as to more effective social policies.

# CAUSALITY IS NEEDED FOR EDUCATION

## RESEARCH AND DEVELOPMENT IS ENHANCED WHEN WE LOOK AT CAUSALITY.

Jerald Hage and Barbara Foley Meeker, Professors at the University of Maryland, SOCIAL CAUSALITY, 1988, p. 33

Social causes are frequently ignored in the development of social theory. As we have seen, there is some confusion in the philosophy of science about the concept. Causes occur in time prior to their effects and represent some mechanism or process which produces a change. These occur in a complex network of causal links. Types of causal link include direct, indirect, spurious and conditional, and may also include reciprocal and feedback processes, Typically in sociology we focus on state variables such as sex, age, income, centrality, size or complexity and do not explicate the causal mechanisms which relate the independent and dependent variable. The concept of social causality provides a useful service by calling attention to this neglected aspect of theory. Both theory development and empirical research will be enriched by considering questions of causality.

## CAUSALITY IS NECESSARY FOR SCIENTIFIC THINKING

Georg Henrik von Wright, Professor at Colombia University, CAUSALITY AND DETERMINISM, 1974, p. 1.

I shall be talking here about one concept of causation only--but one which I think is of sufficient importance to merit this singular attention. Its importance, as I see it, has many dimensions. First, this concept of causation is important because of the role it actually seems to play in scientific thinking and practice, particularly in the experimental and natural sciences. Secondly, it is important because of the even greater role it has played in philosophy as an ideal or model concept. It has set a model to philosophers of what a scientific “causal explanation” ideally looks like. And it has lent support to an idea according to which the entire course of the world, or of nature, is subject to a rigid determinism under inexorable causal laws.

# CAUSALITY IS A GOOD VALUE

## CAUSALITY IS USEFUL IN PREDICTING OUTCOMES.

D.M. Armstrong and Norman Malcom, Authors, CONSCIOUSNESS AND CAUSALITY, 1984, p. 138

The word ‘disposition’ here is a philosopher’s technical term. By ‘disposition’ is meant such properties of material objects such as brittleness, solubility, and elasticity. This rubber band is elastic. If a force is suitably applied it will stretch, and will continue to stretch as long as the force is readily applied. Remove the force, however, and it will return to its original length. It is important to realize that what we have here is are casual conditions. They tell us that if the band were acted upon in certain ways, then certain effects will result. Pulling on the band is a cause. It has the effect of stretching the band. The removal of the pulling agent is a further cause, which has the effect that the band returns to its original shape.

## CAUSALITY MUST BE DETERMINED BEFORE ANYTHING ELSE.

Jerald Hage and Barbara Foley Meeker, Professors at the University of Maryland, SOCIAL CAUSALITY, 1988, p. 13

One of the few features of causality that is generally agreed upon is that a causal process goes in one direction only, and that the action of the cause comes first in time. (Recall that theology, the idea that a cause is the end state toward which an event is heading, is not acceptable scientifically.) If we know the sequence in which events occur, we must take into account in establishing what causes what; the one that occurs second can never be the cause of the one that occurred first.

# CAUSALITY IS DIFFICULT TO DETERMINE

## THE EFFECT OF SOMETHING DOES NOT ALWAYS HAVE TO HAVE A CAUSE.

Myles Brand, Professor at the University of Illinois, THE NATURE OF CAUSATION, 1976, p. 68

Hume's "official" view on this subject may perhaps be summarized as follows: To be is to be perceived. No connection is ever perceived between a cause and its effect. Therefore there is none. An "object" of kind A is called the cause of one of kind B if, in our experience, objects of kind A have always been followed each of an object of kind B. But such following of one object upon a certain other is not "necessary."

## THERE IS NOT ALWAYS A CAUSE TO AN EFFECT.

Myles Brand, Professor at the University of Illinois, THE NATURE OF CAUSATION, 1976, p. 69-70

As to the first, if a man were so situated as always to have heard two clocks striking the hours, one which always struck immediately before the other, he would according to Hume's definition of cause have to say that the strokes of the first cause the strokes of the second; whereas in fact they do not.

## THERE IS NO REAL WAY TO DETERMINE CAUSALITY.

Myles Brand, Professor at the University of Illinois, THE NATURE OF CAUSATION, 1976, p. 72-73

Hume attempts to meet this difficulty by saying that even then we had millions of experiments “to convince us of this principle, that like objects placed in like circumstances, will always produce like effects,” and that this principle then “bestows an evidence and firmness on any opinion, to which it can be applied.” By itself, however, this principle would support equally the generalizing of any sequence observed--of one which is accidental as well as of one which turns out to be casual.

# PROGRESS IS A GOOD VALUE

## PROGRESS IS THE PARAMOUNT VALUE WHICH GIVES ALL OTHER VALUES MEANING

Robert A. Nisbet, University of California at Riverside, HISTORY OF THE IDEA OF PROGRESS, 1980, pp. *4-5.*

No single idea has been more important than, perhaps as important as, the idea of progress in Western civilization for nearly three thousand years. Other ideas will come to mind, properly: liberty, justice, equality, community, and so forth. I do not derogate from one of them. But this must be stressed: throughout most of Western history, the substratum of even these ideas has been a philosophy of history that lends past, present, and future to their importance. Nothing gives greater importance or credibility to a moral or political value than belief that it is more than something cherished or to be cherished; that it is an essential element of historical movement from past through present to future. Such a value can then be transposed from the merely desirable to the historically necessary. Simply stated, the idea of progress holds that mankind has advanced in the past - from some aboriginal condition of primitiveness, barbarism, or even nullity - is now advancing, and will continue to advance through the foreseeable future.

## PROGRESS IS AN ETHICAL IMPERATIVE

Raymond Duncan Gastil, PROGRESS: CRITICAL THINKING ABOUT HISTORICAL CHANGE, 1993, p. 16.

Leaving aside the paradoxical implication of this affirmation of his dedication to scientific relativism, Bury accepts progress as the guiding concept of his age because it fits his understanding of reality. He also accepts progress because he sees it as an ethical imperative that people should believe *in* a concept that stretches ethical responsibility over time and space in a way that transcends immediate personal interest. Only in a “world of becoming” is it possible for people in each generation to be grateful to their ancestors for having laid the basis for a better life than the ancestors could have experienced, and to feel through this gratitude responsibility to generations still to come to provide them with a basis for a better life than is possible in the present.

## PROGRESS HAS HISTORICALLY BEEN CONSIDERED A CRITICAL VALUE

Waiter Tniett Anderson, fellow of the Berkeley-based Meridian Institute, STAR TRIBUNE, January 11, 1994, p. ba.

