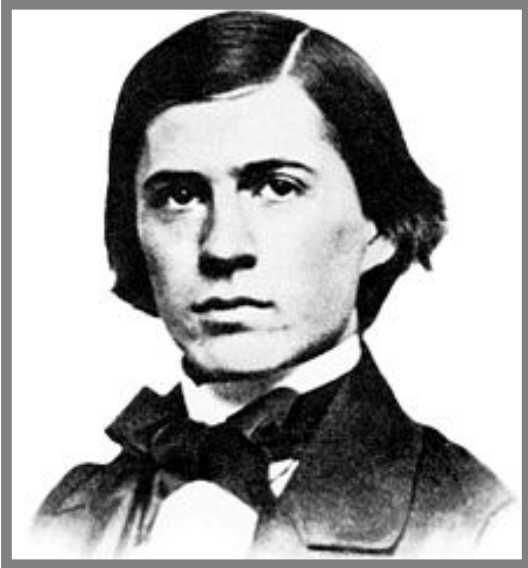


Why I Study C.S. Peirce

by Mike Bergman - Monday, August 21, 2017

<http://www.mkbergman.com/2066/why-i-study-c-s-peirce/>



I Can Sum it Up in Six Words

I am not an armchair philosopher, nor one to seek out books and articles by "big thinkers". I suppose I have the standard amount of curiosity about questions of [metaphysics](#) and [cosmology](#), but I also have never set out to plumb these questions closely. I do not feel wayward or questing for cosmic truths. Yoga might be a good idea, but I don't do it.

Yet, for now more than a decade, and with growing intensity and focus, I find I am studying and reading and learning as much as I can about the great 19th century American logician and polymath, [Charles Sanders Peirce](#). I have to admit I surprise myself with the ongoing dedication I am applying to learn more about this unique scientist and philosopher, one whom I am coming to believe was one of the greatest thinkers in human history. So, it is rather natural I should ask myself: Why do I study this single individual so closely? Why, among all of the writers and thinkers across history, am I compelled to study this man?

While I can appreciate Peirce for his intellectual arrogance, a trait we share, I don't think my attraction to Peirce is personal. He was born into privilege and was brought up among the intellectual elite in Cambridge. His father, [Benjamin Peirce](#), was a professor at Harvard and one of the most prominent mathematicians of the early- to mid-1800s. Charles received a first-rate education, including much personal tutoring by his father, and was given preference and positions and sinecures at a young age probably unjustified by his early accomplishments. He was a dandy and an iconoclast, and also flaunted society's conventions, living with his second wife prior to marriage and after being abandoned by his first wife. He was a prodigious writer and very hard worker over fifty years, but was cavalier, if not unethical, in his abuse of his positions and public funds. He was reportedly a user of morphine and cocaine, ostensibly for neuralgia, but with many of the hallmarks of a basic addict. He pursued his personal

intellectual interests at the expense of his paid responsibilities. He created powerful enemies that ultimately kept him from securing a professorship at a leading university, which he and his family believed to be his birthright. He made poor decisions concerning money and finances, often disastrous ones, and died essentially penniless, with no fame and little notoriety. Yet he befriended and influenced many of the leading thinkers of his time, including William James, Josiah Royce, John Dewey and Oliver Wendell Holmes. After his death, Harvard was scandalous in how it (mis-) handled his donated papers and restricted access for many years to his unpublished writings, a continuation of the vendetta brought by [Charles W. Eliot](#), the longstanding Harvard president. Peirce was routinely undercut by his supposed supporter and family friend, but actual enemy, [Simon Newcomb](#). Yet, within a decade of his death, anthologies were published and his reputation and stature began to grow. The understanding of his insights and accomplishments continues to grow as his voluminous unpublished writings get released and are studied. Peirce's reputation now is the highest it has ever been in the hundred years since his death, growing, and surely greatly exceeds whatever fame he saw during life.

