

## Philosophical Writings

*C.S. Peirce*

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Peirce wrote much but published little. His collected works, supposedly edited out of his *Nachlass* amount to some eight volumes. In the present Dover volume, a small, but as one hopes, central collection has been put together involving some twenty-five odd essays of varying length and ambition.

Peirce is not a very graceful writer, he is on the other hand a very sincere one, and he dispenses with the striking formulation preferring to elucidate ploddingly all the messy aspects of a question. Hence his arguments do not have the compelling force, that is bound to delight the casual reader, who usually prefers not to think for himself but have his thoughts planted and pruned for him by the author. With Peirce the density of every one of his paragraphs calls out for their expansions into minor essays, something that horrifies the naturally lazy and makes retention for the same a particular daunting proposition. The purpose of Peirce philosophizing is to turn philosophy into a science. This means to make it systematic and clear, to do away with subjectivity and to strip concepts of their vagueness, thus enabling different men to speak about the very same thing without any confusion. When the main purpose of philosophizing does no longer consist in questioning the works of predecessors, that crucial phenomenon of accumulation becomes finally possible, and with it a well-defined notion of progress and growth. In particular he takes exception to the limited ambition of only pursuing the study of philosophy as an entertaining exercise of the intellect.

Where does Peirce start? He rejects the Cartesian approach of relentless doubt, stripping everything down to rock bottom, and from them on building a firmly established edifice of knowledge. He rejects the very idea of a rock-bottom, or at least one accessible to mere humans; instead stressing the provisional nature of all human knowledge. To doubt is not a matter of will, your natural tendency is to believe, and here he ties up with William James contention that we all would believe everything would we just be allowed to. Doubt only arises through external pressures, revealed as what is commonly referred to as surprises, when our habits of thought hit upon unexpected obstacles. There is no such thing as genuine doubt internally produced, such self-willed obstructions are just self-deceptions. Belief is something we cannot but feel and can be based on any number of things, but belief in something is not necessarily the same thing as belief in truth, and Peirce is a realist in the sense of believing in an objective world independent upon our wishes and arguments. And that truth will eventually prevail, because any false proposition will eventually be contradicted, and propositions which cannot be so, are by their nature meaningless. The pragmatic content of his philosophy boils down to only what is testable is meaningful, thereby doing away with a lot of obstructing meta-physical speculation. And truth will thus eventually boil down to a social convention, and here he seems very close into falling into the posturing of so called post-modernists. Now any philosopher, who is not merely arguing some technical point, must resort to some meta-

physical assumptions. As Collingwood notes, the very rejection of metaphysics is by itself a metaphysical statement. Peirce is no exception, his metaphysical stand will turn out not only to consist in a belief in an external reality and in the unshakeable conviction that mankind is compelled to approximate its truth more and more closely, but also in some fuzzier speculations on the nature of the universe, its growth and guiding principles, to which we will return later.

Peirce may reject the principle of wilful doubt which is the method of Descartes, but he agrees with him as to the primary importance of thought as it is through thought alone we apprehend the world and to a large extent construct it. This top-down approach is traditionally referred to as idealism, the extreme version of which teaches us that the material world is but a construction of the mind. The bottom-up approach is usually referred to as materialism, explaining that everything is built up from simpler things, and that thought itself will eventually be explainable in terms of simpler things. Peirce himself is temperamentally inclined towards the former, something which will turn out to influence his wider metaphysical flights.

What Peirce thinks about thoughts is quite interesting and goes beyond what James presents in his famous treatise. For one thing thoughts are processes which take place in the brain at definite times, thus two thoughts can never be directly compared. In fact, any kind of comparison of thoughts is a meaningless attempt, as thoughts cannot be moved in time and juxtapositioned. Thoughts are irreducible, or in the words of Peirce, ultimate and inexplicable facts. The main point of thoughts is to generate new thoughts. In fact a thought is meaningless by itself and is inconceivable without a previous thought, which explains why we entertain the illusion of always having existed, because every thought has a precedent leading into an infinite regression. Thoughts will come to an end though, but only through our physical death. Thoughts flow in time, and when time stops, thought is impossible. Thus it is impossible that there will be a last thought, which somehow should summarize all the previous thoughts, so that we at the moment of death will preserve everything which went before. When there is cessation, there is naturally obliteration, as nothing can be preserved by an unchanging thought. Thoughts are thus connected to each other, and such connections are referred to as attentions, especially when it refers to the power of connecting thoughts divided by time.