This is a remarkable state of affairs when you consider how important the belief in progress has been in America's history. Until recently it was the dominant and unifying force in the political life of Western civilization, a true secular faith. The religion of progress dates from the mid-eighteenth century when European intellectuals, their minds on fire with new ideas, began to proclaim the inevitable march of human betterment. The young French philosopher Turgot, generally considered the founding father of the doctrine, gave a public lecture at the Sorbonne declaring that humankind "advances ever, though slowly, towards greater perfection." His ideas had an electrifying impact, inspiring many others including Thomas Jefferson, and took on a new dimension after Darwin's "Origin of Species" showed progress as a driving force in all organic life. the belief in progress was so fervently embraced that the only real controversy it provoked was about which form of progress people should subscribe to. Religious progressives believed things were getting better because God personally guided the course of history. Secular progressives said it was mainly due to human ingenuity and the application of rational thought. Statist progressives believed governments should take an active part in leading the march of progress. Laissez-faire progressives thought governments ought to get out of the way and let individual enterprise work its magic for the betterment of all.

# PROGRESS IS NOT ENVIRONMENTALLY INSENSITIVE

## IT IS POSSIBLE TO CONCEIVE OF PROGRESS IN AN ENVIRONMENTALLY SENSITIVE WAY

Jeremy Rifkin and Carol Grunewaid Rifkin, authors and environmental activists, VOTING GREEN, 1992, p. 30.

By contrast, the Green concept of progress is based on the assumption of economic sustainability rather than unlimited growth and consumption. Progress, in the world of Green politics, is defined as new scientific, technological, and economic initiatives that enhance the well-being of the community, conserve the resources, steward the environment, and protect the interests of future generations of human beings and other species.

## PROGRESS NOW ADDRESSES THE ENVIRONMENT AND OTHER VALUES

Alvin Toffler, Visiting Professor at Cornell, Visiting Scholar at the Russell Sage Foundation, and Fellow of the American Association for the Advancement of Science, THE THIRD WAVE,

1980, p. 295. Today there is a fast-spreading recognition around the world that progress can no longer be measured in terms of technology or material standard of living alone - that a society that is morally, aesthetically, politically, or environmentally degraded is not an advanced society, no matter how rich or technically sophisticated it may be. In short, we are moving toward a far more comprehensive notion of progress -progress no longer automatically achieved and no longer defined by material criteria alone.

## PROGRESS IS NOW ENVIRONMENTALLY SENSITIVE

Jeremy Rifkin and Carol Grunewald Rifkin, authors and environmental activists, VOTING GREEN, 1992, pp. 30-3 1.

The theme of ecological progress was explored by a handful of legislators in 1990 during consideration of new clean air legislation. While industry lobbies and their political allies on Capitol Hill and in the White House argued that economic growth, profits, and employment would all suffer if tough new clean air statutes were adopted, a few members of Congress challenged the old shibboleths, arguing that progress means more than simple output. They reminded their colleagues of the increased health bills that accompany air pollution, as well as the toll atmospheric pollution is taking on the nation's environment and infrastructure. They warned of the long-term biospheric, economic, and social consequences of failing to address the worsening air pollution crisis. They pleaded on behalf of the interests of future generations whose quality of life would be seriously compromised by failure to act now. And finally, a few legislators introduced bills to ease the transition for workers whose jobs would be lost by new clean air provisions that were being considered. In short, they argued for a new perspective with regard to progress.

## PROGRESS CAN BE VIEWED IN A MATURE AND ECOLOGICAL WAY

Walter Truett Anderson, fellow of the Berkeley-based Meridian Institute, STAR TRIBUNE, January 11, 1994, p. bOA.

It's time for a course correction - not back to the narrow-minded boosterism of the past, but onward to a mature vision that combines hope and determination with a realistic recognition that the future is going to include stunning scientific and technological advances, lots of industry, lots of people, lots of striving, big cities and large organizations. Learning, not simply linear betterment, is what progress is about. It involves costs, mistakes, pain, and occasionally unpleasant information. The human race is making a lot of progress, and will continue to do so. While we're at it, we need to make some progress in our thinking about progress.

# PROGRESS HAS GOOD CONSEQUENCES

## ON-BALANCE, PROGRESS HAS DONE MORE GOOD THAN BAD

Robert A. Nisbet, University of California at Riverside, HISTORY OF THE IDEA OF PROGRESS, 1980, p. 8.

But, corruptions of the idea of progress understood - and the two I have just mentioned do not exhaust the number - I remain convinced that this idea has done more good over a twenty-five hundred-year period, led to more creativeness in more spheres, and given more strength to human hope and to individual desire for improvement than any other single idea in Western history. One may say that what is ultimately crucial, the will to advance or improve, lies in the individual alone, that an unverifiable, paradoxical, cosmic dogma is not needed. The individual's own drives and aspirations will suffice to effect progress, and therefore so comprehensive and abstract a proposition as the Western idea of progress is expendable. I do not agree. The springs of human action, will, and ambition lie for the most part in beliefs about universe, world, society, and man which defy rational calculations and differ greatly from physio- psychological instincts. These springs lie in what we call dogmas. That word comes from Greek roots with the literal meaning of "seems-good." As Tocqueville wrote, "No society can prosper; no society can exist" without dogma.

## FAITH IN PROGRESS UNDERCUTS AUTHORITARIANISM

Leo Marx, TECHNOLOGY REVIEW, January, 1987, p. 32.

The modern idea of progress, as developed by its radical French, English, and American adherents, emerged in an era of political revolution. It was a revolutionary doctrine, bonded to the radical struggle for freedom from feudal forms of domination. To ardent republicans like the French philosopher Condorcet, the English chemist Priestley, and Benjamin Franklin, a necessary criterion of progress was the achievement of political and social liberation. They regarded the new sciences and technologies not as ends in themselves, but as instruments for carrying out a comprehensive transformation of society. The new knowledge and power would provide the basis for alternatives to the deeply entrenched authoritarian, hierarchical institutions of l'ancien regime: monarchical, aristocratic, and ecclesiastical.

## REJECTING PROGRESS CONSTITUTES GIVING UP ON HUMANITY

Walter Tniett Anderson, fellow of the Berkeley-based Meridian Institute, STAR TRIBUNE, January 11, 1994, p. bOA.

The trouble with the old cult of progress was that it deliberately blinded itself to the costs of change. The trouble with the new cult of no-progress is that it can too easily become self-fulfilling prophecy. It gives up on science, gives up on institutions - ultimately, gives up on humanity. The people the Utne group regards as optimists are the ones who see nature as somehow healing the wounds caused by human striving.

# REALISM IS A WELL SUPPORTED PARADIGM

## REALIST PRINCIPLES PROVIDE A FOUNDATION FOR AGILE GLOBAL STRATEGY
**David M.**

Abshire, president of the Center for Strategic and International Studies, THE WASHINGTON QUARTERLY, Spring, 1996, p. 39.

Realism would offer the basic foundation of assumptions for an agile strategy. This strategy's starting point is the basic insight of realism: World politics remains a modified form of anarchy in which power and influence are at stake. Therefore, conflicting national interests are a permanent and inevitable aspect of international relations. This does not mean that war among the great powers is unavoidable; it does not mean that the rule of law cannot be established in specific areas; and it does not mean that states (or people) are necessarily more inclined to competition than cooperation. What it does mean is that military conflict – subnational, regional, or global – cannot be ruled out for the foreseeable future, and that economic competition among the world's major powers will remain a permanent feature of world affairs. An agile strategy must therefore provide the United States with the ability to operate in a world where military conflict is always possible and economic competition is inevitable. The economic competition, however, becomes constructive rather than destructive the more markets are not mercantiistic but mutually open, thus providing a win-win situation.