Peirce did not view himself as a philosopher, but as a scientist and logician. His advances in mathematics, logic, the physical sciences, and the scientific method are legion. He was the first to develop a theory of signs ([semiosis](#)), is the acknowledged "father" of American pragmatism, developed diagrammatic ways to represent logic via existential graphs, and explicated a new kind of inference, [abductive reasoning](#). He made contributions to linguistics, the categorization of the sciences, geodesy, and topology. His precise work on physical measures with pendulums and in chemistry led him to make advances in probability, statistics and instrumental errors. He was a realist and understood the limits to truth. His advances appear to be grounded in a relentless questioning of premises and a rigorous application of logic to the most basic questions. These quests led him to a fundamental [cosmogony](#) built around the irreducible and [universal categories](#) of Firstness, Secondness and Thirdness. More on that anon.

As my own [blog explains](#), I was originally trained as an evolutionary biologist and population geneticist. Since my graduate days, I have replaced my focus on biological information with one based on digital information and computers. My passion has been on the role of information -- biological or cultural -- to confer adaptive advantage to deal with an uncertain future and as a means of generating economic wealth. My intuition -- really, my basic belief -- is that there are commonalities between biological and cultural information. I have been seeking insights on this intuition for more than four decades.

The first attraction to Peirce began with my professional interests in the semantic Web. My earliest exposure to the semantic Web kept drawing my attention to questions of symbolic [knowledge representation](#) (KR). Like the genetic language of DNA in biology, my thought has been that there must be better (more "truthful") ways of representing knowledge and information in digital form. My sense has been that there must be better -- as well as, of course, worse -- ways to represent knowledge. My sense is that syntax or specific language is not the key, but that the basic building blocks of grammar and primitives hold that key. We further need a set of primitives well suited to natural language understanding, since so much of humanity's cultural information is embodied in text. Structured data forms not able to represent natural language are not an appropriate starting point.

In the realm of knowledge representation and computer understanding of information, [John Sowa's](#) advocacy to study Peirce was the initial reason I began reading up on Peirce, starting about in 2006 [\[1\]](#). Peirce's semiosis and views on the symbolic nature of language and relation to meaning and representation struck a chord. Yet, despite many links and sources, studying Peirce is hard. This difficulty

is partly the result of Peirce himself: in his quest for precision in terminology, Peirce has created his own vocabulary, sometimes jawbreaking, often with multiple terms that change over time for specific concepts. The difficulty is also due to the fragmented nature, even today, of Peirce's writings. And, the difficulty also comes from the cacophony of voices and views about what Peirce did or intended to say. It literally takes years to tease out these various camps and personal advocacies sometimes admixed with Peirce's own views.

However, now that we have released [KBpedia](#), a major artifact in artificial intelligence and semantic technologies based on our (ongoing) understanding of Peirce's insights, I wanted to reach back over my own decade of exploring Peirce to explain why I think his teachings are so relevant to these new fields. Given Peirce's manifest accomplishments, others often point to very different things they find important in Peirce. That is fine. We all see and gain what we must from our information at hand. But in my context in regard to knowledge representation, here are the six reasons why I study Peirce.

Chance, Both Probable and Absolute

Peirce brings two remarkable insights about chance in his writings. The first insight, now somewhat prosaic but new for its time, was the importance of probability to many problems. The results, for many problems, are not absolute, but probable across a distribution of possible outcomes. To test these probabilities, it is essential to sample randomly, or by chance. Peirce was an early explicator about random sampling and statistics. Indeterminant problems are common, and an understanding of chance and probabilities is the only tractable way to assess them.

The second remarkable insight is more fundamental, and perhaps even more important. Peirce was an early supporter of Darwin's theory of evolution and understood the role of variation. Peirce's probability studies enabled him to see that our world was one of "surprising facts". A completely random world would signal no variety, so that chance must be leading to variants that cause us to inspect and understand emerging properties. Chance is itself offering up variants, some which have the character of persistence because their strong tendencies have a probability to be reinforced. These forces of chance give our world the variety and diversity it possesses. These local variants are the opposite of general thermodynamic entropy. There are laws and habits that lead to regularities that both tend to perpetuate themselves as generalities, but also flash surprising variation that cause us to take stock and categorize and generalize anew. In Peirce's [cosmogony](#), these primitives of chance (Firstness), law (Secondness) and habit (Thirdness) can explain everything from the emergence of time and space, to the emergence of matter, life and then cognition. Though it is true that Thirdness (continuity) is the more synthesizing concept, the role of chance alone to drive this entire reality suggests its essential character. Note that Peirce often used the term [tychism](#) to refer to his ideas about chance and randomness [\[2\]](#).

