The Puzzle of C. S. Peirce's Pragmatism and Economics:

Is it a Scientific Method for Institutionalist or

Neoclassical Economics or Something Else?

James R. Wible

Professor of Economics
Department of Economics
Paul College of Business and Economics
University of New Hampshire
Durham, NH

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C. S. Peirce, a founder of American pragmatism, had interests in many disciplines including economics and several natural sciences. In addition, Peirce contributed to areas of inquiry that would be of interest to the modern mainstream economist here identified simply as a neoclassical economist. One can find writings where Peirce explores mathematical economics and utility theory, the axiom of transitivity, the theory of the firm, statistical methods, sampling theory, mathematical logic, and methods of scientific investigation. What is intriguing is that neoclassical economists hardly know of these interests. In contrast Peirce is often identified as one of the important intellectual figures contributing to the thought and method of American institutional economics. What is even more fascinating is that institutional economics has a history of being sharply critical of the theory and methods of neoclassical economics and seems to know little of Peirce's extensive interest in mathematical economics. This leads to a conundrum. The C. S. Peirce that prominent institutionalists have identified as a leading intellectual figure supporting their methodological positions and a different theory of the individual seems to have made applications to economics of the very sort they opposed and apparently rejected in emerging neoclassical economics. So which school of economics better aligns with the philosophical and scientific pragmatism of C. S. Peirce – the institutionalists or the neoclassicists? As you shall see, an answer is not as simple as a binary comparison might suggest.

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> [T]he foundations of institutionalism consist primarily of the analytic method of Peirce. Dewey is recognized by institutionalists – in large measure because of his influence on Ayres – as a primary source of the self-correcting, evolutionary continuum. Clearly, however, many of Dewey's ideas originated with Peirce, as did those of Commons, and some of those of Veblen. Thus, the basic tools of institutional method are rooted in the works of Peirce.
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> E. E. Liebhafsky, "The Influence of Charles Sanders Peirce on Institutional Economics" (1993, p. 750)

> This is all in Cournot,
>
> (C. S. Peirce, Letter to Simon Newcomb, 1871b, p. 187).

> In other words if a person prefers A to B and B to C he also prefers A to C. This is the first axiom of Political Economy.
>
> (C. S. Peirce, On Political Economy, 1874a, WP 4, p. 176).

1. Introduction

This article is an exploratory essay on the relationship of the works of Charles. S. Peirce to economics.[1] It is exploratory because of the complexity and difficulty of Peirce's thought in many areas of inquiry and because of the protracted and mis-organized way his writings have appeared since his death in 1914. Also, within economics, interpretations of Peirce and his relevance to economics have been exceptionally varied perhaps reflecting the complexity emanating from Peirce's writings. The quotes at the top of the paper reveal some of the near paradoxical themes in the corpus of economists' writings about Peirce's works and Peirce's own writings about economics. C. S. Peirce, one of the founders of American pragmatism, had interests in many disciplines including economics and several natural sciences. In addition, Peirce studied and or contributed to areas of inquiry that would be of interest to the modern mainstream economist here identified simply as a neoclassical economist. For example one can

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[1] Even though many references to the various literatures in which the puzzle of Peirce and economics is found are included, there are many more layers of documentation and citation that could be added. Scholarly details remain quite incomplete in this version of the paper.

find writings where Peirce explores mathematical economics and utility theory, the theory of the firm, statistical methods, sampling theory, mathematical logic, and methods of scientific investigation. The latter two quotes above come from Peirce's exploration of mathematical economics and logic in the early 1870s. What is puzzling is that neoclassical economists hardly know of Peirce's interest in what is often called the foundations of mathematics and logic, economic theory, mathematical economics, and statistics. In contrast Peirce is often identified as one of the important intellectual figures contributing to the thought and method of American institutional economics. What is even more intriguing is that institutional economics has a history of being sharply critical of the theory and methods of neoclassical economics. While institutionalists did develop some descriptive quantitative methods, they mostly have opposed the applications of the methods of mathematics and inferential statistics like what is found in neoclassical economics and have been very critical of utility theory and marginalism as a theory of the individual in economic processes. Indeed some of the most canonical figures of institutionalism cite Peirce's pragmatism as a set of philosophical ideas supporting a different vision of scientific practice than neoclassical economics. This leads to a conundrum. The C. S. Peirce that prominent institutionalists have identified as a leading intellectual figure supporting their methodological positions and a different theory of the individual seems to have made applications to economics of the very sort they opposed and apparently rejected in emerging neoclassical economics.

So which school of economics better aligns with the philosophical and scientific pragmatism of C. S. Peirce – the institutionalists or the neoclassicists? As you shall see, an answer is not as simple as a binary comparison might suggest. The conundrum is even more complicated when you realize that Friedrich Hayek and Karl Popper also read and favorably commented on some of Peirce's writings. Hayek and Popper also seem to have an evolutionary conception of economics. Also, aspects of Milton Friedman's methodology of positive economics have been connected with John Dewey's version of pragmatism.[1] One should not forget that Dewey and even Veblen were students of Peirce's in graduate school. So Friedman may be in some sense an intellectual cousin of Peirce once or twice-removed via Dewey and other philosophers. Moreover, Paul Samuelson's mathematical professor, E. B. Wilson was

keenly interested in Peirce's writings. Samuelson never read much of Peirce and thus did not know of Peirce's neoclassical-like economic writings. Samuelson is known for advocating a methodological position known as operationalism in some of his early writings. Operationalism also could be interpreted as being a variant of pragmatism. Operationalism proposes that for scientific concepts to be meaningful, procedures of measurement need to be specified. In his prime, no one was better at measuring things than C. S. Peirce. It is what he did for a living in the U. S. Coast Survey. Among other things, he measured gravity at many locations in the U. S. and Europe, the speed of light, the shape of the Milky Way galaxy, and may have proposed a way to demonstrate whether space was curved or not. So Samuelson via Wilson and operationalism might be considered as an intellectual cousin with somewhat more distance – say at least twice or more removed from Peirce.[2]

Providing a superficial explanation of why Peirce is so approvingly given a favorable position of intellectual influence in institutionalist circles while his more neoclassical style applications have been ignored is in some sense easy. Most economists simply did not know of his economic writings during his lifetime and few of the philosophical writings of the mature Peirce were published by the time of his death in 1914 and not for decades thereafter. In fact, the vast corpus of Peirce's writings have just begun to appear in the past few decades as The Writings of Charles S. Peirce: A Chronological Edition. Harvard University had published an eight volume collection of Peirce's writings in the 1930s and 1950s, the Collected Papers of Charles Sanders Peirce, but they were topically organized. This made it hard to follow the development of Peirce's philosophical, scientific, and mathematical ideas and how they might relate to his interests in economics. As Phil Mirowski (1988) has commented, reading Peirce is "no fun." But so much more of Peirce's writings are now available than 40 or 50 years ago. It is now possible to give a much richer appraisal of the relationship of Peirce's ideas to the history of economics in the United States.

Before taking up Peirce's influence more directly, a word of warning may be necessary. Some very prominent institutionalists have suggested a preeminent role for Peirce in their methodology. Given these comments one might have expected some consistent narrative with regard to Peirce to emerge in their writings. Unfortunately, that has not been found to be the

case. Heterodox economists seem to be equally as heterodox with the writings and ideas of Peirce as they are with many of their own theories. This was something of a surprise. For example, one might have expected that institutionalist proponents of Peirce might have consistently drawn from Peirce's most famous essays on pragmatism from 1877-78, but that is not the case. Alternatively, another expectation might have been to draw on Peirce's second most well-known set of essays published in the 1890s – The Monist evolutionary metaphysical series – since institutionalists have also adopted an evolutionary point of view as one of the main features of their research program. Again, this is not the case but for a recent exception or two. When Peirce's evolutionary ideas are mentioned most often a few obscure writings are mentioned if any at all. This omission is particularly acute for Veblen who made so much of ideas of evolution and mechanism for his own theories but seems to have bypassed Peirce's most accessible essays on those subjects.

2. The Pragmatism of Peirce and the Various Strands of His Writings

Charles Sanders Peirce (1839-1914) is an intellectual figure who seems to be part of the fabric of American thought and science for a certain period of intellectual history. It seems that everyone from a certain era who is brilliant either knew of him or his reputation, had read an essay or two, or had studied with a professor or one of his students who knew of him. His reputation is that of a difficult, eccentric, and undisciplined genius who could not conform enough to hold an academic position or retain his government job at the Coast Survey after the Civil War.[3] Yet he had social, academic, scientific, and political connections with those at the highest levels of American life. From the vantage point of the early 21st century, his intellectual and scientific reputations seems to have surpassed those of his most critical contemporaries such as William James and Simon Newcomb and his students Dewey and Veblen. So he is a figure who is well-known in American intellectual history, but lines of direct influence on economics are hard to find. Certainly he had an impact for a time on James, Josiah Royce, and even Dewey. Clearly he is acknowledged as a co-founder of American pragmatism – and there is a renewed interest in pragmatism and Peirce as criticisms of positivism and empircism have grown over the

past few decades. But one often runs into the sorts of difficulties as those encountered with economics as mentioned previously. There is a school of economics, the institutionalists, that praises Peirce for his philosophical contributions and scientific method but may not recognize the full range of his scholarship. And there is another school of economics, the neoclassicists, that conducts its scientific practice in ways that Peirce might have desired to some degree, but without any sense of the intellectual context that Peirce gave for practicing science that way. Both schools might learn something with a deeper awareness of Peirce's ideas.

One way to begin is with a broader account of Peirce's ideas than most scholars have brought to his contributions. Often it is thought quite difficult to characterize Peirce's interests because they are so varied and range across so many disciplines. However without a broader frame of reference it is easy to mis-characterize Peirce. The title of a recent book on Peirce, Strands of System (Anderson 1994) provides a suggestion for a way forward. If the various lines of thought and inquiry which Peirce developed are thought of as different "strands" of intellectual and scientific development, then one should think of Peirce as having several important strands of contributions. Andersen (1994, p. 26) tells us that one of the best arguments for a strands hypothesis comes from Peirce's "claim that philosophy proceeds not from a single premise or set of premises along a single thread of reasoning but inductively, gathering from experience what it can and braiding it into a cable of belief." Anderson paraphrases what Peirce wrote in one of his first series of published articles in 1868:

> Philosophy ought to imitate the successful sciences in its methods, so far as to proceed only from tangible premises which can be subjected to careful scrutiny, and to trust rather to the multitude and variety of its arguments than to the conclusiveness of any one. Its reasoning should not form a chain which is no stronger than its weakest link, but a cable whose fibres may be ever so slender, provided they are sufficiently numerous and intimately connected (Peirce 1868g, WP 2, p. 213).

Anderson uses Peirce's classification of the sciences to provide an awareness of the multiple

lines of thought that he pursued. Since Peirce's classification of the sciences changed from time to time and because the place of economics within those classifications is quite obscure, a similar listing of important strands can be constructed from a thorough bibliographic awareness of his writings. One particular categorization scheme of Peirce's writings fashioned to frame the discussion on his intellectual contributions and economics might have the following major strands:

1. Mathematics, logic and algebras of relations, and the logic of mathematics.
2. Pragmatism and methods of inquiry.
3. Evolutionary philosophy, metaphysics, and semiotics.
    A. Critiques of British empiricism, associationism, and utilitarianism
    B. Critiques of continental rationalism and German logicism
    C. Critiques of psychology and psychologism
4. Logic of how to reason: deduction, induction, and abduction.
5. Critique of German historical research relating to ancient Greek philosophy
6. Logic of probability, collections, sampling, and inference.
7. Scientific research conducted mostly for government agencies.
8. Economics, mathematical economics, the economy of research and cognition, and Ricardo..
9. The differing methods of inquiry of the sciences, philosophy, and common sense.
10. Hundreds of book reviews and hundreds of dictionary definitions on many different subjects.

Most accounts of major the major lines of thought which characterize Peirce's contributions begin with the second one, the strand of pragmatism and methods of inquiry especially scientific inquiry. That is because Peirce is most well known for his pragmatic method of inquiry. However, Peirce's classification of the sciences always begins with mathematics, philosophy, and then the special sciences.[4] Peirce always seemed to follow Comte for his most general scheme. Comte thought sciences should be classified according to their degree of

abstraction. Then Bentham's conceptions of the sciences were followed for the special sciences.[5] Peirce maintained that mathematics was more abstract than philosophy and other disciplines. Thus all organized science and inquiry begins with mathematics according to Peirce. Mathematics is also placed as the first strand because most of those interested in Peirce outside of philosophy including most economists are unaware of the preeminence of mathematics in his hierarchy of human knowledge and knowing.

The second strand of writings, the original essays on pragmatism and his subsequent essays on scientific inquiry and method are the ones that have been referenced, recommended, and read the most since pragmatism first became prominent in the late 1800s. If there is one thing for which Peirce is known, it is pragmatism and the first two essays of that series, "Fixation of Belief" (1877) and "How to Make Our Ideas Clear" (18781). These are the two essays where Peirce provides a general, qualitative overview of his conception of the logical principles of scientific inquiry in a way that seems to apply both within and outside of science. Turning to the third strand, it is probably also the second most well-known group of his writings. Peirce wrote a great deal on evolutionary philosophy, metaphysics, and semiotics and he also offered critiques of British empiricism and continental rationalism. These critiques are much less well known and in an intellectual sense they emanate from his philosophical system. Also, Peirce's critiques of rationalism, empiricism, utilitarianism, and associationism seem to be almost toatally unknown to economists in general. Clearly these critiques need to be taken in the context of his evolutionary philosophical system. He also directed these philosophical critiques at the discipline of psychology and he denied the idea that psychology could be a foundational discipline for philosophy and the social sciences. The fourth strand on reasoning processes such as deduction, induction, and abduction (also called hypothesis by Peirce) has also drawn some attention in the past few decades by various scholars including institutionalist economists. This strand stands in sharp contrast to Peirce's critique of psychology. A logical study of reasoning processes was viewed by Peirce as being a more rigorous and more objective way to study some of the more important aspects of higher mental processes.

Beyond the sheer number of strands of Peirce's writings, another matter for those studying his works is that the strands are often intertwined and even nested within one another.