Thus Peirce's conception of thought differs somewhat from that of Collingwood, when the latter says that the purpose of history is to recreate the thoughts of the past. Collingwood is clearly interested in the communicable component of thought, which to some people brings to mind the idea of an idea, and disposes of the very 'quale' of thought as being utterly incommunicable. Thus Peirce rejects that thoughts can be preserved through time by memory. Memory is something quite different from thoughts stored, as the analogy of computer memory seduces the modern readers, memories are reconstructions of past thoughts, and thus each recurrence of a memory changes it invariably. Some memories are visual. They can be quite vivid, although in the words of Hume, they are but faded copies of the real thing. Peirce does not agree, they are something quite different. When you look at a red book and then close your eyes, what you see is not the redness of the book, especially not a faded redness, because you do not see anything at all, that inner vision is not a faded kind of vision, it is a thought and a conviction that when you open your eyes

again you will recognise the color of the book as well as its shape. Similarly Peirce invites the reader to imagine a horse, and then asks him questions about it. The experiment reveals how few particulars we actually imagine, only being aware of the higher abstracter features; while in a real image we can only form the abstract higher features from the particulars. A real image cannot be vague about the details, while in an imagined image, the details are abstracted away and never occur. Once again we make a distinction between the top-down approach (the inner image) with the complicated and abstract entities being the basic ones and the bottom-up (the real image) with everything made up from simpler elements. Thus we cannot draw a triangle without making it a particular triangle, obtuse or acute; while we are able to imagine the generic triangle. Of course when we argue geometrically about a triangle, the actual image is helpful, but in our arguments we need only to use the general features, the ability of which is actually manifested in our ability to imagine without particulars. Admittedly Peirce is engaged in pure speculation with no restraints save those of critical introspection, yet I suspect that his insights have proved perspicuous, especially his idea that an image is to a large extent created from cues and never directly transmitted.

Intimately related to thoughts are feelings, although the two are clearly distinct. In fact feelings are mere components of thoughts, and the immediacy of them cannot be communicated, unlike the intellectual contents of a thought. Thus feelings are felt as closer affectations of our selves, than the intellectual components. They are more dependant upon the accidents of our circumstances. Feelings cannot be duplicated, he claims, as any duplication must be identical with it. Feelings take place at a given time and in a given mind, and are but qualities of consciousness, referred to as states. In particular feelings are impervious to introspection, in fact they are completely veiled from it, because they are immediate manifestations of consciousness. This ties up to some degree with James favourite example of the psychologist fallacy, namely that of confusing the thought itself with the thought of the thought.

Thoughts and language are intimately connected and Peirce is a pioneer in the science of semiotics. To relate thoughts to real external things is quite a subtle undertaking. For one thing thoughts themselves can be the subject of thoughts, but in so being, they are no longer thoughts, but external things<sup>1</sup>. Peirce sees that as a relation involving three things. The thing, the sign for it, and above the two, the interpretation. He makes quite a fuss about such triadic, which he stresses can never be reduced to a sequence of dyadics. He notes that in a graph with valency two can only generate a limited amount of complexity, but once valency three is allowed, there is a profusion. In particular tetradic, pentadic, etc relations can all be reduced to the triadic<sup>2</sup>. Peirce technical accounts, as in his exploration of semiotics (involving icons, indexes and signs in very precise and elaborate

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<sup>1</sup> This, I think, ties up with the subtlety of solipsism. In a sense everything we think of automatically becomes external. Thus it is not clear what is meant by the external things not existing. The very thought of a solipsistic reality, makes that an external fact and thus contradicts its meaning.

<sup>2</sup> In particular there are three radically different elements of consciousness, three and no more. namely immediate feeling is the first, polar sense the second and synthetical consciousness the third. The first takes place in an instant, the polar one includes the awareness of two different sensations, and to this category Peirce places the will. Finally the synthetical consciousness is the awareness of a process, of

senses) are quite difficult to read, and becomes almost impenetrable when he discusses ten classes of signs<sup>3</sup>. The obvious reason being that any technical account necessarily involves far more complicated chains of arguments than what is needed in a purely philosophical one. In particular the simplest proofs in mathematics are far more subtle logically than the profoundest arguments in metaphysics. In mathematics the concepts are very simple and very precise, the subtlety resides in how they are related to each other. While in philosophy the concepts are vague but very rich in associations, and in particular with deep emotional ties that invariably compel the readers attention. Thus in Peirces proto-scientific excursions a demand is made on the reader to make an effort, while it is not obvious whether such an effort is really worthwhile. There is a profound difference between scientific investigation and philosophical exploration, the former is an extension of the bewildering world of the senses, making even more facts and connections known to the observer, while the latter is an elevated abstracted view shorn of confusing particulars. In particular scientific investigations can enter dead-ends and be jettisoned as so much garbage. It is hard for the modern reader not to suspect that much of his technical writing has already become obsolete. This holds in particular for his rather involved classification scheme of sciences, which seems more quaint than interesting.