The idea that chance alone could be the variant that led to the minute differences arising during the Big Bang, which is posited to have led to matter and its structure, or that self-perpetuating life could emerge from inanimate matter, or that forms of life would symbolically capture these variations via cognition and language, may all be seen as inevitable and unexpected events arising from chance. Perhaps most events have a cause, but the fundamental ones really result from chance. "Surprising facts" mean the world is unpredictable, and ultimately probabalistic. Achieving the limits, the 0s and 1s of Cartesian logic, is likely never achievable. Reality is shaded and nuanced.

When Peirce began putting forth these ideas, specifically in his *Popular Science* series in 1878 in "On the Nature" [3], these were radical ideas. At the time of these publications, science was still decades away from quantum mechanics and the Heisenberg uncertainty principal. And, even though Einstein (in) famously said that "God doesn't play dice with the world," [4] Einstein himself, and his unsettling of Newtonian physics, were still three decades away. This is but one, among many, examples where Peirce had insight and prescience well in advance of later supporting science.

The reason, Peirce would say and I would agree, is not that he was somehow miraculously able to see the future. But, through the rigorous application of logic, Peirce was able to see the requisite primitives of existence.

The Three Universal Categories

Not only at the most fundamental level, but actually, at almost all levels of understanding and logic, Peirce articulated a world view that was built around these universal categories of Firstness, Secondness and Thirdness. Peirce uses this triadic structure to describe language, signs, logic, relations, growth, emergence, science, truth, limits, meaning, community, and consensus-building. Though Peirce acknowledges natural classification systems, such as trees of life and dichotomous taxonomic keys, in most areas of ideas and concepts and metaphysics, he boils down his arguments into these three universal categories. He argues that each alone is necessary, each is irreducible, and all three are required to properly represent any information space.

I was first attracted to this schema because I was focused at the time on representing human language and its meaning. Only through context and perspective -- Thirdness -- may we hope to capture and understand the nuances of meaning. When I first saw this strength in Peirce's world view, that (and his writings) led me to look at its applicability elsewhere. The first area where one most likely is to be exposed to Peirce's triadic viewpoint is in his theory of signs (semiosis) consisting of the object, its sign or representation, and how it is interpreted (interpretant). This fundamental structure can be applied to signs themselves (icon - index - symbol) or to the very basis of logic (grammar - logics - methods). Indeed, as I discuss below, this same triadic viewpoint is what helps us think though how to organize our understanding of the world around us.

Too much of what we see today in so-called "upper ontologies" and the like are knowledge representation models that completely ignore the aspects of context and perspective. Most current [upper ontologies](#) -- including BFO, Dolce, SUMO, Cyc, UFO -- are grounded in some form of Cartesian dichotomy, the basis for argument between their proponents. But a Cartesian and nominalistic view is exactly what is wrong in these viewpoints. What makes for the meaning of context and perspective in any aspect of knowledge is gradation. Further, gradations need to move beyond shaded gray in a dichotomous spectrum of white and black, but to also include color, vibrancy, and nuance. Only Thirdness brings this factor.

The sheer ubiquity of Peirce's universal categories often makes them seem invisible. We all can clearly see the folly of using dichotomous schema to model real phenomena, but we (that is, human systems) continue to pursue it without question. Our states and phenomena are not on and off, but are probable or graded, likely or nuanced, or often shaded. Yet we do not question why we continually apply a dichotomous schema to real world phenomena. Peirce did question such basic functions. It is not so much that he was a superhuman of intellect, but that he sussed out what we need to question in our premises,

using sound logic to tease out insight and make questions simpler. This, and the universal categories, was Peirce's secret sauce.

The Primacy of Logic

The reason these points are so important and fundamental to understanding Peirce is that his whole basis for reasoning was based on the primacy of logic. And, boy, does Peirce's inspection of logic help bring clarity.