For example some of his longer writings and essays exhibit themes common to several of the major strands in his writings. Also some of his published series of writings have one or two articles from one strand and one or two from another or a third strand. And even these various articles with various main strands may have minor themes evoking other strands. This remarkable "strands" and "strands within strands" feature of Peirce's writings imparts a sense of perplexing complexity to those who wish to figure out quickly and succinctly what he has to say. The strands quality is what the editors of the Collected Papers tried to undo. But having an awareness of the various strands in mind as one works through his writings and publications over many decades, at some point a certain unity begins to emerge if one reads enough of Peirce. At whatever level the strands appear, reading a great deal of Peirce leaves one with a sense of his own self-impression of what he had accomplished – thought that he had created the outlines of a significant systematic framework of human thought, science, and philosophy. In his own mind he thought his own contributions were the best approach to philosophy and science since Aristotle 2000 years earlier.[6]

Peirce was born in 1839 and graduated from Harvard in 1859. He published his single most widely read set of essays, the "Illustrations of the Logic of Science" in 1877-78. They appeared in The Popular Science Monthly. These are the most prominent writings of the pragmatic strand of his writings. At that point in time, America had few if any academic journals. There were no formal graduate programs until Johns Hopkins University was created in the late 1870s. There were a few periodicals which published articles from many different areas of inquiry such as the North American Review, the Princeton Review, and the more narrowly focused Science. It was not unusual to find pieces on science, theology, religion, history, and technology in the same publication. Peirce's "Illustrations" articles resulted from discussions among the members of a now famous group, The Metaphysical Club. It met in Cambridge Massachusetts in the late 1860s and early 1870s. Other prominent members were William James, Chauncey Wright, and Oliver Wendell Holmes. The "Illustrations" articles are Peirce's single best known series of articles and they would have been available in prominent libraries around the country from the late 1870s. The six contributions to the "Illustrations" series were:

The Fixation of Belief
How to Make Our Ideas Clear
The Doctrine of Chances
The Probability of Induction
The Order of Nature
Deduction, Induction, and Hypothesis

As mentioned above, the first two articles are the ones which have been most widely read and they are the ones that American new school economists and institutionalists most likely could have read as well. "Fixation of Belief" and "How to Make Our Ideas Clear" would be writings that are clearly part of the second strand, pragmatism as a method of inquiry and philosophy and, to a lesser extent, the third strand, evolutionary philosophy. The other four articles are often ignored and they more closely fit other strands of Peirce's writings. The middle two articles, "Doctrine of Chances" and "The Probability of Induction" fall more into the sixth strand of Peirce's interests, the logic of probability, collections, sampling, and inference. The last article, "Deduction, Induction, and Hypothesis," is one of Peirce's early articles focusing on how humans reason at the highest levels of cognition and would fit with the fourth strand. Abduction is now a better known term for forward looking inferences which Peirce also called hypothesis. The fifth article, "Order of Nature," is a mathematically and semiotically facilitated approach to understanding the evolving order of nature with the simple use of an algebraic mindset. As such it represents a blend of the third and sixth strands of Peirce's writings.

A series of writings typically recognized as being Peirce's second most widely read articles are those that appeared in The Monist from 1891 to 1893. The titles of those papers are:

The Architecture of Theories
The Doctrine of Necessity Examined
The Law of Mind
Man's Glassy Essence
Evolutionary Love

The Monist papers are articles based on Peirce's mathematically conceived evolutionary cosmology. That cosmology was authored in manuscript in the late 1880s and is titled "A Guess at the Riddle." The articles of The Monist series are mostly a contribution to the third strand, evolutionary philosophy and metaphysics. The last paper, "Evolutionary Love," contains critical remarks about what was then known as the moral sentiments of "old school" political economy derived from British classical and emerging neoclassical economics. The Monist series also contains many of Peirce's ideas on evolution, the limitations of mechanism and determinism, on evolutionary processes, and the role of human intelligence in evolutionary processes. To this author's knowledge, no institutionalist founder and only one or two later proponents or critics has referenced or acknowledged Peirce's evolutionary critique of political economy from this Monist series. This seems odd given the evolutionary conception of economics articulated by the most prominent founders of institutional economics. Both the "Illustrations" series and The Monist articles were reprinted together in the early 1920s as the first set of Peirce's writings to reappear after his death and appear under the title of Chance, Love, and Logic (1923). An essay by John Dewey accompanies this volume of reprints. Even this republication does not seem to have affected the ideas of prominent institutionalists of that time.

Besides these two very well-known article series, probably the third most well known set of writings were Peirce's Harvard "Lectures on Pragmatism" written and delivered during the spring of 1903. They were not published until the 1930s when a version of the lectures appears in volume V of the Collected Papers. The titles of the Harvard lectures as they appear in the most recent version of the lectures are as follows:

Lecture I: The Maxim of Pragmatism
Lecture II: On Phenomenology
Lecture III: The Categories Defended
Lecture IV: The Seven Systems of Metaphysics
Lecture V: The Three Normative Sciences
Lecture VI: The Nature of Meaning
Lecture VII: Pragmatism as the Logic of Abduction

Volume V of the Collected Papers where the lectures first appeared were reviewed by John Dewey (1935a) so they were known to him and possibly others who would have been reading Dewey's writings in the 1930s. Broadly speaking the "Lectures on Pragmatism" can be seen as contributions to the first two strands of Peirce's writings. Lectures I, VI, and VII fit most generally into the strand of writings on pragmatism while lectures II through V mostly elaborate his evolutionary mathematical cosmology. In lectures VI and VII, there is also another long presentation of how humans reason with extensive comments on deduction, induction, and abduction. Peirce concludes the Harvard Lectures by claiming that pragmatism is equivalent to the logic of abduction.

Other writings of Peirce's which have significant passages on methods of inquiry and deserve to be noted as statements of pragmatism are:

A Theory of Probable Inference (1883)
On the Logic of Drawing History from Ancient Documents Especially from Testimonies (1901)
What Pragmatism Is (1905a)
Issues of Pragmaticism (1905b)
Prolegomena to an Apology for Pragmaticism (1906a)

"Theory of Probably Inference" is from a collection of essays written by Peirce and his advanced logic students at Johns Hopkins in the early 1880s, Studies in Logic. Peirce's essay summarizes and extends many of the main themes of the articles in the "Illustrations" series and would have been available at many of the better academic libraries around the country and to his graduate students at Johns Hopkins. The volume received a favorable review from John Venn. The "Logic of History" has a great deal to say about the application of a methodology of scientific inquiry to historical research. It is a 1901 manuscript that has been published piecemeal in several places but never in its entirety. Besides its main strand which is about scientific inquiry, it has passages on mathematical logic, the logic of collections related to conceptions of

probability, comments on the errors of the German historical scholars, and a substantial passage on the economic aspects of scientific research. "Logic of History" also fashions defenses of the intellectual reputations of Plato. Pythagoras, and Aristotle. From his conception of scientific inquiry Peirce attempts to formulate a method of historical inquiry. The "Logic of History" would not have been available even in part until 1958 when about half of the manuscript appeared in the seventh volume of the Collected Papers. In that version the application of Peirce's method of historical inquiry to the reconstruction of the works of Aristotle is included but not the applications to Plato and Pythagoras. The last three papers on the preceding list are Peirce's last publications explicitly on pragmatism and were originally published in The Monist.

For the purposes of this essay only two more strands of Peirce's writings can be introduced – his interests in mathematics and logic and his evolutionary ideas. Indeed in what may be a surprise to many, these two strands are highly interconnected. Some of Peirce's most important writings in his mathematical strand are:

Upon the Logic of Mathematics (1867)
Description of a Notation for the Logic of Relatives (1870)
On the Algebra of Logic (1880)
New Elements of Mathematics by C. S. Peirce, (1890-1907) ed., Carolyn Eisele, 4 volumes
The Simplest Mathematics, from Peirce's Minute Logic (1902)

In these writings Peirce often explores mathematics from a logical perspective and he is considered one of the founders of mathematical logic. Peirce's mathematical logic analyzes the qualitative algebraic properties of various parts of arithmetic and mathematics. They include his exploration of the new mathematical field of topology. Peirce was one of the major figures who helped push mathematical logic towards relational comparisons and away from the logical content of various methods of reasoning. Peirce also began to interpret syllogisms in a relational way as well. At various places in these writings, Peirce maintained that mathematics was the most abstract part of human thought and reasoning and that many of the problems of philosophy

and psychology could be considered from the vantage point of abstract mathematical logic.

One of the most unusual applications of Peirce's relational mathematical logic was to the process of evolution. The writings which may be most important to consider here are:

The Order of Nature (1878d)
Design and Chance (1883-84)
One, Two, Three: Fundamental Categories of Thought (1885)
A Guess at the Riddle (1887-88)
The Monist Metaphysical Series (1891-93)
Reasoning and the Logic of Things, The Cambridge Conference Lectures (1898)
Harvard Lectures on Pragmatism, II-V (1903)

In the essays on pragmatism in "Order of Nature," Peirce begins to use letters as abstract, algebraic representations of the properties and entities of nature. There he describes hypothetical worlds with a few number of basic elements or processes and permutations of the those elements and processes and how they might begin to evolve. In a lecture to his students in the philosophy seminar at Johns Hopkins titled, "Design and Chance," Peirce begins to think about the universe as evolving from an unknown origin of homogeneity. The philosophy seminar was also called the Metaphysical Club following the name of its predecessor a decade earlier in Cambridge. John Dewey is recorded as being present for the presentation of "Design and Chance." After the lecture, Peirce's primitive evolutionary ideas were further developed into three numerically named categories of first, second, and third. Peirce adopts the word-form of numbers in order to designate his categories to provide a semantic way to avoid confusion with other systems of categories of thought such those of Kant and Hegel. Peirce's categories have unusual qualities in that they can be used to define the origin of things, entities, or processes and later they are used to describe the emerging new creations and processes as natures evolves. The numerical categories impart a recursive quality to Peirce's evolutionary cosmology. The beginning of everything in sameness or homogeneity is what Peirce called firstness. As processes further actively develop and creatively and recursively substitute into the future, what is taking place has greater

complexity for which the category of thirdness was created. When thirdness settles down to a duality of entities constrained by boundaries or other limitations, then Peirce called this category secondness. The mechanical properties of our world and the universe are essentially described as residing in the second category and the properties of evolution and the mind are considered to have the more complex qualities of the third category. Peirce did explicitly develop relational comparisons for the categories and he also related them to the main ideas of other major philosophers and philosophies. Often Peirce used economic examples to illustrate thirdness and this may be why he illustrated the choices of consumers as a relational choice in the 1870s.

3. The Economic Strands of Peirce's Writings

While each of the strands to Peirce's writings cannot be covered in a relatively short paper, there is yet one more that needs to be explored because it involves economics. The main theme of this study is the puzzling relationship of Peirce and his writings to economics. Like the previous strands of Peirce's writings, the economic strand has at least four main sub-strands and they are interrelated with each other at times and with the other major strands of his system of thought on other ocassions. The substrands of Peirce's economic writings are:

1. Mathematical economics
2. Economy of research
3. Efficiency of cognition, abduction, and twenty questions
4. Ricardo as Peirce's favorite economist

Chronologically, the first economic strand is Peirce's interest in mathematical economics and the second, the economy of research and cognition, is also in important aspects an application of the first. Because the mathematical "Note on the Economy of Research" is the most prominent embodiment of both of the first two strands Peirce's writings, this is the piece to begin to reveal Peirce's extraordinary interest in mathematical economics. The "Note" also precedes and is closely related to Peirce's essays on pragmatism. Additionally it was the only writing on economics that was published in his lifetime. Thus the second strand is considered

first. Peirce's writings on the economy of research are as follows:

Note on the Theory of the Economy of Research (1876 [1879])
On the Logic of History (1901), passage on economy of research
On the Economics of Research," Memoir No. 28 of "Carnegie Grant Application, (1902a)
On the Economics of Research," Memoir No. 28 of "Carnegie Grant Application, earlier draft, 1902b

The "Economy of Research" note was published as part of the U. S. Coast Survey publications for the year 1876 which appeared in 1879. The year of authorship of the note is critical. A manuscript of the note has been dated to 1876. The importance of dating the note to 1876 is due to the "Illustrations" articles which are considered the founding contributions of pragmatism. They were published in 1877 and 1878 and came after the "Economy of Research" note. There are some significant economic themes in those articles and they have never been interpreted from an economic perspective. Also, one late preeminent Peirce scholar, Max Fisch, maintains that the "Economy of Research" is so important to understanding Peirce's conception of pragmatism that it should be considered a seventh essay on pragmatism. The body of the note provides the calculus of unconstrained utility maximization for two research projects with appropriate first order conditions. With his equations, Peirce argued that additional research funds should be allocated to two alternative research projects up to the point that the increment of knowledge from each project is the same per dollar of additional spending. The equations of Peirce's model are nearly identical to the ones which Jevons had authored in his now famous Theory of Political Economy where he compares the marginal consumption of two food commodities.[7] Also, Peirce provides a bi-directional graph of the marginal utility of each research project which is nearly identical to Jevons' bi-directional graph for equalizing the marginal utility of two food commodities. Peirce's "Economy of Research" may be the first truly sophisticated interpretation of utility theory a mere few years after the original founding contribution appeared.

Peirce returns to the theme of the economy of research in the "Logic of History" of 1901. The economy of research passage in that very long manuscript is about the equivalent of ten

pages. The first half of the "Logic of History" deals with methods of scientific and mathematical inquiry.[8] There is a substantial passage on infinity and the nature of sampling as it relates to the theory of probability. The main idea of the "Logic of History" is to create a method for historical inquiry and appraise research on the writings and ideas of Aristotle, Plato, and Pythagoras. The economy of research passage is used to criticize the German historical scholars for wasting information and not proceeding with the most efficient hypotheses regarding interpretations of the history of the ancient manuscripts. Another shorter writing about the economy of research was authored just a year later. In 1902 Peirce would make a grant application to the Carnegie Institution so that he could have the financial resources to pull his writings together late in his life. Although his application was rejected, he did intend to write again on the economy of research as "Memoir Number 28." The submitted version and a draft of that part of the application have survived. They indicate that Peirce was still thinking of the economy of research in the last decade or so of his life. Also when the Carnegie funding was denied, William James organized Peirce's Harvard Lectures of 1903 as a way of supporting Peirce's need to systemize and organize the main ideas of his philosophy.