Peirce analysis of logic versus mathematics is particular apposite far more so than most of the musings of modern philosophers. He first clearly recognises that formal logic is a branch of mathematics and in particular has very little bearing on the reasoning of mathematics, but is rather in the nature of applied mathematics. In fact a mathematician is as little interested in or in need of the laws of reasoning, as expressed by logic proper (let alone by formal logic), as is the native speakers in need of the rules of forming his vowels, because he is naturally in command of them. He is mainly interested in the multivarious mathematical world, not the pedantry of how to explain the basic facts. As Benjamin Peirce, the father of Peirce, puts it, mathematics is not the science of necessary conclusions, but a science in which necessary conclusions are drawn, and that mathematics cannot be reduced to a branch of logic. In fact mathematics is pre-logical, the integers are even abstracter than logic. Logic proper is in fact a branch of ethics, it deals with the proper hygiene of mental conduct. This leads us back to the question of how to reason correctly. Here we run into a well-known quandary, how can we reason about reason? Are we not presupposing what we want to elucidate, finding ourselves in a vicious circle. Peirce takes exception to the German school of logicians as represented by Sigwart, namely that reasoning ultimately reduces to *Gefühl*, namely the feel of conviction<sup>4</sup>. This is to confuse logic with the psychology of thinking. As Peirce notes a conviction can come about in many ways, not all convictions being squared with truth. Contrasting the 'German' logic with the 'British', in which consequences are taken into account, Peirce tries to escape of the quandary. This is familiar to most mathematicians, who tend not to be entirely convinced by their own tortuous arguments how compelling they may appear step by step,

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growth and development. It cannot be sensed in an instant, but requires time, and is actually what binds our life together

<sup>3</sup> involving terminology such as qualisign, iconic sign, thematic indexical sign...

<sup>4</sup> This is also a case against the Cartesian method, which ultimately as well, reduces to subjective conviction, a most pernicious thing.

but seek confirmation in numerical evidence or that the results tie in naturally with what has already been established. That in fact it fits perfectly as a piece in a grander jigsaw puzzle<sup>5</sup>. And indeed flaws in arguments are seldom found directly, only when the arguments lead to absurdities are we sufficiently motivated to sufficiently deeply question our comfortable feelings. This ties in with the notion that doubt is not something that is willed, but is forced upon you from the outside.

Thus the deductive method is not only not the only way of obtaining knowledge but also not a very secure one either. And in general, the option is not even available, as we in practice do not learn things from indubitable premisses, we sample nature. This leads Peirce into a longer foray into probability, as well as stating the philosophical principles on which such fuzzy reasoning is based, (to which we will return below). This in its turn leads to the question of how we can know nature, and we can only do it by presupposing some basic regularity, which in particular allows most samples to be representative. The basic idea of putting up hypotheses and trying to falsify them rather than trying to confirm them is only implicitly implied and never explained and expressed with the lucidity of Popper. However, one may find various precursors, such as the remark that *The best hypothesis, in the sense of the one best recommending itself to the inquirer, is the one which can be the most readily refuted if it is false...But if a hypothesis can quickly and easily be cleared away so as to go toward leaving the field free for the main struggle, this is an immense advantage..* Furthermore he points out that science is defined by its problems, and those problems are more clearly formulated on the basis of abstracter science. He emphasizes the openness of research by formulating the maxim 'Do not block the way to inquiry' and warns of such presumptions as claiming that certain things are forever beyond the reach of knowledge, setting as an example, the infamous claim of Comte that the composition of the stars will never be known to man, put forward just a few years before the advent of spectroscopy<sup>6</sup>. Conservatism in the sense of dreading the consequences, Peirce admonishes the reader, has no place in science, which has always been forwarded by radicals. As to science Peirce suggests that it is based on two basic biological needs of men, manely to feed and breed. From the necessity to eat to survive stems the hard mechanical sciences, aimed at the manipulation of our physical environment; and from the instinct to breed, stems the social sciences, i.e. the need of interpersonal manipulation. Peirce in fact doubts that any knowledge that is not ultimately reducible to either of those two needs will ever be within reach to humans.