Peirce was totally familiar with the classic philosophers (Aristotle and Plato, and many others), the medieval scholastics (Duns Scotus), influential recent philosophers (Descartes and Kant) and new mathematics (Boole, Venn and DeMorgan). He explicated deductive and inductive reasoning in the clearest of ways, and corrected erroneous views of what constituted inductive reasoning. He most importantly recognized that, just as many problems are distributive in nature, so are many of the logical questions. For this, Peirce decomposed the basic syllogism of the Greek philosophers to articulate a third kind of inference, abductive reasoning. Abductive reasoning is the positing of possible premises that could lead to observed facts. Science calls them hypotheses.

So, for Peirce, logical tests needed to be clear, understood in terms of applicability and the meaning of results, and tested for logical rigor. For this later objective to be met, Peirce needed to explicate completely the basis, applicability and interpretation of deductive, inductive, and abductive logic. It is really this nugget at the core of Peirce and his approach that provides the understanding of how he generated his insights. As I understand it, Peirce's primacy of logic is to be prosecuted like this: Every statement is to be decomposed into its fundamental premises. These premises are to be tested against all logical tests, including the implications resulting from inference. Anomalies or "surprising facts" should be singled out for attention and subjected to the pragmatic maxim (see below).

Of course, the idea of questioning premises is not so easy. It is not easy because many of us are queasy to really learn how insecure and inadequate we really are. It is not easy because ideas are like onions, and it is often hard to know how or via what perspective we should be peeling back the layers. It may not be easy because we know these things, but have our own agendas that we wish to shield from truthful inquiry. It is not easy because we all try to communicate, but do so imperfectly.

The clear thread through Peirce's writings is the respect and attention given to the primacy of logic, but also the role of community in deciding belief and terminology. Though, as a normative science, logic is not the center root of Peirce's categorization of science, he certainly bases all of his major arguments and insights on logic. And, those insights include ones about the role and principles of logic itself.

Truth is Testable and Fallible

Peirce was consistent in emphasizing that "truth" is not absolute; there is always a finite probability that we do not know actual "truth". Any scientist spending much time on Peirce's writings would quickly affirm that, in nature, Peirce is a scientist. His insights and attentions are grounded in science. His understandings of measurement and error and precision are those of a scientific practitioner.

Peirce's time, as is our own now, was a time of great scientific advance and challenges to conventional understanding. During Peirce's professional lifetime, advances were occurring in the understanding of waves and fields, the chemical periodic table, evolution, electricity, and thermodynamics and gases. Given this ferment, it is clear why Peirce's world view supported the ideas of truth as a limit function, the potential fallibility of understood "truth", and the fact that truth itself stood upon a gradation of certainty.

Yet, whether a product of his own times, or correct and prescient in his nature, I agree totally with the strong thread in Peirce's writings that truth is itself a gradation. "Truth" is a limit function. The purpose of being and inquiry is the questioning of truth, but no matter what the information nor the logic, we will never have complete understanding. Knowledge is fundamentally an open world problem. Completeness of information and completeness of understanding are each, themselves, ideals. We strive for them, but we never can fully achieve them. While we may reach sufficient certitude to bring about belief, itself an essential motivator in this question, we will never absolutely achieve it. "Truth", then, is ultimately (as a continuous limit function) unachievable. But, "belief", which actually guides our actions, may be achieved.

Drilling down further on these questions shows that "truth" is fallible. This is NOT an excuse for saying there is no right, and no wrong. Rather, the fallibility of truth means that we can never have complete certitude about truth. We may have a preponderance of evidence that gives us belief, and therefore the basis for action, but none of this guarantees actual truth. I actually believe that most of the real circumstances of our needing to test truth with logic are actually probabalistic circumstances. Again, that is not saying that truth is relative, but that absolute truth is perhaps never absolutely found.

There is a Categorical Way to Think About the World

These Peircean ideas of the universal categories, applied against basic logical principals, and subject to the understanding about fallibility and the limits to truth, provide a basic set of methods of how to think about and categorize the world. Start with any subject domain.