The extremely mathematical nature of Peirce's "Economy of Research" essay raises interest in a general way about how much mathematical economics he knew. Peirce's writings and manuscripts on mathematical economics are listed below in chronological order:

Letter to Melusina Fay Peirce (1871a).
Letter to Simon Newcomb, (1871b)
[Letter to Benjamin Peirce] (1871c)
Calculus of Wealth (1871d)
Letter, Peirce to Abraham B. Conger 1873a
On Political Economy (1874a)
Note on the Theory of the Economy of Research (1876 [1879])
The Reciprocity Treaty with Spain (1884)
The Spanish Treaty Once More (1885c)
Harvard Lecture I: The Maxim of Pragmatism (1903)

Again, what drew my attention to this small collection of writings was an extraordinary short manuscript in which Peirce clearly provides what must be the first version of the axiom of transitivity in economics. The manuscript is "On Political Economy" and dated to 1874. Perice's version of the axiom is on the first page of this writing. If you generally think of the logicizing of microeonomics as happening with von Neuman and Morgenstern in the late 1940s or with Arrow in the early 1950s, then the unpublished "On Political Economy" is truly quite remarkable. How can it be that someone, whoever it was, was beginning to interpret mathematical economics in an axiomatic if not an algebraic way before much of mathematical economics had been created? The answer of course is that Peirce was part of the logicizing of mathematics with his development of his algebra of logic and his most important article was his "Description of a Notation of the Logic of Relatives" of 1870. So not only did Peirce have knowledge of advanced calculus and was exceptionally creative with its use, he also had moved on to create the ideas to analyze calculus with logic. He is one of the co-founders of mathematical logic. To a very significant degree, much of his mathematical inquiry had begun before the writing and publication of the "Illustrations" of pragmatism essays.

Turning to the first pieces on the preceding list, a further search of Peirce's manuscripts turned up three writings with fairly advanced mathematical economics dated to 1871. They reveal exchanges regarding a periodic meeting of prominent scientists and academics at Harvard which they called the Cambridge Scientific Club. The writings reveal that one of the meetings in December of 1871 was about Cournot's Researches into the Mathematical Priniciples of the Theory of Wealth (1838) using calculus to create a mathematical theory of the firm.[9] The letters explore conceptions of supply and demand and the nature of economic rivalry. One of the letters, from Charles to his father Benjamin, actually reproduces Cournot's now famous duopoly equations and Peirce's interpretation of those equations. Another manuscript from that era, "Calculus of Wealth" also explores aspects of the theory of the firm with fairly advanced calculus for its time. In the mid-1880s, Peirce actually applied the mathematical economics inspired by Cournot to an analysis of the Spanish Treaty and its implications for changing tariffs and the sugar trade. Peirce next returns to Cournot-like mathematical economics in the first Harvard Lecture on Pragmatism where he presents the optimizing calculus of the monopolistic

insurance firm as his most important illustration of pragmatism.

There is also one more economic theme or strand – the significant economic aspects of the process of abduction. As noted, abduction is also Peirce's term for guessing, or hypothesis formation and exploration. Abductive guessing for Peirce is the most efficient resource that human beings have. Humans have an ability to guess properties, patterns, and attributes about previously unknown phenomena that can be observed as the future unfolds. This ability to guess is far from perfect, but it is more efficient than random guessing. Because our guesses have a high propensity for error, they must be tested and this often involves resources. So abductive guessing and the economy of research go hand in hand. One of Peirce's favorite applications of the complexity of abductive guessing was his conception of "twenty questions." The game of twenty questions provided a game-theory like metaphor for how our minds and their abstractive capabilities could be used to anticipate the future. Peirce would often emphasize how different a conception of science would be if it were based on the idea of an abductive imagined sequence of twenty questions compared to either empiricism or rationalism. If there are but two alternatives for each question in the sequence, then 2^{20} implies an extremely rare, complex, and unpredictable sequence of questions that might lead to some informative piece of knowledge about the future.[10] In the last two of the Harvard Lectures, Peirce claims that pragmatism is equivalent to the logic of abduction. This means that Peirce's conception of pragmatism as abductive guessing, as a highly imperfect but economically efficient process of conceptually guided inquiry compared to random guessing, shows how central economic ideas were to his conception of pragmatism

Before leaving the subject of Peirce's interests in economics and beyond the three sub-strands noted so far, there is another matter or two that deserves some mention. Peirce did have a favorite economist who he mentioned most often as portraying the type of mind set he valued in economics. That economist was David Ricardo. Peirce thought Ricardo reasoned with an especially mathematical form of thought and inference. He was not a mathematical economist as such. But his approach to economic analysis seemed to emulate the logic of calculus in Peirce's view.[11] Peirce thought that Ricardo's theory of rent with its emphasis on diminishing returns as additional parcels of less productive land were brought into production revealed the logical structures of a mathematical mind. Another matter is that Peirce often gave an evolutionary

interpretation of or context for classical economics. Even if its emphasis on mechanical-like market processes might look non-evolutionary, Peirce did not interpret classical economics as if it were only mechanistic. He went so far as to suggest that Darwin in part was influenced by the theories of competition in economics when he focused on competition in the biological world. We also know from "Evolutionary Love" that Peirce (1893b) counted mechanical forces as evolutionary processes. We also know that institutional economists would have been very critical of Ricardo and the abstract theorizing of classical economics. They also interpreted mechanistic economic forces as warranting a full deterministic interpretation of economics. It would seem that Peirce would have differed with the broader interpretations of classical and neoclassical economics that institutionalists liked to adopt. A guess is that institutionalists are thoroughly unfamiliar with these aspects of Peirce's conceptions of economics.

4. The Strong Case for Peirce Influencing Institutional Economics

Having outlined the main strands of Peirce's writings and his several lines of interests in economics, the time has come to take up the literature on Peirce from the one school of economics that claims him as a unique and important source of philosophical and scientific ideas. The trail of favorable accolades to Peirce begins early in the history of the movement. Of course in spite of what might be an uneven record, of all of the schools of economics, probably no group seemingly has embraced the ideas of C. S. Peirce as much as the American institutionalists. One need look no further than several of the founding figures of institutional economics. J. R. Commons who is often identified with Thorsten Veblen and Wesley Mitchell as one of the three founding fathers of institutionalism has authored significant comments on Peirce's ideas. Also, some if not many institutionalists have been influenced by John Dewey. Dewey's classes on philosophy and pragmatism at the University of Chicago and then at Columbia University seemed to have had an influence on Mitchell, Clarence Ayers, and others who became prominent in institutionalist circles. Later institutionalists have taken Dewey's conception of science as an influential source and one continues to find relatively recent references to Dewey's works and also to Peirce. Also, articles about Peirce's influence on institutionalist theories, ideas, and historical figures continue to appear occasionally in the Journal of Economic Issues (JEI). The JEI is the scholarly

publication created by institutionalists after they lost a central role in American economics and the journal where many had published in the early decades of the twentieth century, the American Economic Review. Fortunately, Malcolm Rutherford (2011) has published a history of the institutionalist movement during the time it was first self-identified as a movement or school of economics. Rutherford's history, The Institionalist Movement in American Economics: 1918-1947, extends beyond the founding fathers Veblen, Commons, and Mitchell and includes many other influential figures.

American economics took a new turn in the 1880s when several young men interested in economics went to Germany to get their graduate degrees. Men such as Richard Ely, Edmund James and even John Bates Clark studied economics in the context of the views and writings of the German Historical scholars. They returned to the United States and wanted to form a professional association inspired by the academic associations they had observed in Germany. After at least one failed attempt, Richard Ely and others were successful in founding the American Economics Association (AEA). The AEA was dominated by ministers and sons of ministers during its first few years. They created a progressive view of economics and the role of government in relation to the economy. They argued for a larger role of the state in economic affairs and mostly focused on matters of regulation and taxation. Charges of socialism did arise, but the progressive founders denied being socialists. These American progressives were extremely critical of classical economics and its highly individualistic conception of economic activity and opposed giving it the highest place in economic analysis. After a decade or so, opponents of the AEA founders who favored the latest neoclassical developments in economics began to have more influence in the AEA. At that time, economics was often characterized as having a "new school" of economists dominated by the scientific and economic ideas of the American progressives and an "old school" which favored classical and neoclassical economic ideas. In the 1880s, Simon Newcomb was seen as the major proponent of the "old school." Subsequently, John Bates Clark, became the leader of the neoclassical school with its new ideas in microeconomics typically identified as "marginalism" and with the innovations of the British economic theorist, Alfred Marshall. Clark had studied in Germany as well but that did not seem to impede his interests in neoclassical economics.

Institutionalism emerged as an identifiable movement shortly after the end of World War I. The details about the origins of the term "instituionalism" can be found in Malcolm Rutherford's (2011) recent book. The term does appear in print in 1918 and by 1931 there was a major symposium on institutional economics that appeared in the American Economic Review. In the meantime, W. C. Mitchell had written about the state of economics and presented his view of the state of the economics profession in his 1925 presidential address at the American Economic Association. Rutherford summarizes some of the important aspects of this literature acknowledging Mitchell's interest in empirical research and eventually commenting on Dewey and Peirce:

> Institutionalism, then, clearly included statistical and quantitative work within its compass, but more than this: The early work on institutional economics is full of the rhetoric of making economics more "scientific." The idea of science contained within the literature of interwar institutionalism is clearly based on the pragmatic ideas of Charles Peirce and John Dewey .... (Rutherford 2011, p. 23).

A. John Dewey and Peirce

Probably the obvious place to begin with Peirce's influence on the intitutionalists conception of economic science is with John Dewey. Between two of his later most prominent former students, it was Dewey rather than Veblen who eventually came around to view Peirce as an important intellectual influence on his ideas. Consistent with Dewey's own accounts are the writings of many other institutionalists who also describe Dewey as having been influenced by Peirce. Clearly many institutionalists became informed about Peirce from Dewey in Dewey's graduate classes and give prominent mention to Peirce because of Dewey. We do know of course that Dewey encountered Peirce in graduate school at Johns Hopkins University. There Peirce offered two different classes on logic and the methods of the sciences and a survey class on the great men of western thought. The class on the great minds of the Western world was designed to teach methods of inquiry to those who were non-mathematical and non-scientific. Peirce created an elaborate survey of many questions to be used in reading the biographies of the great minds of

Western history. Dewey is known to have taken at least two classes with Peirce. One was the history of great men and the other most likely was the course on logic for the non-mathematical graduate students. Dewey is also known to have participated in the Johns Hopkins University philosophy club which was also given the name "Metaphysical Club" as mentioned above. Recall that Dewey is on the roll of attendees when Peirce presented his first speculative evolutionary paper, "Design and Chance."

While Dewey took classes from Peirce, he initially followed a path away from Peirce. For Dewey, Peirce seemed to be too much influenced by mathematics and the sciences. For the first decade or so after graduate school, Dewey was more of a philosophically minded psychologist. He wrote a well-known survey of psychology which was later eclipsed by William James's renowned work on that same subject. Like many other American philosophers, Dewey had an interest in German philosophy and was inclined towards Hegel. Just a few years ago it might have been possible to tell a story of sharp exchange between Peirce and Dewey that turned Dewey more toward logic and away from Hegelian philosophy. We do know that Peirce (1903) published a favorable review of a book on logic that Dewey (1903) had edited, Studies in Logical Theory, where Peirce publicly praised the work in The Nation. Perhaps this was enough to begin Dewey's increasing emphasis on logic and inquiry. However, in contrast to his public statements, Peirce was very critical of the book in private correspondence written with Dewey in mind. But these letters may never have been sent to Dewey. Whatever the case from that point forward, Dewey began to rethink his view of Peirce's version of pragmatism. Apparently, he made many favorable references in his graduate classes judging from the comments of his students who seemed to gain their knowledge of Peirce from Dewey. There are several places where Dewey comments significantly on Peirce's version of pragmatism. Just after his death, Dewey wrote an article on Peirce and pragmatism. After that there are at least three essays on aspects of Peirce's philosophy and three different reviews of volumes of the Collected Papers in the 1930s. Also in the 1930s, Dewey authored his penultimate view of the role of logic in inquiry, titled Logic: The Theory of Inquiry where Peirce is mentioned several times. One can imagine that Dewey's reading of the first six volumes of the Collected Papers affected the writing of his Logic.

Peirce died in September of 1914 just before World War I began. In tribute to Peirce,

Morris Cohen, a philosopher, organized a symposium of several essays about Peirce for the Journal of Philosophy, Psychology, and Scientific Method in 1916. Essays were written by Josiah Royce of the Harvard philosophy department, Cohen, and three of Peirce's former graduate students: Christine Ladd-Franklin, Joseph Jastrow, and Dewey. Cohen was originally from New York City and had developed an independent interest in philosophy. At one point he was admitted to Harvard as a graduate student in philosophy. He attended Royce's Harvard seminar where Peirce's ideas were given some prominence. Besides attending the symposium on Peirce, Cohen was interested in reprinting some of Peirce's publications. Cohen chose to republish Peirce's 1870s writings on pragmatism, the "Illustrations of the Logic of Science" and the series of essays published in the early 1890s in The Monist setting forth Peirce's evolutionary metaphysical ideas. The evolutionary metaphysical essays were a much richer expression of what Peirce had first expressed in "Design and Chance" his Johns Hopkins paper presented to the Metaphysical Club with Dewey and others in attendance. At the urging of his wife, Cohen had titled this first reprinting and collection of Peirce's writings, Chance, Love, and Logic. Cohen himself provided an introduction and a bibliography of Peirce's writings. After the eleven articles of the two series of Peirce's essays, Cohen included Dewey's article from the symposium of 1916. Cohen was also involved in the circle at Harvard who prepared Peirce's writings that would appear in the 1930s as the first six volumes of the Collected Papers of Charles Peirce.

The inclusion of Dewey's article with Cohen's introduction indicated that Dewey could be considered as something of an authority on Peirce. Dewey's (1923) piece was simply titled, "The Pragmatism of Peirce." Dewey begins by noting that it was William James who had first used the term pragmatism in publication. The term cannot be found in the "Illustrations" papers of 1877 and 1878. Dewey also notes that the use of the term "pragmatic" in English does not distinguish between two different senses of the term which can be found in the German language and also in the philosophy of Kant. Pragmatism does not mean "practical" in the ordinary, common sense understanding of that term in the English speaking world. Instead pragmatism is to be associated with the highly trained and honed habits of the experimental scientist. Pragmatism is essentially the generalized habits of thought and performance associated with focused, organized, and logically minded scientific inquiry. Because other pragmatists had emphasized more of the

practical mindedness of pragmatism, Peirce chose to disassociate himself from other pragmatists such as James and Schiller. Instead he created a more difficult term, "pragmatiscism," to convey his more rigorous, logical conception of inquiry that he thought was at the core of his philosophical views. In his article, Dewey qualifies the view that pragmatism is about beliefs that are validated in action. Instead, pragmatism is about a process of evolution in which our beliefs become more general as a consequence of a social process of inquiry. At the end of his review, Dewey maintains that "both Peirce and James are realists." Pragmatism entails realism because a realist point of view is about real things and processes which have real effects or consequences in the world in which we move, think, and act. Realism – the idea that patterns and properties of an external world may be independent of our awareness of them – is something which is a consequence of inquiry for Dewey. The real is something which is socially constructed as well.