## REALISM ENHANCES OUR UNDERSTANDING OF INTERNATIONAL CONFLICT
**David M.**

Abshire, president of the Center for Strategic and International Studies, THE WASHINGTON QUARTERLY, Spring, 1996, p. 39.

Realism also suggests that balances of power tend to preserve peace, and imbalances of power invite conflict. In the nuclear age, the relationship between power imbalances and war may not be as simple as it once was; but it would be a mistake to assume that the relationship has disappeared altogether. The insights of realism therefore call for an agile strategy that works to preserve balances of power in the key regions of the world.

## REALISM ENHANCES OUR UNDERSTANDING OF INTERNATIONAL COOPERATION

Joseph M. Grieco, Professor of Political Science at Duke University, NEOREALISM AND NEOLIBERALISM: THE CONTEMPORARY DEBATE, 1993, p. *135.*

These tests are likely to demonstrate that realism offers the most effective understanding of the problem of international cooperation. In addition, further analysis of defensive state positionality may help pinpoint policy strategies that facilitate cooperation. If relative gains concerns do act as a constraint on cooperation, then we should identify methods by which states have been able to address such concerns through unilateral bargaining strategies or through the mechanisms and operations of international institutions. For example, we might investigate states' use of side-payments to mitigate the relative gains concerns of disadvantaged partners. Thus, with its understanding of defensive state positionality and the relative gains problem for collaboration, realism may provide guidance to states as they seek security, independence, and mutually beneficial forms of international cooperation.

## REALISM CORRECTLY IDENTIFIES THE LIMITS TO AMERICAN POWER

David M. Abshire, president of the Center for Strategic and International Studies, THE WASHINGTON QUARTERLY, Spring, 1996, p. 39.

Finally, realism offers a cautionary note about foreign commitments. It enjoins national leaders to keep their ends and means in balance, and **to** avoid global crusades, which almost always prove self-defeating - for example, rapid worldwide democratization, or unquestioning anticommunism in every corner of the globe. Thus an agile strategy must recognize the limits **to** American power and must outline goals for foreign policy that operate within those limits. This again requires taking seriously the distinction between short-term and long-term aims: long-run strategy can be more idealistic and seek a gradual transformation of world politics, but in the short term, pragmatism and prioritization must reign supreme.

# REALISM IS A DESIRABLE FRAMEWORK

## REALISM IS THE DOMINANT PARADIGM IN INTERNATIONAL RELATIONS

Joseph M. Grieco, Professor of Political Science at Duke University, NBOREALISM AND NEOLIBERAUSM: THE CONTEMPORARY DEBATE, 1993, p. 116.

Realism has dominated international relations theory at least since World War II. For realists, international anarchy fosters competition and conflict among states and inhibits their willingness to cooperate even when they share common interests. Realist theory also argues that international institutions are unable to mitigate anarchy's constraining effects on interstate cooperation.

## RUSSIA HAS ADOPTED AN EXPLICITLY REALIST FOREIGN POLICY

Mikhail A. Alexseev, Visiting Scholar at the Henry M. Jackson School of International Studies, FLETCHER FORUM OF WORLD AFFAIRS, Winter/Spring, 1997, p. 34.

This Cold Peace national security consensus in Russia is likely to endure and shape Russia's foreign policy over the long term, whatever the outcome of Yeltsin's medical treatment or the power struggle in the Kremlin halls and at the polls, for four major reasons. First, this consensus has its roots in basic assumptions about the nature of world politics. Consistent with the main tenets of political realism, the current international system is conceptualized as structural anarchy, in which interactions take the form of zero-sum games and the central motivation of the key actors, nation-states, is to maximize military economic power. Second, the Cold Peace paradigm cuts across ideological divides among the major political parties in Russia, as evidenced by the writings of party leaders. Third, it embraces the national security and intelligence establishment that has shown considerable resilience and continuity amidst Russia's political upheaval. This establishment is likely to be a major source of politically significant information about the outside world for any Russian administration. Finally, reassessment of Russia's strategic posture by the political elites is underlined by anti-Western trends in public opinion.

## REALISM IS COMPATIBLE WITH GLOBAL COOPERATION

David M. Abshire, president of the Center for Strategic and International Studies, THE WASHINGTON QUARTERLY, Spring, 1996, p. 39.

In addition **to** the insights of idealism, an agile strategy must recognize that in many new areas, serious emergent problems and challenges must be addressed and hopefully solved on a cooperative transnational basis and with proper recognition of interdependence. This is not a modification of realism in favor of some sort of one-world idealism. Rather, it is the supremely realistic view that the perils as well as the promises of a range of global trends with revolutionary implications can only be handled transnationally, which, by the way, means with U.S. leadership. These revolutionary trends include changes in demography, telecommunications, and world financial markets, and the increasing salience of international organized crime. Nongovernmental actors become more important than ever. Hence, ideas and even ideals count, and the various instruments of public diplomacy as well as private organizations remain important in propagating such ideas in the post-cold war world.

## REALISM ALLOWS STATES TO ASSESS RELATIVE POSITIONS

Michael Mastanduno, Associate Professor of Government at Dartmouth, NEOREALISM AND NEOLIBERALISM: THE CONTEMPORARY DEBATE, 1993, p. *255*.

One of the key insights of the realist approach to international relations is that nation-states are consistently sensitive to considerations of relative gain and advantage. As Robert Gilpin has observed: "Nation-states are engaged in a never-ending struggle to improve or preserve their relative power positions." Relative position matters because nation-states exist in anarchy, without a higher governing authority. Anarchy breeds fear and distrust, leading nation-states **to** worry, at the extreme, that they will be conquered or destroyed by their more powerful counterparts. Even if nation-states do not fear for their physical survival, they worry that a decrease in their power capabilities relative **to** those of other nation-states will compromise their political autonomy, expose them to the influence attempts of others, or lessen their ability to prevail in political disputes with allies and adversaries.

# Negative Evidence

# Math was Invented- General

## Math required the invention of proof

Robert Matthews, "Was maths invented or discovered?," BBC Science Focus Magazine, https://www.sciencefocus.com/science/was-maths-invented-or-discovered/

The fact that one plus one equals two, or that there's an infinite number of primes, are truths about reality that held even before mathematicians knew about them. As such, they're discoveries – but they were made using techniques invented by mathematicians. For example, according to Pythagoras' theorem, the square of the hypotenuse of a right-angled triangle is equal to the sum of the squares of the other two sides. This is true for all right-angled triangles on a level surface, so it's a discovery.

Showing it is true, however, requires the invention of a proof. And over the centuries, mathematicians have devised hundreds of different techniques capable of proving the theorem. In short, maths is both invented and discovered.