In a more technical sense Peirce makes a distinction between abduction and induction. The latter is just the testing of a certain hypothesis by experiment, but Peirce appreciates that the forming of an hypothesis is not a simple thing. In fact the true intellectual content of any scientific inquiry is not in the testing, but in the forming of a hypothesis.

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<sup>5</sup> This ties in with yet another one of Peirce criticisms of the Cartesian approach. reasoning should not forma chain, which is no stronger than its weakest link, but more that of a cable, in which each fiber be slender, but thta being made up by there being so numerous and intimately connected

<sup>6</sup> In this context Peirce makes an obscure reference, nowadays only known to Swedes, suggesting that the hazards of asserting that the truth will never be found out are greater than those accompanying Andree on his quest for reaching the North Pole by balloon, something that must have been widely known at the very end of the 19th century, but which now is completly forgotten

The art of forming one he refers to as abduction. Here there are obvious constraints, such as a hypothesis should comply with previous facts, but there are more subtle one, such as simplicity. This is not just Occams razor, although that medieval thinker tried to form a general principle of hypothesis making, but a rather subjective notion of simplicity that accords naturally with our instincts. And we simply have to accept the metaphysical fact that our natures are in accordance with those of Nature itself, otherwise we cannot entertain any hopes of understanding it<sup>7</sup>. Clearly it is here that the creative element of science enters, the art of being able to put the right question. It was here that Kepler proved his mettle, by determining the orbit of Mars, not just making any wild guess. And more to the point maybe, it was here that Galileo exhibited his genius<sup>8</sup>, and it is from Galileo that the unreasonable effectiveness of the mechnaical sciences stem<sup>9</sup>

Let us join Peirce returning to logic, refering to the well known syllogism. A) All men are mortal B) X. is a man, hence C) X. is mortal, in order to get a taste for his principles of classification. He refers to the three terms as Rule, Case and Result respectively, noting that in deduction we reason from Rule and Case and conclude Result. This is a formula of volition. While in induction we proceed from Result and Case to Rule. This kind of process is one of the forming of a habit, depending on repetition. And yes indeed in real life, the premisses A) is a result of induction, not something given. Finally the forming of a hypothesis is to reason from Rule and Result to Case. This is the formula of acquiring secondary sensation, of bringing order and structure to a bewildering confusion of catenation of predicates through a synthesizing predicate.

As noted above Peirce is concerned with probability, remarking that while elementary geometric reasons lead few people astray, the pitfalls into which people fall when reasoning about probability are legion. Probability in its formal aspects involves simple rules of manipulation, involving concepts like independant events. This formal part of probability is just pure mathematics, what is not mathematics is the way this is made to model the so called real world, and on a more philosophical level, what is really meant by a probability. To Peirce it is natural to think of probability as a generalization of logic, in which truth is no longer discretely encoded by one or zero, but is given by a continuum. So what is really meant by a nubere between zero and one? Peirce inverts it twice and then takes the logarithm, claiming that this number indicates the faith with which we should hold on to its truth. More precisely consider  $F(p) = \log(p/(1 - p))$ . Clearly  $F(0) = -\infty$  for false statements and  $F(1) = \infty$  for true statements, although by this definition the belief function is not really additive on independant confirmations as Peirce claims. Maybe his words are too vague to allow an unambiguous formulatic interpretation, or he has made one of those elementary slips. Anyway he relates this logarithmic approach to belief to the celebrated Weber-Fencher law which states that the actual internal sensation is proportional to the logarithm of the external stimulation. In fact belief should be thought

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<sup>7</sup> This is a metaphysical assumption to which Peirce returns repeatedly. Elsewhere he puts it: If nature seems highly uniform to us, it is only because our powers are adapted to our desires.

<sup>8</sup> The knowledgable reader may be familiar with a discussion of this central feature of reasoning as expounded in Brechts play - Galileo.

<sup>9</sup> Wigners 'the unreasonable effectiveness of mathematics' has now become an almost hackneyed quote, just as Galileos saying that the language of Nature is mathematics.

of just another internal sensation stimulated by external probability. He makes some effort of trying to define probability by a method of calculation. In finite cases this is trivial, but what about an infinite case of tosses say? Infinity divided by infinity is meaningless. In this conjunction he observes that immortality would subject every man eventually to the miseries of having all his trusts sequentially betrayed, no matter how unlikely each occurrence would be. What saves us from such a hell is death.