Dewey's interest in Peirce's writings continued to grow. He wrote another essay on the development of pragmatism and Peirce's role in 1925. Dewey (1925, p. 3) credits Peirce as being the originator of pragmatism but claims that Peirce was "not at all a systematic writer and never expounded his ideas in a single system." Here Dewey doesn't seem to realize the significance of Peirce's various strands of inquiry. Dewey also comments on the various meanings of the term "pragmatism" in the German language where the word originates. Then Dewey explains HTMOIC again for his readers.

When the volumes of Peirce's Collected Papers began to come out in the 1930s, Dewey wrote several reviews. He authored a review of volume 1 in 1932, of volume 5 in 1935, and of volumes 1 to 6 in 1937. In the review of volume 1, Dewey praised the editors of the Collected Papers for their patience and devotion to editing the manuscripts of Peirce. He believes that the papers found in volume 1 have "succeeded to a degree which one would hardly have thought possible" and that Peirce is "the most original philosophical mind this country has produced" (Dewey 1932, p. 273). He also tells us that it is unlikely that Peirce will ever be known as a popular philosopher and that he is a "philosopher's philosopher, and in an unusual degree" (p. 273). In his review of volume 5, where the most important publications and writings on pragmatism are found, he claims that Peirce's pragmatism "cannot be grasped except as part of his general philosophical enterprise" (Dewey 1935a, p. 421). Dewey was impressed enough to

recommend that every philosopher should read it as a matter of obligation because it dealt with the most fundamental matters by the most original philosophical mind the nation had yet produced. Two year later, Dewey wrote another review of all six volumes of Collected Papers. Again Dewey's comments are quite mixed. Dewey recognizes that interest in Peirce's writings is only just beginning and that his influence will continue to grow. He (1937, p. 479) tells us that Peirce was "ahead of his times." Dewey goes on to tell us that Peirce has been neglected and that while he was sowing germinal ideas, "he flung abroad many stones, sometimes pebbles, sometimes boulders." He goes on to assert that Peirce united "a disciplined mind and an undisciplined personality" (p. 479). The last part of the review deals with Peirce's ideas on evolution and continuity.

In the 1930s while reviewing the Collected Papers, Dewey was working on his Logic: The Theory of Inqury which was published in 1938. Dewey turned eighty in 1939 so his Logic was written in his late 70s. Apparently he regarded it as his most important work and a reformulation of all that he had tried to achieve intellectually with his life.[12] In that work Dewey was very critical of the conceptions of logic he had learned at the University of Vermont and Johns Hopkins University. He was very critical of Aristotlean logic that he had learned from H. A. P. Torrey at Vermont and similarly, he questioned if not repudiated Hegel's conception of logic stemming from his graduate instruction with G. S. Morris. The first logician mentioned in Dewey's Logic is Peirce. This stands in sharp contrast to Studies in Logical Theory where Peirce is not mentioned at all. In the preface of Dewey's Logic, Peirce is prominently mentioned. Dewey acknowledges that Peirce's conception of the continuity of thought and inquiry has greatly influenced his views of human thought and logic. At one point, Dewey tells us that he has come to disagree with most logicians and their treatises on logic, but his disagreements do not extend to Peirce: "...with the outstanding exception of Peirce, I have learned most from writers with whose positions I have in the end been compelled to disagree."[13] Dewey acknowledges that the term "pragmatism" does not appear in the body of the text of his Logic. This is due to the controversies surrounding the term "pragmatic" as he was writing the book. However, he does claim that his book is "thoroughly pragmatic" if by that term is meant that consequences can be specified as tests of the validity of propositions where the consequences can be operationally carried out and resolve the problem

being investigated.[14] There are also two essays where Dewey (1935b, 1946) wrote about Peirce's philosophy and semiotics.

B. John Rogers Commons on Peirce's HTMOIC

While Rutherford's work clearly directs attention to Dewey as perhaps the most important figure carrying Peirce's ideas forward to economists in the early part of the 20th century, one of the founding figures of institutionalism also points to a crucial role for Dewey. Passages forging an intellectual connection between the ideas of Peirce and Dewey with economics can be found near the end of what may be the longest exposition of Peirce's ideas by a major economic figure. That long discussion is found in J. R. Commons's Institutional Economics which appeared in the inter war year of 1934. One of the early chapters, chapter four, is titled "Hume and Peirce" and runs for 27 pages. There Hume receives much more of the attention and the last seven pages are devoted to Peirce.

Institutional Economics is itself a long work running more than ten chapters and 900 pages. The longer chapters serve more as major divisions of the book. What precedes the chapter on "Hume and Peirce" is interesting. Much of the material builds towards creating a pivotal role for Peirce in Western thought. In the first chapter, Commons tells us what has influenced him to take the intellectual positions put forth in the work. Much of this is personal experience. In his early work experience Commons was a member of several unions. This piqued his interest in what he called "collective activity." He also read Henry George and took Richard Ely's class on economics and law at Johns Hopkins in 1888. His early professional experience provided opportunities to help draft laws in Wisconsin and at the federal level. His focus eventually centered on the emergence of the concept of intangible property. He also read the writings of a number of heterdox economists including Marx, Proudhon, and Carey.

The first really long chapter of Institutional Economics is the second one which is titled, "Method." It includes a long discussion of John Locke's Essay Concerning Human Understanding. What interests Commons is Locke's empiricist theory that the mind passively copies the mechanical properties experienced in our external environment. Initially, according to Locke, there is nothing in the mind that does not originate except through the senses. Commons does

emphasize that Locke had a concept of experience where emotions become associated with ideas and the mind becomes more active. From the discussion of the mind, Commons next moves to Locke's conceptions of value, custom, and law. The discussion of custom takes up the notion of transactions in economics as compared to exchange. A transaction is much more complicated and becomes much more complex than simple exchange if it is accomplished through detailed legal arrangements. It is as though institutions begin to emerge as exchange evolves into varying layers of legal transactions. In chapter III, Commons credits the French economist, Francios Quesnay with bringing the ideas of both natural and moral orders to economics.

Chapter IV on Hume and Peirce continues Commons' line of thought on the nature of social order and the motives, forces, or constraints that dominate the social order. Here is found a long discussion of scarcity and abundance. Apparently Locke and Quesnay had focused on abundance while Hume turned to scarcity. Relative scarcity gives rise to notions of property and justice. Hume also modified Locke's idea of the mind as copying sense impressions originating from external experience. Since sense impressions are ephemeral and do not endure, there is no certain foundation for knowledge. This leads directly to one of Hume's most famous doctrines that of extreme skepticism. Hume's skepticism is lessened by the presence of habit and custom. Habit and custom give rise to opinion and belief. Opinion and belief give rise to expectations about the future. But we are a long way from the certainty of knowledge that had pervaded much of western culture for hundreds of years.

While the preceding summary does not do justice to the rich and detailed nature of Commons' tour through much of western epistemology, a place has been reached where Commons brings Peirce into his discussion. Here Commons credits Peirce for giving an answer to Humean skepticism and for providing an active theory of the human mind and intelligence. In section three of the chapter titled "Pragmatism," Commons simply declares his view of the importance of C. S. Peirce to western thought:

> It was the founder of American Pragmatism, C. S. Peirce, in 1878, who dissolved Hume's skepticism by creating the concept of an active mind....We do not forget the hundred and forty years from Hume to Peirce, with its philosophical forerunners of

> pragmatism, such as Dugald Steward and William Hodgson. We simply find Peirce's method more useful for our purposes. Nor do we forget the fifty years since Peirce, with such successors as William James, John Dewey, and Schiller, nor the Gestalt psychology of Kohler and Koffka (Commons 1934, p. 150).

Commons goes on to note that he realized that Peirce had become dissatisfied with other versions of pragmatism. It is interesting that Commons was aware of this disagreement between Peirce, William James, F. S. C. Schiller and others at this early point in time:

> Peirce afterwards protested against the use made of his term "pragmatism' by James and Schiller, saying that his was a theory of knowledge and truth, while theirs was a philosophy of life, value, or desire (Commons 1934, p. 150).

If there are multiple interpretations of pragmatism, then something needs to be said indicating the relative priority of the different versions. Here is the resolution suggested by Commons:

> We are compelled, therefore, to distinguish and use two different meanings of pragmatism: Peirce's meaning of purely a method of scientific investigation, derived by him from the physical sciences but applicable to our economic transactions and concerns; and the meaning of the various social-philosophies assumed by the parties themselves who participate in these transactions. We therefore, under the latter meaning, follow most closely the social pragmatism of Dewey; while in our method of investigation we follow the pragmatism of Peirce. One is a scientific pragmatism – a method of investigation – the other is the pragmatism of human beings – the subject-matter of the science of economics (Commons 1934, pp. 150-151).

What follows seems to be quite extraordinary from the vantage point of Peirce and economics. In the next few pages of Institutional Economics, Commons compares Hume and

Peirce based on what may be Peirce's (1878) single most well-known piece, "How to Make Our Ideas Clear" (HTMOIC). Commons picks up the theme of the nature of human thought that he had developed in such detail in his discussions of Locke and Hume. Commons has a long quotation from HTMOIC where Peirce compares music to thought. Thought has a continuous feeling of awareness which includes the flow of time which is different than the subjective experience from sense impressions. Hume's direct impressions of sense serve as the notes in this musical analogy. Conscious thought for Peirce is like the continuous sense of melody that flows through the stream of sensations which form the basis of a musical experience. At another point, Commons quotes at length from HTMOIC regarding the characteristics of beliefs which have a high degree of reliability. Beliefs that are to be taken seriously result in habits of thought and action. Volition is part of the process so there is an element of conscious deliberation. Such beliefs must be in our awareness, they must resolve an irritation of doubt, they must result in some rule of action, the action must then result in a habit of action as a consequence of choice. At this stage of his review, Commons quotes Peirce's well-known maxim of pragmatism that seems to focus on sensible consequences: "Consider what effects, which 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." And Commons adds this trailing comment to Peirce's maxim, "In other words, Pragmatism is Futurity."[15]

Keeping in mind that Commons's interest in economics focuses on multi-person rather than individual patterns of activity, he next turns to comparing Hume and Peirce on habit and custom. Apparently Hume was extremely individualistic and could not distinguish between custom and habit. However, Peirce emphasized the agreement of an informed community making use of all available knowledge including experimental results. Peirce's emphasis on a community of inquirers permitted him to distinguish between habit and custom. Habit is individual and limited to the experience of a single person while custom is social: "Peirce requires only social confirmation by all who see, remember, and confirm by experiment .... This is the difference which we shall make between bias and science, and between Habit and Custom. Bias is individual opinion. Custom is consensus of opinion."[16] In Commons's view, Peirce reveals Hume's deficiencies. Hume viewed the mind as passive and thought that sense impressions had little

duration. In contrast, Peirce viewed the mind as active and having duration. Thus an instant of time is experienced in the present as being in continuous relation with the past and the emerging future. Commons's views on the new ideas which Peirce brings to philosophy and economics are full of expressiveness and layers of nuance. Here is an example of the significance which he attaches to the ideas of Peirce:

> Since Peirce's concept of the mind was that of an active organizer of impressions, Hume's "impressions" themselves are now seized upon in their external relations of parts to the whole activity, past and future, instead of coming in to the mind as separate impressions associated by resemblance, contiguity, and succession. The mind does not wait for impressions, it is continually looking for them, breaking them into parts, and reconstructing them into new feelings. These new feelings are not Hume's passive impressions, but are Peirce's active beliefs reaching forward for future action. It is this relation of the part to the whole and of the past experience to future expectations that becomes the psychology of our transactions and going concerns (Commons 1934, pp. 152-153).

What follows is more contrasts of Hume and Peirce and the need to emphasize the social nature of custom. Near the end of this line of thought, Commons provides several elaborate comments in summarizing his point of view:

> Thus we approach, through Hume in 1739 and Peirce in 1878, the meaning of meaning. This meaning, however, is not yet complete for our economic purposes, because Hume was an individualist and sensationalist, while Peirce's field of research was the physical sciences. Not until we reach John Dewey do we find Peirce expanded to ethics, and not until we reach institutional economics do we find it expanded to transactions, going concerns, and Reasonable Value. Yet Hume's "belief," as interpreted by Peirce, is what we mean by meaning (Commons 1934, p. 155).

And finally, Commons tells us what it means to apply Peirce to economics:

> Peirce's pragmatism, applied to institutional economics, is the scientific investigation of these economic relations of citizens to citizens. Its subject-matter is the whole concern of which the individuals are members, and the activities investigated are their transactions governed by an entirely different law, not a law of nature but a working rule, for the time being of collective action (Commons 1934, p. 157).

Thinking back to the major strands of Peirce's writings, Commons seems to emphasize the second and third strands, that of pragmatism and evolutionary philosophy.

C. Allan Gruchy and Peirce

Just a little over two decades from Dewey's essay on Peirce's pragmatism and a decade after Commons' Institutional Economics came another one volume work on institutional economics. It is probably the next best discussion of Peirce's intellectual impact on institutional economics after Commons' contribution. Commons had noted how different Peirce's philosophy of mind was compared to that of Hume and the difference this made for viewing the individual as part of a social process. Taking a somewhat different intellectual approach, Allan Gruchy in a work titled, Modern Economic Thought: the Amercian Contribution, comments extensively on Peirce's contribution to what Gruchy called "economic heterodoxy." Instead of commenting on Peirce's different philosophy of mind or taking the line of interpretation offered by Commons, Gruchy focuses on extensive mechanistic aspects of mainstream economics. In the introduction to his book, Gruchy claims that British and American economics had focused on the enduring, static features of the economy from an intellectual vantage point which was extensively mechanical. For example, the theories of monopoly, competition, and markets, as found in American economics in the 1940s, were interpreted as being very mechanistic by Gruchy. Theoretical attention was on the mechanical logic of economic decisions rather than the social processes of economic activity or the organizations of capitalism. Gruchy notes the widespread use of "rigid analytical molds that

served the generation of A. Marshall, J. B. Clark, and F. W. Taussig" (Gruchy 1947, p. 14).

After characterizing neoclassical economics, Gruchy titled a section of his discussion "The Philosophical Foundation of Economic Heterodoxy." Peirce is considered to be among those contributing to new philosophical thinking such as: "Hegel, Marx, Darwin, and Spencer in Europe, and of Peirce, James, and Dewey in the United States" (Gruchy 1947, p. 15). Gruchy claims that Hegel and Marx attacked the mechanistic conceptual view of Newton and other Anglo-Saxon thinkers. But it was Peirce who best expressed the new, anti-mechanical point of view:

> The new anti-mechanistic way of looking at the world was not merely a borrowed intellectual product as far as American thinkers were concerned. A unique movement in the intellectual history of the United States was begun in 1868 by Charles S. Peirce with the publication of a number of essays on the nature and logic of scientific thought. (Gruchy 1947, p. 16).