## Math was invented and developed as the need grew in history

Interesting Engineers Society, 12-9-2019, "Has Math Been Around Forever or Did Someone Invent It?,", https://interestingengineering.com/who-exactly-invented-math

The Invention of Math

The origins of mathematics date back to early pre-historic times that were, well, prehistory. That means that we have no proof of the origins of the first use of mathematics, but we can infer. The first peoples on earth would've had to deal with principles of number, magnitude, and form on a daily basis. From deciding which berry to eat or which basic task accomplished the most work in the shortest amount of time.

NASA Announces Members of SpaceX's Crew-2 Launch in 2021
In a hunter-gatherer culture, you early humans also would've had to have dealt with the division of food evenly throughout the community. So there would've needed to have been some method of mathematical distribution.

As for actual evidence of these first practices, we have artifacts dating back 20,000 years in Africa that present some of the first conceptual theories of time.

Geometry was one of the first subsets of mathematics that was likely formed as well. We have evidence dating to the fifth Millenium B.C. demonstrating Egyptian's knowledge of geometric principles.

The early years of math
For the early years of math, cultures existed largely siloed into their own communities and geographical areas. This meant that each region developed its own means of doing math that slowly evolved to reflect the core principles of the mathematical laws of nature.

Mesopotamian and Egyptian societies likely made the largest advancements in early mathematics simply due to their age of existence and their overall size and resources.

More advanced mathematical methods started developing in Greece around 2,500 years ago. These are specific formulas and theorems like the work of Pythagoras or Euclid.

Most experts in the realm of mathematics agree that around 2,500 years ago was the first time that humanity as a whole saw the foundation of organized science. This means that the world, roughly as one, started working together and sharing knowledge of math and science.

All of the previously siloed work that was being done throughout various other cultures in the millennia prior slowly started to be integrated into one joint collection of knowledge.

It was from this point onward that the question of "who invented math?" can be answered a little better. Not only do we have a firm history of the founders of modern mathematics, but there are also specific people to come up with specific formulas.

The answer to the question of who invented math is, disappointingly, everyone and no one at the same time. If you'd like to learn about all of the different regions of mathematics. The video below lays them out fairly comprehensively. You'll note that there are so many subsets of

mathematics it's hard to even grasp who the most prominent mathematicians in modern history are. Take a look.

## Historians credit math with being invented

John Bohannondec. 16, 2013 , 3, 10-31-2014, "Polynesians May Have Invented Binary Math," Science | AAAS, https://www.sciencemag.org/news/2013/12/polynesians-may-have-invented-binary-math

How old is the binary number system? Perhaps far older than the invention of computers or even the invention of binary math in the West. The residents of a tiny Polynesian island may have been doing calculations in binary—a number system with only two digits—centuries before it was described by Gottfried Leibniz, the co-inventor of calculus, in 1703.

If you're reading this article, you are almost certainly a user of the decimal system. That system is also known as base-10 because of its repeating pattern of 10 digits: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 is followed by 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, and so forth. But the decimal system is not the only counting system available. The Babylonians used base-60. The Mayas used base-20. Some Australian aboriginal groups may have used base-5. And of course, today most counting and calculation is done by computers not in decimal but binary, the base-2 system of zeros and ones. Each system has subtle advantages depending on what sort of counting and calculations are needed. The decimal system is handy considering that people have 10 fingers. But when it comes to division, other systems are better. Because 10 has only two prime factors (2 and 5), dividing by thirds results in an annoyingly infinite approximation (0.3333 … ) whereas the base-12 counting system produces a nice finite solution. (Indeed, some mathematicians have advocated for a worldwide switch to base-12.) Binary, meanwhile, has a leg up on decimal when it comes to calculation, as Leibniz discovered 300 years ago. For example, although numbers in binary become much longer, multiplying them is easier because the only basic facts one must remember are 1 x 1 = 1 and 0 x 0= 1 x 0 = 0 x 1 = 0.

But Leibniz may have been scooped centuries earlier by the people of Mangareva, a tiny island in French Polynesia about 5000 kilometers south of Hawaii. While studying their language and culture, Andrea Bender and Sieghard Beller, anthropologists at the University of Bergen in Norway, were astonished to find a mathematical system that seems to mix base-10 and base-2. "I was so thrilled that I couldn't sleep that night," Bender says. It could be not only the first new indigenous arithmetic system discovered in decades, but also the first known example of binary arithmetic developed outside Eurasia.

Like all Polynesians, the people who first settled on Mangareva more than 1000 years ago had a decimal counting system. But, according to Bender and Beller, the islanders added a binary twist over the ensuing centuries. Just like English has a few special words like a dozen for 12 and a score for 20, the Mangarevan language has special words for large groups. But their special counting words are all decimal numbers multiplied by powers of two, which are 1, 2, 4, 8 … . Specifically, takau equals 10; paua equals 20; tataua, 40; and varu, 80. Those big numbers are useful for keeping track of collections of valuable items, such as coconuts, that come in large numbers. Bender and Beller realized that the Mangarevan counting system makes it possible to use binary arithmetic for calculations of large numbers, they report today in the Proceedings of the National Academy of Sciences in a paper that even nonexperts will enjoy reading.

But here's the catch. Even if the native mathematical system of Mangareva employed binary arithmetic, the current residents of the island no longer use that system. Two centuries of contact with the West has resulted in a complete switch to decimal calculation. Even the Mangarevan language itself is now threatened with extinction. Bender and Beller are relying on their analysis of the language and an account of the traditional counting words written by ethnographers in 1938. They acknowledge that it is impossible to prove exactly when Mangareva developed the system, but the entrenchment of the number terms in the language suggests a far-reaching origin.

Unfortunately, the anthropologists may have made their discovery just one generation too late to see Mangarevan math in action.

“The hypothesis advanced by the authors is indeed plausible,” says Rafael Núñez, an anthropologist at the University of California, San Diego, “but the absence of original Mangarevan written records constitutes a real challenge.” However, Núñez notes that ironically, “it is the absence of written practices in this culture that makes the hypothesis plausible.” Keeping track of all those calculations in their heads would have been so much easier with the binary math built into the Mangarevan language, he says.

## Math concepts might require imagination but the creation of new theories is an invention

Dayana From, "Who Invented Math?," No Publication, https://www.wonderopolis.org/wonder/who-invented-math

We're sure that more than one student has wished that he could travel back in time and prevent someone from inventing math. Of course, that same wish probably has been made with regard to all subjects that result in homework and difficult tests from time to time.

But would that really be possible…even if time travel existed? Probably not! Why? Unlike a light bulb or a computer, mathematics isn't really an invention. It's really more of a discovery.

Mathematics encompasses many different types of studies, so its discovery can't even be attributed to one person. Instead, mathematics developed slowly over thousands of years with the help of thousands of people!

How did it get started? No one can know for sure, but we can use our imaginations to think about how mathematics might have gotten its start. For example, if we go all the way back to prehistoric humans gathering berries to eat, we can imagine how this basic task probably gave rise for a need for math. If you and your prehistoric buddy gathered a basket full of berries, you'd probably agree to split them evenly. First, you'd need to know how many berries you gathered. That means you'd need to count them. You might first need to come up with names for the basic units of measurement. Is this how counting and the first numbers came about? No one knows, but you can see how this might be how it happened.