Returning to the real problem, that of predicting the future with some degree of probability. We must assume that the world is orderly, i.e. that the past gives an indication of the future, because in a universe of total chaos, reasoning would be of little avail<sup>10</sup>. Now in this context how should we think of probability? One solution is to assume that the universes are as plentiful as blackberries<sup>11</sup>, the probability is just a matter of the probability of us happening to exist in a particular universe. This approach is rejected by the author, and hence he claims we should never ask what the probability is that Nature will agree with our hypothesis or prediction, this would assume the multiple-universe approach, instead we should simply ask what is the probability that our hypothesis agrees with the fact. Hairsplitting? Maybe, maybe not.

The quintessential probabilistic method of obtaining probable truths is based on samples. In taking samples it is of paramount importance that we phrase our questions before we sample. Given a sample it is very easy to come up with a lot of coincidences of low probability that they will be due to chance, to which it will comply. This fallacy of reasoning, ultimately based on a confused sense of what is meant by randomness, seems to be one which still many people fail to appreciate, thinking that scientific investigation consists in taking samples (observations) and investigating what kind of rules those samples adhere to.

Peirce observes that every sane person lives in an Inner as well as an Outer world, and that the way we are able to distinguish the two is that great changes in the Inner can be made with little effort, while to change the Outer, you need to exert yourself, often involving muscular effort, even when the changes desired are minimal. It is tempting to see in this a distinction between an Inner, fictional world, in which we approach omnipotence, and an Outer, real world, where our power is very limited. In the parlance of Peirce we are talking about a world of fancies and percepts respectively. In our modern world, where everything turns to become more and more virtual, and where especially muscular effort plays less and less a role, maybe the ability to make the necessary distinction is becoming weaker and weaker, and thus threatening to make madmen of us all.

What is truth? The search for it consists in distinguishing the unreal from the real. This is done through thought, and in order for there to be a connection between thought and reality, there has to be signs, the science of which is semiotics. Each individual mind is not big enough for the task, the project cannot be done in isolation, in fact it does not

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<sup>10</sup> If the universe would be modelled on a sequence of independent tosses, there is no way we can reason as to the next throw on the basis of the previous. Thus our guesses, if this will be turned into a game, must rely on some principle beyond reason. Now of course the universe is bigger than the sequence of tosses, we can argue about it and design a strategy, which is based on global reason, but whose local steps are not.

<sup>11</sup> The simile is that of Peirce, and this has been taken up in the title of a recent book by Gardner, yet as it is used repeatedly it could also be a common saying at the time.

make sense in isolation, but only in a community. A community is not just a collection of people at a certain place and time, but it extends both geographically and in time, and thus the community in its widest sense is mankind taken as a whole. Truth is what this community eventually will settle for. This makes it independent upon individual wishes, and it is this that supplies its ultimate independence. So we can summarize one of the major tenets of Peirce's thought, which make up a basic component in his general scheme of pragmatism, or pragmatism, an awkward construction, ugly enough to be safe from kidnappers in the words of Peirce himself<sup>12</sup>. The other major tenet is that truths which have no practical consequences for the community are meaningless. In particular that holds for the ontological claims of meta-physics, which are either gibberish or downright absurd. Peirce refers to Bain's definition of truth as "that upon which a man is prepared to act" as pragmatism in a nut-shell. As noted above the ambition of Peirce is to make philosophy into a science, and the first thing that has to be sacrificed is the literary elegance, which has no more relevance to the issues at hand, than the fancy uniforms of armies of the past. Pragmatism has as object not to ascertain Truth as is, but merely to supply a method of clarifying the meanings of hard words and abstract concepts. In particular as regards to qualities of feelings they have no intrinsic significations beyond themselves, and can in fact be interchanged without anything but feelings themselves being affected. Different with intellectual concepts.

Finally as to metaphysical speculations, there are of course of different kinds. One kind certainly concerns pre-scientific thought, such as Peirce's wild and imaginative speculations, whether the fundamental laws of mechanics hold good for single atoms, and whether their movements are really constrained to three dimensions. Modern physics does bear him out, although one should remember that he had no foundations for his speculations, but that they were more in the nature of suggesting the freedom of imagination. The other kind of metaphysics is more elevated and concerns the nature of the universe. Peirce rejects the Cartesian dualism and notes that such extreme views will find few defenders nowadays. On the other hand he finds the materialistic doctrine quite repugnant, and leans instead towards some objective idealism, in which matter is effete mind, and where inveterate habits have become laws. Still such a theory, he demands, need to be able to explain the 3-dimensionality of the world, its physical laws, with mathematical clearness and precision.