What follows is Gruchy's account of Peirce's conception of scientific explanation (Gruchy 1947, p. 15) which is influenced by his evolutionary account of how the universe began. This evolutionary perspective led to an inversion as to how things should be conceived:

> In order to explain his scientific views Peirce had to work out an explanation of the nature of the universe. In doing so he started with the fundamental proposition that the basic features of reality are not its uniformity and its capacity to remain unaltered, but its diversity and its capacity to change and develop. As Peirce explained it, our universe began with an original "germinal nothing" which consisted of an "undefined and unlimited possiblity – boundless possibility ... freedom." According to Peirce's interpretation the universe developed out of an original spontaneity which has in time, merely as the result of chance happenings, come to exhibit certain uniformities of behavior (Gruchy 1947, p. 16).

A consequence of Peirce's evolutionary and indeterministic insight was that it cast doubt on

"the whole thought pattern or framework of interpretation of those individuals who clung to the inherited mechanistic Weltenschauung" (Gruchy 1947, p. 16). Gruchy holds that this means that probabilities replace the mechanistic thinker's absolutes. He believes that probabilities open things to the possibility of change or novelty while a conceptual world of absolutes closes the door on more dynamic perspectives. He claims that Peirce had a dramatic impact on American thought:

> In the final analysis Peirce may be said to have restored life and growth to a universe which had been almost stilled by the absolutist convictions of those who clung to a mechanistic intellectual orientation.
>
> Peirce's views on a universe filled with spontaneity, diversity, and chance development were accepted by William James and John Dewey, who came to regard Peirce as the founder of American pragmatism. James and Dewey, following Peirce, take the world order to be not a stable mechanism but a continuum or an emergent process (Gruchy 1947, p. 17).

Gruchy's depiction of Peirce's system of ideas seems to deal mostly with the third strand, evolutionary philosophy and cosmology.

5. The Weak Case for Peirce Influencing Institutional Economics

It should be clear from the writings of Dewey, Commons, and Gruchy, that a case can be made for Peirce as an important philosophical and scientific influence on institutional economics. Each seems to have emphasized a different strand of Peirce's writings. Dewey took up Peirce's ideas on logic and philosophy, Commons emphasized Peirce's writings on higher mental processes and the essays on pragmatism, while Gruchy focused on Peirce's evolutionary indeterminism. There is no common narrative about Peirce that is shared by Dewey, Commons, and Gruchy. That each of these important figures emphasized very different aspects of Peirce's thought and writings and did not build on one another's interpretations imparts a certain unevenness about the influence of Peirce that must be acknowledged. Additionally there are others of prominence within institutional economics who seem to ignore his ideas. A significant problem is that two of the

three founding figures of institutional economics, Veblen and Mitchell, either pay no or very little attention to Peirce respectively. It is hard to know what to make of the sharp differences that institutionalists exhibit with regard to Peirce. It could be the case that Peirce's role is acknowledged in detail by a few leaders while other leaders moved on to new theories and subjects of inquiry. But the differences are too significant to be ignored and have not been discussed or acknowledged by institutionalists but for the case of Veblen. For Veblen, various writers have suggested lines of connection between Peirce and Veblen even though Veblen never mentions Peirce. For Mitchell, one can find a citation or two to Peirce, but nothing on the order of influence that Peirce had on Dewey, Commons, or Gruchy. Also no one seems to have written about the influence of Peirce on Mitchell as they had for Veblen.

A. Thorstein Veblen and Peirce

In the writings of Commons and Dewey, who were two of the leading figures of institutional economics when it emerged as an influential school of economic thought, one can find extensive, interesting, and somewhat contrasting comments on Charles Sanders Peirce. Allan Gruchy's work also provides an important statement about the role of Peirce's ideas. For the third figure, Thorstein Veblen, things are quite different. In contrast to Commons, Dewey, and Gruchy who directly credited Peirce for influencing their views, there appears to be no direct connection between the writings of Peirce and Veblen. The question of whether Peirce influenced Veblen is one that has intrigued several commentators over the past few decades. Those writers have suggested reasons for maintaining a line of influence between Peirce and Veblen even if it was never acknowledged by Veblen. One can begin by noting again that Veblen did attend America's first graduate university while Peirce was in residence as a lecturer. Veblen apparently attended Peirce's class on elementary logic at Johns Hopkins and this is the kernel of experience that has led subsequent thinkers to suggest that somehow Peirce influenced Veblen. The general idea is that Veblen would have heard of Peirce's conceptions of science and logic and become familiar with his writings especially the essays on pragmatism, of 1877-78. They had just appeared in print in and would have been viewed as being relatively fresh statements of his conceptions of science and logic by his students in the early 1880s and one would hope that this would include the attention of

Dewey and Veblen as well. Those who have drawn a connection between Peirce and Veblen have done so by arguing for a similarity between some ideas in Peirce and conceptions later developed by Veblen. Again, without any direct evidence, the idea persists among institutionalists that Veblen was fundamentally influenced by the ideas of Peirce in some profound way.

The first person to suggest a line of influence between Peirce and Veblen was Veblen's biographer, Joseph Dorfman. Dorfman claims that Veblen referred to Peirce's class in a letter to President Daniel Gilman when Veblen conveyed his request for a scholarship so that he could remain at Johns Hopkins for another year: "The letter to the president reveals what the official records do not, that some time after the term began Veblen became interested in the lectures on "Elementary Logic" given by a man who was later to be recognised as a creative intellectual force. This was Charles Peirce, a temporary lecturer" (Dorfman 1934, p. 41). Dorfman identifies several ideas of Peirce's that he believes influenced Veblen. One was that the function of thought was to produce habits of action. Another was that the habits of the mind coalesce into "guiding principles." A third was that thought is a type of action which results in further thought. Also, Dorfman noted that Peirce emphasized a philosophy of inquiry which seems to be at odds with a method of authority rooted either in sense experience or common sense. In other words, Veblen may have gotten his critical stance towards much of western philosophy from Peirce.

A half century after Dorfman's biography, the question of the relationship of Veblen's ideas to Peirce led to several articles in recent decades. In what may have been the first of recent contributions connecting Veblen and Peirce, Alan Dyer (1986) explores how Peirce's ideas may have influenced Veblen's conception of scientific creativity. Dyer focuses on Peirce's conceptions of human reasoning and the sense of imaginative playfulness that often accompanies creative scientific inquiry. Dyer's article takes up Peirce's processes of reasoning not from the "Illustrations" essays of the late 1870s, but from one of his last essays written thirty years later, "A Neglected Argument for the Reality of God" (1908). The "Neglected Argument" article emphasizes several of the important strands of Peirce's writings such as the three major processes of human reason in the scientific process – induction, deduction, and abduction, the methods of the sciences, and the concept of deity in the context of an evolutionary philosophy and universe.

The piece also characterizes a playful sense of hypothesis creation which he called

musement. Peirce's basic notion is that the idea that God exists is ventured as a playful abduction or hypothesis that could be true but not provable. This again should be contrasted with William James' idea of the "Will to Believe" that theism is plausible if the evidence for its opposite is not definitive. In the "Neglected Argument," Dyer ignores the main theme of Peirce's article – his argument for theism – and makes an application of several of the sub-themes relating to scientific inquiry. Dyer sees an intellectual connection between Veblen and Peirce's conceptions of science as a process with various phases as presented in the "Neglected Argument." In terms of its phases in the "Neglected Argument," science is portrayed as beginning with an abduction or hypothesis, the abduction then is followed by deductively derived consequences, and those consequences in turn result in the inductive processes of investigation producing meaningful evidence on which to base a provisional conclusion. This provisional conclusion is recognized as having the character of a guess if the evidence is weak. More specifically, if science is viewed as a series of phases and if these phases of the process are carried out with a sense of imaginative creativity, then there may be a similarity between Veblen's and Peirce's conceptions of the scientific process. Also Dyer argues that Veblen's conception of "idle curiosity" is very similar to Peirce's conception of "musement" and that Veblen's comments on deduction and induction exhibit an appreciation of Peirce's idea of abduction.

Even though thirty years had passed since Peirce's "Illustrations" articles on pragmatism, one can see a line of connection between the presentation of Peirce's conception of human reason in the "Neglected Argument" article and the essays on pragmatism. The famous "Illustrations" series would have been readily available to graduate students like Veblen and Dewey, other founders, and later prominent institutionalists from the late 1870s forward. While many interpreters look initially and almost exclusively to two the first two essays in the "Illustrations" series, HTMOIC and "Fixation of Belief," Dyer's interpretation could have started from another article in the "Illustrations" series, "Deduction, Induction, and Hypothesis" (DIH). Passages on the three processes of human reason also appear in the evolutionary Monist series of 1892-93. Of the three processes of human reasoning, Peirce's special contribution was the third process hypothesis (or abduction). Hypothesis was Peirce's idea about how humans make logical inferences about events unfolding towards the future. In other writings, Peirce also used the terms "retroduction"

and "abduction" to refer to this third process of human reasoning oriented towards the future. What is odd of course is that Dyer bases his interpretation directly on one of Peirce's more obscure articles when one of the original essays on pragmatism would seem to have been a more obvious starting point and possibililty more directly influential on Veblen.

In an article about a decade later titled: "What Veblen Owed to Peirce – The Social Theory of Logic," Robert Griffin (1998, p. 734) claims that Veblen's exposure to Peirce "made a difference in his philosophical and scientific thought." Making this connection is not straight forward since Griffin also notes that "Veblen wrote nothing about Peirce and never referred to him (p. 734)." Griffin goes on to elaborate the four methods of inquiry identified by Peirce in the article preceding HTMOIC, "Fixation of Belief," and to identify aspects of Veblen's thought which seem to be inspired or very similar to ideas that Peirce had developed. One interesting connection is that Griffin asserts that Veblen (pub date?) used ideas from Peirce in his published review of Kant's Critique of Pure Reason. In particular, he believes that Veblen's restatement of Kant's conception of adaptation is very similar to Peirce's pragmatic maxim as found in HTMOIC. Also the concept of adaptation leads us to an emphasis on guessing. Of course Peirce had a great deal to say about guessing as noted several times already. Another suggested connection concerns one of the four methods of inquiry from the "Fixation of Belief," Peirce's method of tenacity. Griffin points out that Veblen analyzed economists as being tenacious with their methods in his 1925 critique of the discipline in the AER. Again, Veblen does not mention Peirce, but one can see why Griffin claimed there could be a Peircean influence. Also, Griffin suggests that Veblen's adoption of an evolutionary framework could have been due to Peirce. Going back to the idea of strands of Peirce's writings, one can clearly see that Griffin has quite understandably embraced the second and third strands of interpretation suggested previously.

Turning to what may be the most recent example of authors suggesting a connection between Veblen and Peirce, John Hall and Oliver Whybrow (2008) make an unusual connection to Peirce's writings. Like Dyer, they bypass Peirce's original articles on pragmatism and the The Monist evolutionary series. Instead, they focus on one of his more esoteric ideas his conception of continuity. Their claim is that it is Peirce's conception of continuity which most influenced Veblen. Hall and Whybrow do not reference The Monist evolutionary series. There Peirce does

offer an account of his conception of continuity. There Peirce thought that everything in the world of ideas and the mind is continuously connected. As was his custom, Peirce (1892, p. 313) used an ancient Greek word to name his theory of continuity with the term "synechism." What Hall and Whybrow argue is that Peirce's conception of continuity strongly influenced Veblen's conception of evolutionary, cumulative causation. Furthermore they argue that this conception was Veblen's most important contribution to economics. Veblen's concept of cumulative causation also functions to distinguish mainstream economics from Veblen's economics and thus from institutional economics.

Besides ignoring two of his most well-known articles series – the essays on pragmatism from the late 1870s and evolutionary metaphysical articles of the 1890s – there is another problem with Hall and Whybrow's interpretation of Peirce. Hall and Whybrow seem mostly to ignore many of the more important aspects of Peirce's theory of evolution. As a basis for their claim, they mentioned Peirce's conception of philosophical categories instead of his more direct ideas on evolution. Now Peirce did offer versions of an evolutionary cosmology in his "Guess at the Riddele" (1887-88), "Evolutionary Love" (1893), and the Harvard "Lectures on Pragmatism" (1903) using his philosophical categories numerically named as firstness, secondness, and thirdness. But those categories and Peirce's application were so abstract and depended on Peirce's even more abstract conceptions of mathematics, logic, and mathematical logic, that it is hard to believe, that Veblen with his aversion to mathematics and logic would have developed his ideas from Peirce's categories.[17] Also, not mentioned is that Peirce thought there were three different types of evolutionary processes. As was his custom he provided terms rooted in Greek words for these processes as a way of distinguishing his ideas from those of others. For Peirce, there was evolution by mechanical forces (anancasticism), by chance (tychism), and by higher purposes (agapasism). Also synechism or continuity as mentioned previously, describes the realm of ideas and the mind where Peirce holds that ideas and thought are continuously connected even as they change. Perhaps Veblen's conception of cumulative causation is a combination of many of these ideas and its possible that they bear some influence from Peirce. That would assume that Veblen had read Peirce's second most well-known set of evolutionary metaphysical essays in The Monist from the early 1890s. These essays would have been available to Veblen through Cohen's volume

Chance, Love, and Logic or in original form from The Monist in 1891 and 1892. But Hall and Whybrow did not base their interpretation of Peirce's evolutionary ideas affecting Veblen on these readily available articles. Unfortunately the lecture series Hall and Whybrow seem to cite unknowingly as a reference for Peirce's ideas on evolution, the Cambridge Conference Lectures of 1898, likely was not available even as excerpts for several decades until they were published in a disjointed and incomplete way in the Collected Papers in the 1930s just after Veblen died.

In summary, there have been several notable attempts to connect the ideas of Peirce and Veblen, even though Veblen never did cite Peirce. The strategy seems to be to pick a writing or two of Peirce's that must have influenced Veblen in some hypothesized way for some particular reason. The problem is that the selected avenues of connection pose problems of their own and they are all different. Furthermore the chosen lines of connection often obscure, distort, and or incompletely draw on Peirce's writings. In some very important respect, the literature attempting to connect Peirce and Veblen is fragmentary , unsystematic, and unconvincing. The various interpreters seem to pick up on one or another strand of Peirce's writings almost haphazardly without recognizing or criticizing the validity of the other Peirce-related interpretations of Veblen. It seems that a systemic and sustained line of intellectual connection between Veblen and Peirce has yet to be established.