Similarly, division might have been born from the need to split that pile of berries evenly. How advanced did prehistoric humans get with mathematics? Probably not far at all, but a need for certain mathematic principles likely arose from daily life and, as such, were discovered or created out of need rather than invented. Early learning eventually led to more advanced fields of mathematics, such as algebra, geometry, calculus, and trigonometry!

Because many mathematical discoveries were made as a result of necessity, it comes as no surprise that scientists believe that many basic mathematical functions, such as addition, multiplication, and the like, appeared thousands of years ago in various areas at the same time, including China, India, Mesopotamia, and Egypt.

The oldest clay tablets with mathematics date back over 4,000 years ago in Mesopotamia. The oldest written texts on mathematics are Egyptian papyruses. Since these are some of the oldest societies on Earth, it makes sense that they would have been the first to discover the basics of mathematics.

More advanced mathematics can be traced to ancient Greece over 2,500 years ago. Ancient mathematician Pythagoras had questions about the sides of a right triangle. His questioning, research, and testing led to a basic understanding of triangles we still study today, known as the Pythagorean Theorem.

Most experts agree that it was around this time (2,500 years ago) in ancient Greece that mathematics first became an organized science. Since that time, mathematical discoveries have

spurred other mathematicians and scientists to build upon the work of others, constantly expanding our understanding of mathematics and its relation to the world around us.

## Math is invented by humans

Derek Abbott, 9-10-2013, "Is Mathematics Invented or Discovered?," HuffPost, https://www.huffpost.com/entry/is-mathematics-invented-o_b_3895622

Math is a human construct. The only reason mathematics is admirably suited describing the physical world is that we invented it to do just that. It is a product of the human mind and we make mathematics up as we go along to suit our purposes. If the universe disappeared, there would be no mathematics in the same way that there would be no football, tennis, chess or any other set of rules with relational structures that we contrived. Mathematics is not discovered, it is invented. This is the non-Platonist position.

## Math can’t be successful without human invention

Derek Abbott, 9-10-2013, "Is Mathematics Invented or Discovered?," HuffPost, https://www.huffpost.com/entry/is-mathematics-invented-o_b_3895622

Math is not so successful. Those that marvel at the ubiquity of mathematical applications have perhaps been seduced by an overstatement of their successes. Analytical mathematical equations only approximately describe the real world, and even then only describe a limited subset of all the phenomena around us. We tend to focus on those physical problems for which we find a way to apply mathematics, so overemphasis on these successes is a form of “cherry picking.” This is the realist position.

## Math is a construct invented to produce results

Derek Abbott, 9-10-2013, "Is Mathematics Invented or Discovered?," HuffPost, https://www.huffpost.com/entry/is-mathematics-invented-o_b_3895622

What matters is that mathematics produces results. Save the hot air for philosophers. This is called the “shut up and calculate” position.

The debate over the fundamental nature of mathematics is by no means new, and has raged since the time of the Pythagoreans. Can we use our hindsight now to shed any light on the above four positions?

A recent development within the last century was the discovery of fractals. Beautiful complex patterns, such as the Mandelbrot set, can be generated from simple iterative equations. Mathematical Platonists eagerly point out that elegant fractal patterns are common in nature, and that mathematicians clearly discover rather than invent them. A counterargument is that any set of rules has emergent properties. For example, the rules of chess are clearly a human contrivance, yet they result in a set of elegant and sometimes surprising characteristics. There are infinite numbers of possible iterative equations one can possibly construct, and if we focus on the small subset that result in beautiful fractal patterns we have merely seduced ourselves.

Take the example of infinite monkeys on keyboards. It appears miraculous when an individual monkey types a Shakespeare sonnet. But when we see the whole context, we realize all the monkeys are merely typing gibberish. In a similar way, it is easy to be seduced into thinking that mathematics is miraculously innate if we are overly focused on its successes, without viewing the complete picture.

The non-Platonist view is that, first, all mathematical models are approximations of reality. Second, our models fail, they go through a process of revision, and we invent new mathematics as needed. Analytical mathematical expressions are a product of the human mind, tailored for the mind. Because of our limited brainpower we seek out compact elegant mathematical descriptions to make predictions. Those predictions are not guaranteed to be correct, and experimental verification is always required. What we have witnessed over the past few decades, as transistor sizes have shrunk, is that nice compact mathematical expressions for ultra small transistors are not possible. We could use highly cumbersome equations, but that isn’t the point of mathematics. So we resort to computer simulations using empirical models. And this is how much of cutting-edge engineering is done these days.

The realist picture is simply an extension of this non-Platonist position, emphasizing that compact analytical mathematical expressions of the physical world around us are not as successful or ubiquitous as we’d like to believe. The picture that consistently emerges is that all mathematical models of the physical world break down at some point. Moreover, the types of problems addressed by elegant mathematical expressions are a rapidly shrinking subset of all the currently emerging scientific questions.

# Truth Bad

## Truth is too incomprehensible to be obtained

**Marshall, William P.** Galen J. Roush Professor of Law at Case Western Reserve University Law School, GEORGIA LAW REVIEW, Fall, 1995, P. 21-22.

For example, even if truth does exist, it will be of little utility in serving as a meaningful direction for human conduct unless it is also comprehensible to human understanding. The possibility and importance argument, therefore, depends not only on truth's existence, but also upon its accessibility--a factor that, although not undercutting truth's importance, makes the search potentially even less likely to achieve fruition.

## Truth is all relative to the individual

**Higgins, Tracy E.** Associate Professor of Law - Fordham University, HARVARD WOMEN'S LAW JOURNAL, Spring, 1996, p. 94.

Central to postmodernism is its critique of the claim that scientific knowledge is universal and can be justified in a noncontextual way. Postmodernists contend that standards of truth are context-dependent.... Postmodernists tend to favor forms of social inquiry which incorporate an explicitly practical and moral intent, that are contextual and restricted in their focus (local stories are preferred over general ones), and that are narratively structured rather than articulating a general theory.

## Truth is not necessarily preferable. Sometimes ignorance is better

**Schauer, Frederick.** Professor of the First Amendment at the John F. Kennedy School of Government at Harvard, CASE WESTERN RESERVE LAW REVIEW, 1991, pp. 708.

When the question is so rephrased, it then appears that what is at issue is not whether it is better (for you? for me?) that you believe (correctly) that I am an academic rather than (falsely) that I am a professional wrestler, but whether it is better that you believe (correctly) that I am an academic than that you have no beliefs at all about me. And what if I were in fact a professional wrestler? Or a religious fundamentalist? In these cases, I might be better off if you had no knowledge at all. And maybe so would you, and so would society. Think of what it means to say, "I wish I hadn't known that." It is possible that in most cases it is better to have a true belief than a false one. It is also possible, however, that in a nontrivial number of cases it is no better to have a true belief as opposed to no belief whatsoever.