Time is another feature he considers in technical depth. For one thing he proposes a continuum. It is not clear whether he means that in the mathematical sense, i.e. of an uncountable number of instances. He does speak of infinitesimals, and how immediate

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<sup>12</sup> Much has been made of the opposition between William James and Peirce, in particular that Peirce took exception to the philosophy of the former, and changed the name as to avoid any confusion between their two philosophies. Nothing of such a putative animosity is to be found in those pages. The two were almost contemporaries, both belonging (along with later notables such as Justice Holmes) to the same discussion club (known half-ironically and half defiantly as The Metaphysical Club), and throughout his essays there are numerous testimonies to the great regard he held for his fellow philosopher and scientist. And while he does admit that there are some differences, those appear, at least to the casual reader as rather minute, not to say negligible. But philosophers thrive on those small differences, which so often constitute their *raison d'être*. In fact Peirce admits that the differences between him and James engage other parts of philosophy than those pertaining to pragmatism.



feelings take place in an infinitesimal duration containing the present instant. At the time he was writing, the mathematical continuum was well understood and could have supplied precise definitions. To him continuity is essential, it is through this thoughts connect each other, by being present in continuous variations spread in time. He also points out that time is meaningless without change. For time to be continuous it has to record continuous change. In this way he connects the continuity of time with the perceived continuity of space.

To turn from the local cohesion to the asymptotic long-range, Peirce takes evolution seriously, if not exactly the form presented by Darwin. First he points out that certain processes takes time and make no sense in an instant. This is also pointed out forcefully by Collingwood. Personality is one such phenomenon, that can only be apprehended over relatively long stretches of time. He believes that there is an evolution of the universe which is not restricted to the biological world, but that the laws of nature themselves have evolved, and that the ultimate goal is to result in a perfectly rational universe where chance has been abolished. In the process of things getting more regular, they also get less dreamy and more real. He points out that development essentially involves a limitation of possibilities<sup>13</sup> This principle of development and growth he considers a primordial element of the universe, and he is quick to point out that this is in no way antagonistic to the idea of a personal creator but rather inseparable from it. This is a kind of remark, which surely would startle the modern reader. His openness to the idea of telepathy is another matter which dates his thought, as exemplified by his speculations that there may exist continuous connections between minds other than those of space and time.

To conclude, Peirce speaks about three kind of evolutions. Tychastic, anacastic and agapastic. Meaning evolution by fortuitous variation, by mechanic necessity and creative love, respectively. Of the Darwinian tyhastic, he remarks that it is based on greed, and that it fits very well into the ideas of the 19th century as the Economical Century<sup>14</sup>. Hegels ideas he considers as being an example of anacastic evolution, and wonders wheter its feature of necessity really allows the notion of a free will, as given a set of premises, there is but only conclusion to be drawn, and where is the scope for the unfettered will? Clearly Peirce considers the agapastic evolution to be superior to the other two, in fact they can only be seen as degenerate forms<sup>15</sup>

Yes, Peirce believes in God. And not only that he believes that most people actually do deep down, even those contemporary scientists who claim that such beliefs are unfounded. He rejects the attempts to make the notion of God more precise, its very vagueness is a manifestation of the common sense through which we know it. He takes exception to the idea that god being perfect knows neither reasoning nor perception, as proposed by

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<sup>13</sup> This should be compared with Poppers falsifications, which essentially cuts down on the number of possibilities, enabling us to explore the configuration spaces more deeply. This is also what Kuhn refers to when he explains why there has been no development of philosophy, as avenues of explorations, have never been definitely cut-off, making no thought really obsolete.

<sup>14</sup> Peirce is quite well-aware of the intellectual debt of Darwin to the economists of the 18th and early 19th century

<sup>15</sup> Interestingly Peirce takes as a metaphor, the line and the conic, which together share many formal properties of non-singular cubics, but do not have any points of flexure.

some theologians, its mind being so unlike ours that we simply cannot fathom it. On the contrary, Peirce claims, even if we cannot fully comprehend the thoughts of God, the predictive powers of science prove that we can at least catch a fragment of them.

As to God, open your eyes - and your heart, which is also a perceptive organ - and you see him. Those are the concluding words of the concluding essay in the collection. What to make of them? Is he being profound, or just uttering conventional pieties of his times?

October 7-10, 2007 **Ulf Persson:** *Prof.em, Chalmers U.of Tech., Göteborg Sweden* ulfp@chalmers.se