B. Wesley Clair Mitchell and Peirce

Other than Dewey, Commons, and Veblen, the other figure considered to be one of the prominent founding figures of institutional economics is Wesley Clair Mitchell. Mitchell is known for several things: as the most quantitative of the founders for his path-breaking efforts to study business cycles, and as a founder of the National Bureau of Economic Research. Mitchell earned his doctorate at Chicago when Dewey and Veblen were both there. Mitchell's connections to Peirce are not like those shown for Dewey and Commons, or like what was suggested for Veblen. Clearly Mitchell could have learned of Peirce from Dewey at Chicago. Mitchell does reference Peirce in at least one place but that has more to do with Commons. The reference appears in Mitchell's (1935) review of Common's Institutional Economics which as we know, includes the long passage on Peirce's philosophy compared to Hume's. So this is really a second-hand

reference to Peirce. Also, in Mitchell's (1967, 1969) two-volume work on the history of economics with chapters on institutional economics, Types of Economic Theory, Peirce is not mentioned even in passing. Given the remarkable passages and writings of Dewey, Commons, and Gruchy where extensive connections are made between Peirce and the ideas of institutional economics, this is all the more surprising if not perplexing.

Similar comments hold for Mitchell's publications on business cycles at the NBER.[18] Even when there are discussions of economic theory, scientific method, and the role of mathematical economics, Peirce is never mentioned. Also, there appear to be no articles in recent decades like those comparing Peirce and Veblen trying to find an indirect connection or some influence that Peirce must have had on Mitchell. Given that Peirce was so interested in quantitative research and statistics, it does seem odd that no one has written a piece exploring the similarity or lack thereof of Veblen's conception of quantitative investigation with Mitchell's allowing for differences between physical and social science applications of those methods. Also, Mitchell seems to have been more influenced by Veblen than Dewey or Peirce. Like Veblen, Mitchell seems to have been very critical of utility theory and its mathematical formulations holding that they are based on a hedonistic and outdated psychology. But these criticisms are no where linked to the ideas of C. S. Peirce and his criticisms of utilitarianism.

C. Clarence Ayres and Peirce

Clarence Ayres (1891-1972) is another important historical figure in institutional economics for the first half of the 20th century. Among later generations of institutionalists, Ayres is sometimes often portrayed as being just as important as its founders such as Dewey, Veblen, Commons, and Mitchell. Ayres had taken his graduate degree in philosophy at the University of Chicago and there was introduced to the ideas of Veblen and Dewey. Like the founding institutionalists, Ayres was very critical of capitalism, neoclassical economics, and overly mechanistic conceptions of science and economics. As with Veblen and because of the many prominent references to Peirce in the institutionalist literature over the decades, the question can be raised -- did Peirce have any real influence on Ayres?

Possible lines of influence between Peirce and Ayres could run through Dewey and

poosibly Veblen if one beieves that he had been influenced profoundly by Peirce. This connection has been explored by H. H. Liebhafsky (1986). Liebhafsky answers the question of Peirce's influence on Ayres affirmatively. To support this claim, he wants to argue that there is a similarity between Peirce and Ayres on how human values are created and altered. Leibhafsky then argues that Ayres' conception of the processes of determining human values are actually a qualitative version of Peirce's conception of a self-correcting methods of science as Peirce outlined in his essays on pragmatism and in subsequent restatements of those methods later in his life. In presenting a summary of Peirce's ideas, Leibhafsky does cite several of Peirce's essays on pragmatism. He also notes ideas from Peirce's evolutionary essays of the early 1890s and the essays in the 1905 and 1906 where Peirce restates his conception of pragmatism. Liebhafsky's summary of Peirce's ideas in just a few pages is one of the better presentations of his ideas in the institutionalist literature on Peirce. With respect to direct influences from Peirce to Ayres, Leibhafsky provides these informative remarks:

> Ayres did not discuss Peirce's philosophy substantitively in his courses, nor did he do so in any of his books. At most, he may have mentioned that Peirce was generally considered to be the originator of Pragmatism. Peirce's name does not appear in Toward a Reasonable Society. But if Ayres apparently ignored this philosophy of Peirce, he was more than generous in acknowledging his debts to Thorsetein Veblen and Dewey (Liebhafsky 1986, pp. 5-20).

Leibhafsky goes on to note that Peirce was a realist and claims that both Peirce and Ayres rejected humanism. He also claims that both Peirce and Ayres were fallibilists claiming that Ayres accepted Peirce's conception of fallibilism. In his conclusions, Leibhafsky (1986, p. 19) asserts that Ayres had come to the same view as Peirce that "scientific method was the best method for fixing belief." Liebhafsky's final comment reveals that he believes that institutionalists do not know enough about Peirce:

> By 1961, many of Peirce ideas had been widely diffused and become part of the

> public domain. Nevertheless, contemporary institutionalists would benefit from a more careful study of his many papers. The quotations I have used herein constitute a sampling of his logical approach, and I have by no means exhausted his contribution (Liebhafsky 1986, p. 19).

Just a year before Leibhafsky's article was published, the relationship of Peirce's philosophy to institutional economics had been taken up by Mark Lutz (1985) although Liebhafsky did not reference Lutz. Lutz was exceptionally critical of Ayres social philosophy with the criticism coming from an interpretation of Peirce's philosophy based on writings institutionalists mostly have not emphasized. Lutz contended that Ayres' interpretation of the self-correcting method of science as a model for a self-correcting process for creating instrumental human values really did not fit well with Peirce's conception of science or religion. Lutz traces many of Peirce's comments on religion and the relationship of science and religion holding that Peirce's pragmatic methods of science really parallel a separate human process for critically reviewing and appraising human beliefs outside the realm of science. Lutz argues that Peirce did not believe that religious beliefs should be subject to the detailed scrutiny of a scientific theory being appraised with some version of a scientific method.

Lutz is one of the few economists writing about Peirce and institutional economics who has made use of Peirce's 1892 article, "Evolutionary Love." There Peirce portrays the process of evolution as one which allows many types of human and social process to emerge. Among those processes are some if not many that are focused on "higher purposes." Religious purposes are certainly among those purposes, but so are other domains of humanity activity such as art, education, and science. In "Evolutionary Love," Peirce is raising the idea that evolutionary and social processes create contexts in which they surpass their instrumental origins and grow to embrace the highest of purposes. The growth of human civilization towards higher purposes was one of Peirce's three major categories of evolutionary processes. Higher purposes were termed by Peirce as "agapastic" processes after the Christian conception of self-less other centered love. It is in this article that are found some of Peirce's most biting critiques of an economics premised on theories of self interest. Two other categories of evolutionary processes were those resulting from

mechanical forces and those due to chance. For the goals of agapastic processes Peirce used the idea of a "summum bonum" to describe higher ends which which lie beyond those dominated by instrumental value. At this point, Peirce would argue that such higher purposes required the use of aesthetic judgments. Lutz summarizes his conception of Peirce's view of economics and ethical values:

> The entire ethics of Peirce was founded in the view that personal existence is an ephemeral affair, together with the view of the evolutionary process moving inexorably toward an unlimited community embodying concrete reasonableness and creative love. The best means towards realizing that goal is to rise above one's self-interest in following reason disinterestedly and in loving self-giving (Lutz 1985, p. 145).

Lutz's critique did lead to a response by Lewis Hill (1986) and a rejoinder by Lutz (1986). Hill re-asserts that an instrumental value theory was developed by Dewey and picked up by Ayres which is prominent in much of late 20th century institutional economics. Further he asserts that this instrumental value theory is consistent with Peirce's conception of the self-corrective methods of inquiry of found in science and that religious beliefs and human values are not incompatible with this instrumental value theory of institutional economics. Hills view of Ayres and Peirce was better summed up a few years earlier, Hill had written that:

> Clarence Edwin Ayres is my choice as the fourth among the founding pioneers of institutionalism because in my judgment he was more directly in the Veblenian tradition than any of his contemporaries....Veblen had acquired [his conception of pragmatism] from C. S. Peirce at Johns Hopkins, William James at Yale, and John Dewey at Chicago....Clarence Ayres, was, in my judgment, the greatest philosopher of the institutional school of economic thought in the same sense that Commons was its greatest historian and Mitchell was its greatest statistician (Hill 1981, pp. 313-314).

In his reply, Lutz reiterates that there is an inherent conflict between a conception of final cause or purpose and the instrumental value theory that seems to be so characteristic of Veblen and Ayres.

E. Later Institutionalists and Peirce

Other than the founders of institutional economics, there have been subsequent prominent figures who have provided several comprehensive volumes setting forth the main ideas of institutional economics. Among these subsequent prominent figures, the uneven pattern with regard to Peirce as found with Veblen, Mitchell, and Ayres seems to continue. Again, in some works he is neither mentioned nor cited, in others he is mentioned as a touchstone in passing to more important ideas, and in a few places Peirce is portrayed once again as one of the central inspirations of the scientific method of institutionalist economics.

In a highly selective compendium written by Paul Homan (1928), Contemporary Economic Thought, long intellectual biographies were written for several major figures of economics at the end of the 1920s. Homan apparently wrote much of the book while in residence at the Robert S. Brookings Graduate School of Economics and Government, where institutional economics played a major role. He also played a prominent role at the meetings of the American Economics Association in the 1931 where the subject seemed to be the coherence and future of institutional economics. Homan's subjects are the lives and economic contributions of John Bates Clark, Alfred Marshall, John Hobson and also Veblen and Mitchell. In portraying the two institutionalists and their conception of the economy, Homan comments on the importance of Mitchell and Veblen:

> If Veblen is the Messiah, Mitchell is at least the high-priest of what has come to be called in the United States "institutional economics," the devotees of which are coming to include a considerable portion of the more capable younger economists. It cannot be said that there is any particular unanimity among them as to the proper scope and method of this new and well-advertised brand of economics. (Homan, 1928, p. 414.

Homan goes on to note that institutionalists can be recognized by several loosely bound

intellectual principles. They hold "a highly skeptical attitude toward the 'principles' of all variants of classical economic theory" (p. 414). Their aim is understand the institutional arrangements of the economy. They seem to hope for some type of synthesis of that will coalesce into a body of economic theory at some point in the future. With regard to Peirce, and somewhat like Veblen, Mitchell, and Ayres, Homan never mentions Peirce in his account of institutional economics. Nowhere in Homan's book is Peirce mentioned as an intellectual influence or precursor of anyone. Homan does not pick up on Dorfman's suggestions that Veblen had influenced Peirce nor does he mention the impact of Peirce through Commons on Mitchell on institutional economics. Apparently, the influence of Peirce on key features of institutional economic thought or method at that point in time was simply not perceptible or not prominent enough to mention. Perhaps Peirce's place of influence in institutional economics is not as settled as some would like to believe. It could be that the place of Peirce within institutional economics must also be one of those loosely bound principles of heterodoxy.

In more recent works that were written as systematic restatements of institutional economics by prominent scholars in the field, one can find little more than token references to Peirce if any at all. They are closer to Homan or Mitchell with little or no emphasis on Peirce than to Commons or Gruchy who portray Peirce prominently. One of those later works aiming to be a definitive restatement of institutional economics is Marc Tool's (1979) The Discretionary Economy: A Normative Theory of Political Economy. Tool is writing less than two decades after the institutionalists had founded a new professional association and he would become the editor of its new journal for a time. In the preface, Tool (1979, p. xv) claims that his book "offers a theory of political economy based mainly on economic, political, and philosophical writings of American (U.S.) contributors. It presents a normative and evolutionary point of view – technically a neoinstitutionalist perspective." The first substantive chapter in Tool's work, titled "Social Inquiry and Reality," outlines many approaches to scientific method in economics not just that of institutional and neoclassical economics. What is surprising is that this chapter is preceded by a well-known quotation from Peirce's Cambridge Conference Lectures of 1898. On the page before the prose begins is found this quote:

> Upon this first, and in one sense this sole, rule of reason, that in order to learn you must desire to learn, and in so desiring not be satisfied with what you already incline to think, there follows one corollary which itself deserves to be inscribed upon every wall of the city of philosophy:
>
> Do not block the way of inquiry.
>
> (C. S. Peirce as quoted in Tool 1979, p. 23).

Tool provides nothing about the historical context of the quote nor anything about how important Peirce might be in the history of institutional economics. Instead Tool takes up the theme of the quote about not blocking pathways of inquiry.

In the first paragraph of the chapter, Tool claims that many of the various methodologies of the many varieties of economics have acted as blocks to the processes of inquiry in economics. He discusses capitalism and Marxism as ideologies that block inquiry. He also notes the methodology of positive economics which Tool believes blocks questions about the nature of economic life – that it is more social than individual in nature. He offers many more ideas than can be explored here. In many of the notes to this chapter on social inquiry one finds references to Dewey's Logic: The Theory of Inquiry. While Tool uses Peirce's quote for its semantic themes, one thing he does not do is explain that the preceding quote is an indirect reference to other conceptions of pragmatism. Peirce's "Will to Learn" with its corollary "Do not block the way of inquiry" is as much about William James and his "Will to Believe" than anything else. This is worth noting because many institutionalists have mentioned James and Peirce over the years, but few if any have recognized that Peirce's method of inquiry was developed to counter directly James's much less rigorous conception of science and scientific research. The odd thing about all of this is that besides the quote and an oblique reference to it, Tool makes no other mention or citation to the general ideas of Peirce. So it is difficult to tell what Tool thinks about the importance of Peirce's ideas from the little said in his book.

Another book-length treatment of institutional economics appeared soon after Tool's.[19] Wendell Gordon published Institutional Economics just a year later in 1980. In the first line of the preface, he writes:

> This work is a survey of economics, done from the perspective of the institutional approach. This approach centers on ongoing process....This institutional view of the primary role of economics differs greatly from a conception such as price theory and general equilibrium analysis, oriented to demand and supply considerations in a context where it is assumed that the process to be analyzed is that by which the economy tends to a static (or steady state growth) equilibrium and a welfare maximum and the motives of the participants are conceived to be a reflection of a personal psyche which is definitely given and oriented to monetary-gain maximization (Gordon 1980, p. ix) .