## Truths are valueless and the quest to find them causes harm to others

**Schauer, Frederick.** Professor of the First Amendment at the John F. Kennedy School of Government at Harvard, CASE WESTERN RESERVE LAW REVIEW, 1991, pp. 710-711

As a number of the examples above were designed to suggest, it is clear that many increases in someone's knowledge come at the expense of someone else's well-being or dignity. I find it wildly implausible to suppose that in every case the well-being of the recipient of the new information is increased by more than the well-being of the subject is decreased as a result of the disclosure. Here, however, it is important to distinguish those activities that are, on balance, undesirable from those that have no value at all. Under one view, all increases in knowledge are valuable, but some may also cause disvalues outweighing the value produced. Yet under another view, some increases in knowledge simply have no value at all.

# Truth does not exist

## Transcendent truth does not exist

**Marshall, William P.** Galen J. Roush Professor of Law at Case Western Reserve University Law School, GEORGIA LAW REVIEW, Fall, 1995, p. 3.

Contemporary philosophical thought, it is said, does not believe in truth, at least in the "objective" or "transcendent" sense of the word. To the contemporary mind, objective or transcendent truth is seen as nonsensical or, at best, unintelligible. The Enlightenment claim that the powers of reason could lead humanity **to** a knowledge of truth has been savaged. Beliefs in religious revelation, while still accepted by some, are seen as too idiosyncratic and too faith-laden for constructing universal notions of truth. Human cognitive powers fare no better. Humanity has yet to recover from the empirical skepticism of Hume or the scathing attack on the capabilities of human knowledge and reason leveled by Nietzsche.

# Truth not desirable

## Truth does not exist and is not obtainable

**Kreyche, Gerald F.** philosophy professor, USA TODAY MAGAZINE, September, 1996, p. 82.

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Perhaps Plato was right in holding that truth does not exist in this world, but only in a higher one. Or was German philosopher Friedrich Nietzsche correct in stating that there are no facts, only interpretations? David Hume, the Scottish philosopher, might have summed it up best, maintaining that 'The truth is, there is no truth."

## Truth is not inherently desirable

**Schauer, Frederick.** Professor of the First Amendment at the John F. Kennedy School of Government at Harvard, CASE WESTERN RESERVE LAW REVIEW, 1991, pp. 706-707.

Given the deep-seeded racism in the United States, I would consider it an open-question whether the United States would be better off if everyone in the country believed (falsely) that George Washington, Abraham Lincoln, Franklin Roosevelt, and Elizabeth Cady Stanton were African-Americans. I am not convinced that the country would be, on balance, hurt if American men believed (falsely) that cigarettes and alcohol cause baldness. I am also willing to entertain the possibility that the (false) belief of most Americans that their banks have well in excess of fifty percent of deposits available for immediate withdrawal is an essential condition for the successful operation of the banking system in the United States, which is in turn (possibly) instrumental to economic stability, which is in turn (possibly) instrumental to the general welfare of the people of the United States. At the very least, therefore, it appears that if truth is instrumental, then more truth, or even less falsity, is not in every case instrumental to what it is that truth is instrumental to.

## Lack of truth creates human freedom

**Marshall, William P.** Galen J. Roush Professor of Law at Case Western Reserve University Law School, GEORGIA LAW REVIEW, Fall, 1995, p. 22-23.

Arguably, humanity is free precisely because truth is not known. It is only because of the absence of discernible divine or natural law that humanity is free to create its own rules of conduct. Truth, on the other hand, presumably binds humanity to its precepts. Thus, as Leonard Levy notes, neither freedom of speech nor freedom of press could "become a civil liberty until the truth of men's opinions, especially their religious opinions, was regarded as relative rather than absolute." If there were only one "true religion," there could be no toleration of dissent because everyone would "be compelled to accept it for their own salvation as well as for the good of God and the nation."

## "Who decides?" is an inadequate response to the critique of truth

**Schauer, Frederick.** Professor of the First Amendment at the John F. Kennedy School of Govermnent at Harvard, CASE WESTERN RESERVE LAW REVIEW, 1991, pp. 705.

Of course, the benefits of falsity might be overwhelmed by the harms consequent upon establishing some institution to determine which falsehoods are socially desirable, but this does not defeat the point in the text that falsity is not necessarily bad, and truth is not necessarily good. As to the latter, consider whether to disabuse a dying person of her false belief, which now brings her great happiness, that her son has never been in trouble with the law. Thus, my concern, not just here but in general, is that the lawyers typical "Who's to decide?" challenge is a rhetorical device that conflates two distinct questions. The first question is whether some distinction can be drawn between alternatives, at least within the discursive context in which the distinction is offered. That is, do you, the reader, and I, the writer, agree that there is a distinction between x and y? In some cases we may not, or we may agree that there is no distinction. But, if we agree that there is a distinction, then the next but distinct question is about the circumstances, if any, under which some institution might be empowered to draw x/y distinctions. It is a mistake to conclude from the inadvisability or impossibility of creating such institutions that there is no drawable distinction. Similarly, it is equally inappropriate to infer from the putative undesirability of a governmental institution established to determine truth, or to determine the value of truth, that distinguishing truth from falsity or determining the value of truth is impossible.

# Cultural Relativism Bad

## DISCRIMINATION AND OPPRESSION REQUIRE A RESPONSE REGARDLESS OF CULTURE

Sandra D. Lane and Robert A. Rubenstein, Center for Bioethics, THE HASTINGS CENTER REPORT, May, 1996, P. 31.

Although most anthropologists at the time appeared to consent to this cultural relativism, some rejected it. Julian Steward, a leading anthropologist of this period, wrote in the American Anthropologist, "Either we tolerate everything, and keep hands off, or we fight intolerance and conquest... As human beings, we unanimously opposed the brutal treatment of Jews in Hider Germany, but what stand shall be taken on the thousands of other kinds of racial and cultural discrimination, unfair practices, and inconsiderate attitudes found throughout the world?

## CROSS-CULTURAL VALUE DISCUSSION IS POSSIBLE AND PLAUSIBLE

Loretta M. Kopelman, anthropologist, SECOND Oyou PINION, October, 1994, p. 54.

We need not rank values similarly with people in another culture, or our own, to have coherent discussions about their consistency, consequences, or factual presuppositions. That is, even if some moral or ethical (I use these terms interchangeably) judgments express unique cultural norms, they may still be morally evaluated by another culture on the basis of their logical consistency and their coherence with stable and cross-culturally accepted empirical information. In addition, we seem to share some moral values, goals, and judgments such as those about the evils of unnecessary suffering and lost opportunities, the need for food and shelter, the duty to help children, and the goods of promoting public health and personal well-being.