We know the things, and therefore the characteristics, of the things that populate this domain. So, we first spend time enumerating and describing the features of the things in this domain. We'll call this category of characteristics, Firstness. Then, we try to enumerate and organize the actual things in this domain. These, specifically, are the events and entities, that we can imagine or enumerate about this domain. This list of particulars, what we call Secondness, is surely always going to grow, so from an operational viewpoint we want easy update and modifiable input files for these items.

But the items in our domain also have generalities and shared aspects that help place those items into meaningful categories. These groupings, admittedly synthetic in one sense, are also real in another sense when the groupings make logical sense. These generalities are an expression of Thirdness. This categorization into Thirdness is actually fairly straightforward to do on simple logical grounds, but is more difficult when explanatory power is desired.

Nonetheless, when the "surprising fact" arises that causes us to question premises and regularities, we can apply this same categorization logic in order to assess the next level of subject specificity. Some logic activities are, indeed, processes, and are a combination of steps or states. But, now, we are in a mediating portion of our information space, likely again requiring new categorization. Peirce's universal categories

provide a powerful unifying force for organizing and categorizing knowledge domains.

We Must Make Practical Choices in Our Limited Time

In a probabalistic world, which it is, we see lines of evidence everywhere for inferring various aspects of the world, now and into the future. The truth is, as Peirce often makes clear, is that only the here and now is knowable; what might come next (into the future) is a probability. The stronger, or more definitive, means of inference, deduction and induction, can never apply to the future. I'm not sure Peirce understood that his formulation of abductive reasoning was the needed pathway here, but it is also true that abductive reasoning is the only path to new knowledge or novelty.

The future is not given. The future may be changed via action. Some future conditions are more favorable to me as an entity in the present than other future conditions. There is every reason to believe that active agents will pursue acts in the present to perpetuate their interests into the future.

The choice of next actions among many possible next actions has some pragmatic implications. One, not all alternatives may be tested simultaneously. Two, some alternatives are more likely to be instrumental than others. Three, any alternative has its own unique set of actions and steps. Peirce developed what he called the [pragmatic maxim](#) [5] as a way to sift through the myriad of possible explanations for things in order to select those with the most economy and likelihood of bearing fruit. The pragmatic maxim provides guidance to scientists as to what to study next, and how.

So, Why I Study Peirce

These points should make it clear that Peirce considered himself foremost as a scientist, who probes and questions premises with logic and purpose. Peirce's critical attention and refinement of the scientific method places him in the top tier of philosophers of science. Peirce believed all questions lent themselves to scrutiny and logical analysis. Among the myriad of possibilities available to us for inquiry as scientists, Peirce's methods help point to those options most likely to yield fruit within limited time and resources. The universal categories provide us with a constant and consistent framework for representing, analyzing and organizing knowledge.

As for the six words that help me understand Peirce's writings, I offer: chance, universal, logic, fallible, categorical, and practical. These are topics I will turn to again as we continue to probe Peirce's views on the world and knowledge.

[1] For Sowa's writings, see https://www.google.com/search?q=%22peirce%22&as_sitesearch=jfsowa.com. For my own writings on Peirce to date, see <http://www.mkbergman.com/category/c-s-peirce/>.

[2] See Philip Rose, 2013. "[Another Guess at the Riddle: More Ado About Nothing](#)," *Analecta Hermeneutica* 4 (2013) and Philip Rose, 2016. "CS Peirce's Cosmogonic Philosophy of Emergent Evolution: Deriving Something from Nothing," *SCIO Revista de Filosofia Journal of Philosophy*: 123-142, November 2016.

[3] C.S. Peirce, 1878, "[The Order of Nature](#)", *Popular Science Monthly*, v. 13, pp. 203–217 (June 1878). Reprinted (CLL 106-130), (CP 6.395-427), (EP 1:170-185).

[4] See https://en.wikiquote.org/wiki/Albert_Einstein.

[5] In Peirce's own words, "It appears, then, that the rule for attaining the third grade of clearness of apprehension is as follows: Consider what effects, that might conceivably have practical bearings, we conceive the object of our conception to have. Then, our conception of these effects is the whole of our conception of the object." (CP 5.402)

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