In Gordon's book there are a few explicit references to Peirce. When Gordon wants to provide intellectual depth to the positions he offers on some key subject he often cites Peirce along with others. For example just three pages into the first chapter, Gordon (1980, p. 5) tells us: "The philosophy of this book, and of institutional economics, is pragmatic, in the tradition of the pragmatism of C. S. Peirce, William James, and John Dewey. In fact, this is what economic theory in the "American tradition" ought to be." Again in the next chapter Gordon talks about value theory in a very different way than supply and demand and the subjective theory of value in neoclassical economics. Here value means what is valued by people in the value judgments they make and that these change in a self-correcting way. Certainly Peirce talked about self-correcting ideas. Gordon (1980, p. 9) claims that his value theory "is dynamic in the manner of the pragmatism of C. S. Peirce and and John Dewey." Another mention of Peirce, James, and Dewey is made in a much longer discussion of self-correcting value judgments in the next chapter (p. 43). And finally the same issue of self correcting value judgments is related to an economic understanding of law and the impact that Peirce and Dewey have had on legal scholarship (p. 78) as an alternative to the relatively new Chicago School approach to law and economics.

Before leaving the general topic of C. S. Peirce's influence on institutional economics, there is one more contribution that needs to be considered. In what may be the most extensive discussions of how much Peirce influenced institutional economics in recent decades, there is the contribution of the iconoclastic Philip Mirowski which was published as part of a two-volume

collection of essays titled, Evolutionary Economics in 1988. Mirowski has written extensively about the history, philosophy, and sociology of economics and science. I am not aware that he would regard himself as an institutionalist. Yet in his essay, "The Philosophical Bases of Institutionalist Economics," Mirowski (1988) portrays Peirce as a major intellectual force that could still be relevant to the future direction of institutional economics. Early in his article Mirowski offers the claim that Anglo-American economics is strongly Cartesian and mechanistic with markets and rational choice playing central roles in how neoclassical theory has developed. In contrast, American pragmatism is portrayed as resulting from 19th century German philosophers such as Kant and Hegel and a German historicist hermaneutical approach to social research originating in the same time period. He maintains that these lines of intellectual influence coalesced into the institutionalist school of economic theory in the early decades of the 20th century. Mirowski also holds that there are a few other intstitutionalists who have similarly recognized Peirce's pragmatism as an important intellectual alternative to the other western epistemologies of empiricism and rationalism.

After discussing hermaneutics and hermaneutic communities, Mirowski summarizes the major features of Peirce's philosophy. He reprises simplistic and more thoughtful interpretations of the pragmatic maxim and even William James's more pyschologistic interpretation of pragmatism. Then Mirowki reviews Peirce's three aspects of human reasoning and scientific inquiry – deduction, induction, and abduction. In these discussions, Peirce often talked about the role of instincts and this terminology often can be found in the writings of Dewey and Veblen. With regard to economics, Mirowski notes that there are passages where Peirce is critical of the economics of his own time. With regard to logical positivism and other epistemological excesses of the 20th century, Peirce was clearly ahead of his time offering various critiques of empiricism and positivism that anticipate criticisms made decades later. Moving on to consider Dewey, Mirowski portrays Dewey as extending Peirce's hermaneutic themes and accepting Peirce's critique of utilitarianism. With regard to Veblen, Mirowski sees him as being more influenced by Dewey and James than Peirce. Moving to another major founder, Mirowski (1988, p. 75) also asserts that "Commons followed Peirce in many respects." At the end of his piece, Mirowski (1988, p. 83) holds that institutional economics can be rebuilt along the lines of Peirce's ideas

more broadly interpreted: "Institutional economics .... with its Peircian pedigree, should be well-positioned to participate in the reconstruction of economic theory from a hermaneutic perspctive." In contrast, Mirowski holds that it will be difficult for neoclassical economics to make progress based on assumptions which isolate it increasingly from cultural trends in favor of deterministic and static conceptions of economics and the economy.

Before taking leave of the whole subject of Peirce's influence on Veblen and Mitchell, Allan Gruchy's pont of view may need to be noted again. In his sketch of Veblen's life and thought, Gruchy does hold that Peirce influenced Veblen and Michell even though direct affirmations seem to be missing. Like Dorfman and others, Gruchy notes that Veblen studied with Peirce at Johns Hopkins. Gruchy claims that from Peirce Veblen learned to be as critical of the work of scientists as he had been of philosophers. He also learned from Peirce "that scientists develop relatively permanent habits of thinking which serve as guiding principles in the analyses of the facts of the objective, external world" (Gruchy 1947, p. 32). Gruchy also claims that Mitchell was influenced by Peirce through Dewey and others:

> As a consequence of his early academic contacts Mitchell became familiar with the trends of scientific empiricism. Charles Peirce's early pragmatic views were passed on by William James and John Dewey at a time when the social sciences were groping for more adequate techniques of investigation (Gruchy 1947, p. 250).

Gruchy maintains that the system building of the previous era was being replaced with an emphasis on the critical testing of hypotheses with observation and testing. Peirce's ideas were influential in providing a new and different sense of how science should be conducted.

E. E. E. Liebhafsky and Rutherford on Peirce and Institutional Economics

In spite of all of the praise they have directed towards Peirce and several of the strands of his writings, there is a certain unevenness and narrowness that is apparent when surveying what institutionalists have written and incorporated about Peirce in their system of thought. There is much more to Peirce than what has been broached by several generations of institutionalists from

the founders to the most recent generation. This has been recognized to a limited degree in a few relatively recent articles from several authors. Lutz (1985) as noted previously was one of the first to question the relationship of Peirce's ideas to those of institutional economics. Just a few years later would come another paper questioning the adequacy of the institutionalist's incorporation of Peirce's ideas. Malcolm Rutherford wrote a piece questioning Peirce's relationship to institutional economics in 1990. Also, there is another piece by another Liebhafsky, E. E. Liebhafsky (1993), who seems to recognize the inherent weakness and disparate interpretations of Peirce among institutional economists.

Like Mark Lutz, Malcolm Rutherford has questioned the how accurately the ideas of institutional economics reflect those of C. S. Peirce. In his 1990 article, Rutherford takes up Peirce's conception of a self-corrective method of inquiry and how close it is to the views of modern institutionalists. He summarizes quite nicely some of the most read passages of Peirce on pragmatism. He reprises Peirce's four methods for fixing belief and how to clarify doubt. Then Rutherford notes that Peirce's conception of scientific method only works in the very long run – the indefinite long run or perhaps even the infinite long run. This is where institutionalists have departed from Peirce:

> From the foregoing it is clear that although some of Peirce's terminology has come through into institutionalist writings, the view of science and its potential for fixing belief, creating consensus and short-term application to social problems that is found in Peirce's work differs markedly from that found within modern institutionalism.
>
> The most significant difference is to be found in Peirce's very long-run perspective. Science fixes belief and generates consensus only in the long run, and science does not, therefore, provide a reliable basis for short-term social engineering. As part of this, Peirce does not see science in purely instrumental terms. Science is justified not by practical beliefs but by its long run search for truth (Rutherford 1990, p. 402).

Rutherford (1990, p. 402) goes on to comment that: "Arguements that in Peirce's hands were a defense of tradition against the intrusion of science into practical life have been turned to the purpose of proclaiming the superiority of science over traditional norms and conduct." Rutherford (1990, p. 403) then concludes that the "links between Peirce and later institutionalists....are not as clear as sometimes been supposed."

The purpose of Liebhafsky's article seems to be to set the record straight and argue that Peirce should be acknowledged as a dominant philosophical influence along side Veblen, Commons, Ayres, Dewey, and Mitchell. Liebhafsky (1993, p. 741) notes that compared to those just mentioned: "Acknowledgment of indebtedness to Peirce, however, occurs with considerably less frequency." A few paragraphs later, Leibhafsky seems to have an even stronger position in mind for Peirce and his ideas:

> It is the purpose of this article to show that Peirce's philosophy of science serves as the wellspring of contemporary institutional method and that Veblen, Dewey, and, therefore, Ayres were influenced by Peirce's ideas (Liebhafsky 1993, p. 742).

In the introduction to the article, Liebhafsky provides examples of institutionalists that either don't have anything or very little to say about Peirce. One is a survey of the literature by Bush (1991) which makes no mention of Peirce and the other is how little Tool (1979) has to say about Peirce. In contrast, Liebhafsky, notes the larger role of Peirce that Dyer and Mirowski have argued for Peirce.

In the article, Liebhafsky sets out to summarize Peirce's ideas so that he can argue for a more significant place for Peirce in contemporary institutionalist inquiry and research. The title of the first major section of the paper is "Peirce's Empiricism." Compared to all of the citations and references to Peirce by institutionalists that have been surveyed in this paper, those by Liefhafsky nearly exceed the sum total of all other references to Peirce's writings in those papers. It certainly appears that Leibhafsky systematically read and deeply thought about Peirce using the eight volumes of The Collected Papers of Charles Sanders Peirce. He cites volume V often which contains the published essays on pragmatism and the Harvard "Lectures on Pragmatism" of 1903.

There are also many references to volume I which contains writings on Peirce's evolutionary philosophy. There are also references for volumes II, VI, and VII. Because the strands are often intertwined there are references and cross references to other strands within the major strands.

Liebhafsky's account of Peirce's empiricism is mostly about Peirce's view of how humans reason. It begins with abduction and extends first to induction and then to deduction. Like Dyer he claims that inquiry begins with a guess or an abduction. Abductions are fresh and new ideas that need to be held up to the facts so that empirical investigation is necessary. In Liebhafsky's view, a scientific inference is held together in the process of deduction and leads to a true conclusion if reasoning is properly used. Speaking more broadly, Leibhafsky maintains that Peirce's philosophy of science leads towards an evolutionary ideal of concrete reasonableness, or what Peirce called a "summum bonum." Leibhafsky maintains that the process of scientific inquiry can be used to reason about the summun bonum. He also picks up on Peirce's conception of normative science from the Harvard Lectures on Pragmatism and argues that Peirce provides a framework for considering normative values within the scientific community. Then near the end of his summary of Peirce, Leibhafsky finally and briefly picks up on the essays of the pragmatic strand of Peirce's writings mentioning the "Fixation of Belief" but not "How to Make Our Ideas Clear" or the last essay, "Deduction, Induction, and Hypothesis." In the next section of his article, Leibhafsky goes on to argue that his conception of Peirce is close to the view of Peirce that must have influenced Dewey.

Liebhafsky's awareness of Peirce's writings seems to be on par with those of two earlier figures in institutional economics, Commons and Gruchy, who seem to have read and known the most about Peirce. Leibhafsky seems to have read as much of Peirce as was readily available and he was able to synthesize. However, there are some major problems with the Collected Papers on which Leibhafsky and most other institutionalists have based their interpretations of Peirce. Those volumes attempt to provide a somewhat linear version of Peirce with a highly selective and topically organized sample of Peirce's writings. Quite clearly they did not cope well with the "strands" character of his writings. The Collected Papers were edited by two graduate students in philosophy in the 1920s and early 1930s. What they did was heroic in trying to organize the best of Peirce's publications and over 100,000 pages of manuscripts. But the Collected Papers remain a

deeply flawed compendium of Peirce's writings. They greatly obscure the "strands" quality of Peirce's writings. Beyond the Cohen volume, the Collected Papers provide a point of entry into Peirce's writings and ideas. Leibhafsky, Commons, Dewey, and Gruchy seemed to have benefitted greatly from the publication of the Collected Papers. However, a new edition of Peirce's papers have appeared and Carolyn Eisele has edited many volumes of Peirce's scientific and mathematical papers. These new publications of Peirce's writings provide a much greater awareness of additional strands of his writings and ideas that are significant in framing an overall perspective of Peirce's philosophy and his contributions to the sciences. What all of this means is this. In spite of significant efforts to master Peirce, there are newly published writings and strands of his writings that Leibhafsky and other institutionalists have not considered. A more inclusive appraisal of the significance of Peirce for institutional economics and even neoclassical economics needs to include these other strands which are briefly discussed in a few subsequent paragraphs.

6. Some Initial Reflective Thoughts on the Peirce Puzzle and Institutional Economics

By this point it should be clear that most of the founding figures of institutional economics seem to have had a very limited awareness of Peirce's system of philosophy, his publications and writings, and his interests in classical and neoclassical economics and mathematical economics. Much the same can be said for subsequent generations of institutionalists as well. The interests of the founders, but for Dewey, seem to be limited to two or three strands of Peirce's writings. Additionally Dewey's interests in Peirce's ideas, though broader than those of the institutionalists, also seem to be quite limited and understate the importance of the mathematical strand for Peirce's evolutionary philosophy, his philosophy of science, his pragmatism, and in turn for his evolutionary mathematical cosmology. This limited awareness of Peirce's ideas and writings in a very real and practical sense is partly rooted in how Peirce's manuscripts and publications have been printed or reprinted. But it is also due to the inherent difficulties that most well-educated intellectually minded individuals would have had in following the various strands of Peirce's ideas and writings. So to a large extent, the limitations of the founders in understanding Peirce seems almost inevitable to some extent.

So what's the best that can be said about Peirce and institutionalists who have tried to make him a prominent source of influence? Institutionalists seem to have picked up on Peirce's conceptions of pragmatism and inquiry, some of his ideas about evolution, and Peirce's three processes of reasoning – induction, deduction, and abduction. However institutionalists in my view seem to practice institutional economics as Peirce thought philosophy should be practiced without any of the special methods and tools of the special sciences. This thought leads one to interpret institutionalism as more a philosophy of economics than a separate well-developed body of economic theory and ideas. Second, a reading of economics in the late 19th century would seem to suggest that most mainstream American economists interpreted British classical economics and the functioning of the American economy in a mechanical way. Also most American economists did not believe that Ricardo's theory of rent held for the United States during that period perhaps for good reasons. But they were quite mechanistic and often theistic in interpreting the laws of economics and Adam Smith's invisible hand. So the critique of institutionalists that American economics was mechanistic seems to be accurate in a sociological sense as a description of attitudes, mindset, and practices prevalent in the economics profession in that era.

Perhaps the most critical remark that can be made is that institutionalists going back to the founders have not seemed to understand Peirce's mathematical, evolutionary cosmology very well and his consequent insistence on the possibility of a central role for mathematical economics within an evolutionary conception of economic science. Also, some of Peirce's best writings on evolutionary processes seem to have been ignored totally by institutionalists. Consequently Peirce's idea that classical and neoclassical economic ideas could be interpreted within his evolutionary cosmology as he did would seem to be a notion most historic figures of institutionalism would choose to reject. Similarly Peirce's idea that mechanical forces were also forces within evolutionary processes would seem to be a notion that institutionalists could take more seriously. Perhaps it was the case that institutionalists adopted too narrow a conception of evolutionary processes and the future developments of evolutionary sciences and thus set up an impossibly restrictive conception of evolutionary economics as a block on the road to scientific inquiry as Peirce might have said. That of course would be quite unfortunate.