## CULTURAL DIFFERENCE DOES NOT ABSOLVE MORAL RESPONSIBILITY

Michael Agar, professor of linguistic anthropology at the University of Maryland, LANGUAGE SHOCK: UNDERSTANDING THE CULTURE OF CONVERSATION, Quill Press, 1994, p.[58]

If differences are just to be accepted, just to be investigated as an alternative reality, does that mean, for instance, that we have to accept the behavior of a Hitler as just another possible way of doing things? Is anything anyone wants to do okay, as long as it participates in an alternate system? Of course not. Linguistic and cultural relativism are methodological assumptions. They don't mean a person abandons all moral standards. They do mean that a person confronted with a difference investigates and understands its role in an alternative system, whatever he or she may think of it in moral terms.

# CULTURAL RELATIVISM IS AN UNDESIRABLE VALUE

## CULTURAL RELATIVISM JEOPARDIZES THE BASIC RIGHTS OF WOMEN

Tracy E. Higgins, Associate Professor of Law - Fordham University, HARVARD WOMEN'S LAW JOURNAL, Spring, 1996, P. 91

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On the one hand, feminists note that culture and religion are often cited as justifications for denying women a range of basic rights, including the right to travel, rights in marriage and divorce, the right to own property, even the right to be protected by the criminal law on an equal basis with men. Women have much to lose, therefore, in any movement away from a universal standard of human rights in favor of deference to culture.

## RELATIVISM MASKS GENUINE OPPRESSION

Elizabeth Powers, nqa, COMMENTARY, January, 1997, p. 23.

Today, of course, this relativism-in-the-service-of-a-new-absolutism has contaminated far more than the upper reaches of academia and the fringes of the Modem Language Association. All introductory college courses, be they in literature, sociology, anthropology, religion, etc., have become shot through with the insights of deconstruction, and an afternoon of watching Oprah is enough **to** demonstrate how they have filtered down into the general culture. The goal of this new orientation is, ostensibly, radical human freedom and equality, without ties to oppressive institutions of any kind, especially not to the patriarchy, that shibboleth of social reconstructionists. But what deconstruction has really done is to banish, as nothing more than a set of arbitrary conventions, the moral promptings that lead people to notice oppression in the first place, and along with them the ability to distinguish true oppression from false.

# PROGRESS IS A DESTRUCTIVE VALUE--ESPECIALLY TO THE ENVIRONMENT

## THE WORLD CANNOT SUSTAIN PARAMOUNT FOCUS ON PROGRESS

Bob Goudzwaard, Professor of Economic Theory at the Free University in Amsterdam and former member of the Dutch Parliament, CAPITALISM AND PROGRESS, 1979, p. 120.

Can a societal system in which everything is directed to uninterrupted progress indeed continue to exist? That question must be asked because, with respect to at least three points, such a "system of progress" appears to be distinctly vulnerable. This is true first of all for the environment in which economic and technological expansion takes place and which in the final analysis furnishes the material possibilities for such expansion. We can employ an analogy here: a spaceship may be equipped with the most reliable rocket engines and its internal system may function perfectly, but to make its journey it needs adequate fuel which has its source outside of the spaceship. It is not a self-sufficient system. In one way or another it puts a strain on its environment. With respect to our larger problem, we must ask: can the finite earth upon which we live tolerate in the long run the strain of our unbridled progress? Secondly, the functioning of the system itself is vulnerable. We noted earlier that the market economy required government support; at times it was even in need of fundamental revision. Still, the economy in most countries does not function smoothly at all. To the contrary, certain problems of economic policy, such as unemployment and inflation, now seem quite unsolvable. Last, but not least, the vulnerability applies to men and women, the passengers who travel the road of progress. Will they always be prepared to play the role assigned to them? Will not the adaptation this requires ultimately be unbearable? In these three forms of vulnerability we encounter almost all the problems posited in the Introduction as challenges to our present-day western culture.

## PROGRESS IS ECOLOGICALLY AND PHILOSOPHICALLY UNTENABLE

William Julius Wilson, the Lucy Rower University Professor of Sociology and Public Policy at the University of Chicago, THE NEW YORK TIMES, January 27, 1991, p. 1.

However, in “The True and Only Heaven” he maintains that the idea of progress rests on several untenable propositions: that material expectations can be constantly revised, that luxuries can be ceaselessly redefined as necessities, that new groups can be continually incorporated into the culture of consumption and that a global market embracing impoverished populations around the world can be ultimately created. Neither the right nor the left has yet come to grips with an increasingly obvious problem: “the earth’s finite resources will not support an indefinite expansion of industrial civilization.” Given the present rate of population growth, he argues, an environmental disaster would be created if the Western standard of living were successfully exported to the poorer nations of the world. Moreover, the advanced countries have neither the will today nor the resources to assume such an immense program of development They cannot even address their own problems of poverty. “In the United States, the richest country in the world,” Mr. Lasch writes, “a growing proletariat faces a grim future, and even the middle class has seen its standard of living begin to decline.”

## "PROGRESS" IS USED TO JUSTIFY PATRIARCHAL DOMINATION OF NATURE

Luanne Armstrong, Master's in feminist ecology, ALTERNATIVES, April, 1995, p. 32.

Paradoxically, sentimentalizing the earth as female, as passive, and as available to be acted upon and changed by men, is not, by any means, a new idea. It was present in the Enlightenment in Europe, especially among scientists, like Sir Isaac Newton or Francis Bacon. Merchant writes: Melding together a new philosophy based on natural magic as a technique for manipulating nature, the technologies of mining and metallurgy, the emerging concept of progress and a patriarchal structure of family and state, Bacon fashioned a new ethic sanctioning the exploitation of nature.

# PROGRESS IS HARMFUL SOCIALLY

## FAITH IN PROGRESS PRODUCES ALIENATION AND FATALISM

Bob Goudzwaard, Professor of Economic Theory at the Free University in Amsterdam and former member of the Dutch Parliament, CAPITAUSM AND PROGRESS, 1979, pp. xxii-xxiii.

In the third place, it is striking that the mutually intertwined problems of which we spoke earlier are also, in one way or another, related to the technically and economically oriented progress of the West. This is true not only for environmental and resource problems but also for the particular character of inflation and unemployment Moreover, alienation and loneliness are also closely connected with technical and economic progress. The same is undoubtedly true of what Alvin Toffler describes as “future shock” - the emotional inability to keep up with rapid change in the modem world. Furthermore, the theme of progress has been a welcome occasion for several interpreters of our culture to entertain notions of fatalism and feelings of profound impotence.

## NIHILISM AND AUENATION ARE INTRINSIC TO THE IDEA OF PROGRESS

Theodore Olson, Professor of Philosophy, MILLENNIALISM, UTOPIANISM, AND PROGRESS, 1982,p. 296.

If the present century’s development of the doctrine of progress is, from some perspectives, morally distasteful or if - perhaps worse - it shows signs of foundering on the congruence of self-assertion and nihilism, these problems are traceable to the inherent instability of the notion of progress itself. There is no pleasure in this assertion; and I have no wish to end by labeling this or that “ism” as the root of modern man’s problems. We are all too deeply implicated in the problems of the present for any of us to take so simple a position. It is sad to record the flawed development of the doctrine of progress. We can see its issue in our own time in a reductionism in which success and nothingness are almost indistinguishable. The final achievement of the will to knowledge becomes the loss of both knowledge and will - a loss so complete that its advocates cannot even recognize it as such. Such an enterprise diminishes all men. This tendency, I repeat, is not one that can be bracketed as an aberration. It seems to me central to the doctrine of progress itself.

## PRO-PROGRESS AUTHORS IGNORE THE COSTS OF PROGRESS

Joel Nilsson, editorial writer, THE ARIZONA REPUBLIC, May 13, 1995, p. BlO.

Progress is a word that conveys the image of inevitability. Woe be the one who dares to stand in the way of progress. There's a fatalism at work, as if progress is preordained and if something should stand in the way of fulfillment then it's just too darn bad. Invariably, there has to be a sacrifice, mind you, in the name of progress. Those denizens of progress talk passionately about it as if, by definition, all progress, no matter how insignificant, is good. They conveniently ignore that there are costs to progress -- human, economic and social. Just ask anybody in rural America where superstores have gone in and undercut the small mom and pop retailers.

# REALISM IS A FAILED FRAMEWORK

## WORLD RESPONSE TO AMERICAN HEGEMONY DISPROVES REALIST TENETS

Robert Kagan, Alexander Hamilton Fellow at American University in Washington and a contributing editor of the Weekly Standard, COMMENTARY, April, 1996, p. 21.

The unique style of American hegemony at the end of the cold war led to a situation that ought to have been impossible according to any theory of international equilibrium. In the words of one leading neorealist, Kenneth N. Waltz, the "excessive strength" of one power should "prompt other states to increase their arms and pool their efforts against the dominant state." But when the Soviet empire collapsed and the United States was left as the sole remaining superpower, the normal and predictable response of the world's other great nations--to pull together in a coalition to check American power--did not happen. The reaction of America's European and Asian allies was not to fear or resist the emergence of this new giant. Their fear, rather, was that the United States would withdraw from its leadership role and unburden itself of responsibilities for preserving the world order it had created and from which they had so greatly benefited. Even Russia, America's mortal enemy in the cold war, came to understand that American hegemony, while harmful **to** Russian egos, might not be at odds with fundamental Russian interests. This is a critical point often overlooked in the historical debate over the causes of the Soviet empire's collapse. Although Mikhail Gorbachev and his reform-minded associates had many reasons to seek a reordering of their society and a reprieve from the costly competition with the West, beneath all their calculations lay a fundamental assumption: they knew that what the United States wanted from them was not incompatible with the survival of the Russian state, or even with its prosperity and well-being. Put bluntly, they knew it was safe to surrender; and, as Germany and Japan could attest, it might even be lucrative. If American military and economic power had helped force the Soviets to a moment of painful decision, American principles made the choice for reform and integration into the American world order a fairly easy one.

## IDEALISM IS ESPECIALLY PERTINENT IN THE GLOBAL INFORMATION AGE

David M. Abshire, president of the Center for Strategic and International Studies, THE WASHINGTON QUARTERLY, Spring, 1996, p. 39.

This is especially true of the central tenet of idealism: the notion that ideas count in international relations. America's democratic system and ideals exercise a critical influence on its foreign policy the making of that policy, its appeal, and its effectiveness – just as Japan's unique interpretation of capitalism and China's central Communist rule influence those countries' relationships with other states. Whether or not we believe, as Francis Fukuyama has argued, that world history has become a relatively unilinear trend toward free markets and democratic systems, it is clear that the democratic ideal has at least temporarily infected a much larger percentage of the world's population – and it is just as clear that this development carries substantial implications, largely positive, for U.S. national interests. Apart from (and to some degree in contrast **to**) democracy and free markets, the category of ideas and identities to be found under the broad heading of culture also has powerful implications for world politics. Here the starkest model has been proposed by Samuel Huntington, who sees a coming "clash of civilizations" produced by cultural differences in political and economic matters. And here again, whether or not one agrees fully with Huntington's thesis, one cannot deny that cultural habits, identities, and biases exercise an effect in international relations-an effect that cannot be captured by looking at all actors as equivalent "black boxes" whose political structure, economic organization, and cultural norms are irrelevant to their behavior in the global community. In an information age, it could be that the relationship of ideas **to** policy is closer than it has ever been.

# REALISM IS AN UNDESIRABLE FRAMEWORK

## MODERN REALISM IMPLIES A DANGEROUS LEVEL OF ISOLATIONISM

Robert Kagan, Alexander Hamilton Fellow at American University in Washington and a contributing editor of the Weekly Standard, COMMENTARY, April, 1996, p. 21.

But perhaps the first thing to be said about today's realists is that, their appeals to tradition notwithstanding, there is a big difference between their position and that of the realists of *50* years ago. That difference is rooted in historical circumstances. In a bipolar world, espousing a realist definition of the national interest meant accepting the need for constant international engagement and constant preparedness for war. Even today, if the world were genuinely multipolar--with six major powers of relatively equal strength competing for preeminence--the older conception of the national interest would still require American vigilance on the international stage. But in the world as it actually is, with a single, predominant superpower and several much weaker powers, the realist position logically impels the nation toward minimalism, if not toward isolationism. Indeed, the greater our power in the world, the more we would seem required, by realist definitions, to withdraw from active involvement. Or, to put it another, paradoxical way, the greater our power, the smaller our national interest. The Western hemisphere, after all, seems fairly secure these days; and the danger that a single power will come to dominate the Eurasian World Island and then cast its greedy eyes on the New World is smaller now than at any time in this century. In such a world, those "vital national-security interests" which many Congressmen insist can alone justify the loss of a single American life would seem hard to come by, while excuses for indifference or disengagement are plentiful. If there is a "temptation" abroad in the land today, this is it. Whatever the inadequacies of early cold-war realism, its goal had been to find the place where the pursuit of principles intersected with the realities of international power politics. Given those realities, Reinhold Niebuhr, for one, hoped that America would "accept its full share of responsibility" for solving the world problem. Today, with the acquisition of unparalleled global influence, one might argue that our share of responsibility for the "world problem" has not shrunk but grown. Yet the only people willing to assert this are not today's realists but a shrinking camp of internationalists with nothing but airy "humanitarianism" on their side.

## REALISM IS DENIED BY EMPIRICAL OBSERVATION OF THE ACTUAL WORLD

Robert O. Keohane, Stanfleld Professor of International Peace at Harvard University, NEOREALISM AND NEOLIBERALISM: THE CONTEMPORARY DEBATE, 1993, p. 271.

Serious challenges to realism only arose when anomalies appeared between its presumptions and patterns of action in the world. The anomalies that were noticed in the United States were, not surprisingly, those that liberals could easily recognize, including the increasing salience of economic interdependence and the apparent tendency of democracies to behave differently in foreign policy than authoritarian states. Commercial liberalism and republican liberalism hold the beliefs that economic interdependence contributes to peace and that democracies are more peaceful, at least in some relationships, than non-democracies have long been important strains in liberal thinking. So has what Joseph Nye calls "sociological liberalism," which in Nye's words, "asserts the transformative effect of transnational contacts and coalitions on national attitudes and definitions of interests."