7. Concluding Remarks

This inquiry began with the puzzle of whether Peirce's systematic pragmatism and philosophy of science better aligns with neoclassical or institutional economics. On the surface Peirce's mathematical economics seems to better align his ideas with neoclassical economics while institutionalists have taken up several of the major strands of his works. Peirce's interests in classical economics, Ricardo, and the neoclassical theory of the firm and utility theory suggest that these interests would be difficult to reconcile with the positions taken by prominent figures in the history of institutional economics against both classical and neoclassical economics. Similarly Peirce's criticisms of utilitarianism, empiricism, and political economy could pose problems in making a direct alignment of Peirce and neoclassical economics. So there may not be an easy answer to the question.

In contrast to the dominant interpretations of both neoclassical and institutional economics, there is considerable evidence to support the idea that Peirce interpreted both classical and neoclassical economics from a broader evolutionary cosmology that spans philosophy, the sciences, and economics. Additionally Peirce interpreted mechanism as an evolutionary force throughout his career. Thus he would differ with the idea that mechanism necessarily is inconsistent with a broader evolutionary conception as to how nature and the social worlds grow and evolve. A deeper reading of Peirce suggests that he would have been critical of the sharp dichotomy that has been drawn between classical and neoclassical economics on the one hand versus institutional economics on the other. Furthermore, Peirce might have argued that such a sharp distinction between their views would block the road to inquiry for those who would practice economics within either view. A noted figure who has addressed how institutional economics and neoclassical economics might be conceived had this to say:

> Some institutionalists consider their approach to be mutually exclusive with neoclassicism here as others, including this writer, consider institutionalism and neoclassicism to be supplementary....I should defend my assertion that institutional and neoclassical economics are supplementary, notwithstanding their different methodological and philosophical foundations and practices. It is a position to

> which several readers of earlier drafts of this article have taken offence. Neoclassical economics deals with questions with which institutional economics does not, or deals with the same or comparable questions in a different manner – from all of which one can learn. I believe that insights and knowledge from one school can, with adequate formulae of translation, be carried over to other schools of thought. The willingly eclectic person can embrace, or at least maintain in reserve, mutually incompatible or inconsistent positions (Samuels 1993, pp. 569-70, note 2).

Perhaps the strands of Peirce's system of philosophy, science, and economics could provide a framework in which the theoretical and methodological problems of both neoclassical and institutional economics might be raised. For Peirce mechanical processes are embedded within broader evolutionary processes. Could it be that the economic processes in which households, firms, and markets are embedded are evolutionary processes? If so, then we might have the beginning of a case for believing that both theoretical frameworks have some important ideas and results to contribute to the understanding of the economy, its institutions, and its markets. One way to make sense of the preceding Samuels quote is to adopt the broader evolutionary cosmology of Peirce not just for institutional economics, but for classical and neoclassical economics as well. Perhaps the ideas of Peirce provide an adequate framework for carrying out the intellectual comparisons that Samuels imagined as indeed being possible.

Endnotes

1. See Hirsch and Neil de Marchi (1990).

2. One author who has similarly offered the view that both neoclassical economics and institutional economics may have some validity is Warren Samuels. In an appraisal of the state of institutional economics in the early 1990s, Samuels takes the view that the two schools of economics are supplementary:

"Some institutionalists consider their approach to be mutually exclusive with neoclassicism whereas others, including this writer, consider institutionalism and neoclassicism to be supplementary....I should defend my assertion that institutional and neoclassical economics are supplementary, notwithstanding their different methodological and philosophical foundations and practices. It is a position to which several readers of earlier drafts of this article have taken offence. Neoclassical economics deals with questions with which institutional economics does not, or deals with the same or comparable questions in a different manner – from all of which one can learn. I believe that insights and knowledge from one school can, with adequate formulae of translation, be carried over to other schools of thought. The willingly eclectic person can embrace, or at least maintain in reserve, mutually incompatible or inconsistent postitions" (Samuels 1993, pp. 569-70, note 2).

3. The best biography of Peirce is Brent (1998). There are biographical essays for periods of Peirce's life at the beginning of the Writings of Peirce volumes.

4. One place where the classification of the sciences was discussed was in Peirce's (1896d, CP 3, p. 270) review of Ernst Schroeder's Exact Logic.

5. A much more detailed description of Peirce, economics, and the classification of the sciences by Comte and Bentham can be found in Wible and Hoover (2015b).

6. Peirce's identification with Aristotle comes from the following quotation from the Harvard Lectures on pragmatism and relevant scholarly details:

> A great variety of thinkers call themselves Aristotleans, even the Hegelians on the strength of special agreements. No modern philosophy or very little has any real right to the title. I should call myself an Aristotlean of the scholastic wing, approaching Scotism, but going much further in the direction of scholastic realism (Peirce 1903d, EP 2, p. 180).

In the passage above, the words "or very little" were not Peirce's first expression regarding which modern philosophers were Aristotlean. They were a revision. Peirce had originally written no modern philosophy "except my own." Also see an editor's note 3 in EP 2, p. 522.

7. For a more detailed discussion of the economics of the "Note on the Economy of Research" see Wible (1994).

8. The economic aspects of the "Logic of History" are discussed in much greater detail in Wible (1998).

9. For a thorough exploration of Peirce and Cournot see (Wible and Hoover 2015a).

10. Peirce in the Harvard Lectures remarks about inference and the game of twenty questions:

> An experiment says Stöckhardt, in his excellent Schools of Chemistry, is a question put to nature. Like any interrogatory it is based on a supposition. If that supposition be correct, a certain sensible result is to be expected under certain circumstances which can be created or at any rate are to be met with. The question is, Will this be the result? If Nature replies "No!" the experimenter has gained an important piece of knowledge. If Nature says "Yes," the experimenter's ideas remain just as they were, only somewhat more deeply engrained. If Nature says "Yes" to the first twenty questions although they were so devised as to render that answer as surprising as possible, the experimenter will be confident that he is on the right track, since 2 to the 20th power exceeds a million Peirce (1903f, EP 2, p. 215).

11. Probably the first to notice Peirce's favorable comments on Ricardo was Eisele (1979). Peirce's interest in Ricardo and what he called Ricardian inference is developed in much greater detail in Wible and Hoover (2015b).

12. Martin (2002, p. 425).

13. Dewey (1938, p. iv).

14. Dewey (1938, p. iv).

15. Commons (1934, p. 152).

16. Commons (1934, p. 153).

17. Boulding (1981, p. 23) maintains that there was not much evolutionary science when Veblen was authoring his most important works: "In 1898 Thorstein Veblen published his famous paper entitled, "Why is Economics Not an Evolutionary Science?" The answer I think at that time was clear, although Veblen did not give it. In 1898 there was not very much evolutionary science, and even what there was, unfortunately, Veblen did not understand very well."

18. Many of the NBER publications can be found on line and one can easily check for references to Peirce.

19. Hill (1981) also holds that Peirce's ideas are important for institutional economics.

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Peirce Bibliography: Sources and Abbreviations

WP Writings of Charles S. Peirce, 7 volumes, Indiana University Press
EP The Essential Peirce, 2 volumes, Indiana University Press
CP Collected Papers of Charles Sanders Peirce, 8 volumes, Harvard University Press
HP Historical Peprspectives on Peirce's Logic of Science, Carolyn Eisele, ed., 2 volumes
NEM New Elements of Mathematics by C. S. Peirce, Carolyn Eisele, ed., 4 volumes.

Writings of Charles S. Peirce: A Chronological Edition, vols. 1-6 and 8, 1857-1892. Many editors. Indiana University Press: Bloomington, 1984 to 2010.

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1867a [1868]. "On an Improvement in Boole's Calculus of Logic," WP 2, pp. 12-23.
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1867c [1868]. "On a New List of Categories," WP 2, pp. 49-59.
1867d [1868]. "Upon the Logic of Mathematics," WP 2, pp. 59-69.
1867e [1868]. "Upon Logical Comprehension and Extension,"WP 2, pp. 70-86.

1867f. "[Venn's The Logic of Chance]," WP 2, pp. 98-102.

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1868g. "Some Consequences of Four Incapacities," WP 2, pp. 211-242.
1869a. "Grounds of Validity of the Laws of Logic: Further Consequences of Four Incapacities," WP 2, pp. 242-272.

1869b. "The English Doctrine of Ideas," WP 2, pp. 302-307.

DNLR, 1870

Peirce's most important mathematical paper.
1870. [1984]. "Description of a Notation for the Logic of Relatives," WP 2, pp. 359-429.

Economic Papers Related to the Cambridge Scientific Club, 1871-74

1871a. "[Letter to Melusina Fay Peirce]," in Brent (1998, p. 89).
1871b. "Letter to Simon Newcomb," in Baumol and Goldfeld (1968), pp. 186-87.
1871c. "[Letter to Benjamin Peirce]," in NEM, Vol. III/I, pp. 553-554.
1871d. "Calculus of Wealth," in NEM, Vol. III/I, pp. 551-552 (paper is dated as December 1871 by editors of WP 2, p. 568.)
1873a. "Letter, Peirce to Abraham B. Conger," WP 3, pp. 109-10.
1874a. "[On Political Economy]," WP 3, pp. 173-76.

1872. "Educational Text-books, II," WP 3, pp. 1-7.

Popular Science Monthly Series, 1877-78
"Illustrations of the Logic of Science"

Six papers published in the Popular Science Monthly in 1877 and 1878 and reprinted in WP 3, pp. 242-338 and EP 1, pp. 109-199.

1877f. "The Fixation of Belief," WP 3, pp. 242-257.
1878a. "How to Make Our Ideas Clear," WP 3, pp. 257-276.
1878b. "The Doctrine of Chances," WP 3, pp. 276-289.
1878c. "The Probability of Induction," WP 3, pp. 290-305.
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The Johns Hopkins Writings on Scientific Method, 1880-1885

1880a. "[On the State of Science in America]," WP 4, pp. 152-156.
1881a. "Jevons's Studies in Deductive Logic," WP 4, pp. 238-239.
1882a. "Introductory Lecture on the Study of Logic," first published in Johns Hopkins

University Circulars, 2: 19, November, pp. 11-12 in WP 4, pp. 378-382.
1883a. Studies in Logic by Members of the Johns Hopkins University, editor, WP 4, pp. 406-450, CP 2, pp. 313-326, 433-477.
1883b. "A Theory of Probable Inference," in Studies in Logic 1883a, WP 4, pp. Pp. 408-453.
1883-84a. "[Design and Chance]," WP 4, pp. 544-554 and EP 1, pp. 215-224, dated December of 1883-January 1884.
1883-84b. "Study of Great Men," WP 5, pp. 26-104, CP 7, pp. 165-174.
1885a. (with Joseph Jastrow), "On Small Differences of Sensation," WP 5, pp. 122-135.

Three Writings with Economic Themes, 1884-1885

1884e. "The Reciprocity Treaty with Spain," WP 5, pp. 144-146.
1885c. "The Spanish Treaty Once More," WP 5, pp. 147-148.
1885d. "[Testimony on the Organization of the Coast Survey]," given January 24, 1885, Miscellaneous Documents of the Senate of the U. S. 82, 1886, WP 5, pp. 149-161.

Three Philosophical Manuscripts, Summer 1885

Three philosophical manuscripts that are precursors to "A Guess at the Riddle written in the summer of 1885.

1885e. "An American Plato: Review of Royce's Religious Aspect of Philosophy," WP 5, pp. 221-234.
1885f. "Notes on Categories," WP 5, pp. 235-241.
1885g. "One, Two, Three: Fundamental Categories of Thought," WP 5, pp. 242-247.

[One, Two, Three], Summer 1886

Drafts of chapters of proposed book titled [One, Two, Three] from the summer of 1886. These are the same ideas more fully developed in "A Guess at the Riddle." (1887-1888).

1886a. "One, Two, Three: Kantian Categories," WP 5, pp. 292-294.
1886b. "One, Two, Three," WP 5, pp. 294-298.
1886c. "One, Two, Three: An Evolutionist Speculation," WP 5, pp. 298-302.
1886d. "[First, Second, Third]," WP 5, pp. 302-308.

1886h. "Qualitative Logic," WP 5, pp. 323-378.
1886i. "An Elementary Account of the Logic of Relatives," WP 5, pp. 379-387.
1886j. "Letter, Peirce to A. Marquand," WP 5, pp. 421-423.
1887a. "Logical Machines," WP 6, pp. 65-72.
1887b. "Correspondence Course on the Art of Reasoning," WP 6, pp. 9-60.

A Guess at the Riddle Winter, 1887-88

Drafts of a proposed book, "A Guess at the Riddle," and a similar manuscript from 1888.

1887-88a. A Guess at the Riddle, in WP 6, pp. 168-210, EP 1, pp. 245-279, CP 1, pp. 181-226.
1887-88b. "[Contents]," WP 6, pp. 166-167.
1887-88c. "Chapter I: Trichotomy," WP 6, pp. 168-180.
1887-88d. "[Chapter III]: The Triad in Metaphysics," WP 6, p. 181.
1887-88e. "Chapter IV: The Triad in Psychology," WP 6, pp. 182-187.

1887-88f. "Chapter V: The Triad in Physiology," WP 6, pp. 188-198.
1887-88g. "Chapter VI: The Triad in Biological Development," WP 6, pp. 199-202.
1887-88h. "Chapter VII: The Triad in Physics," WP 6, pp. 203-210.
1887-88i. A Guess at the Riddle, in CP 1, pp. 181-226.
1888a. "[Trichotomic]," WP 6, pp. 211-216.

[Arithmetic], 1890-1907

Several manuscripts of drafts of parts of a simple text on arithmetic. Eisele reconstructs and arranges the manuscripts in subject order covering the topics Peirce outlined in his plan for the work. Here they are listed in chronological order. Some of the manuscripts have yet to be dated and are here listed as between 1890-1912. See Eisele, NEM 1, pp. 1-187.

1890a. "C. S. Peirce's Vulgar Arithmetic: Its Chief Features," in NEM I, pp. 81-106.
1890b. "Familiar Letters about the Art of Reasoning," in NEM I, pp. 131-142.
1893a. "Peirce's Primary Arithmetic upon the Psychological Method," in NEM I, pp. 65-79.
1904-1905. "Lydia Peirce's Primary Arithmetic," in NEM I, pp. 1-42.
1903-1912, "[Secundals]," in NEM I, pp. 145-175.
1890-1912. "Primary Arithmetic [With Suggestions for Teachers]," in NEM I, pp. 43-63.
1890-1912. "Practical Arithmetic," NEM I, pp. 107-120.
1890-1912. "Factotal Augrim," NEM I, pp. 121-129.

The Monist Metaphysical Series, 1891-93

Five papers and a reply published in The Monist 1891 to 1893 and reprinted in EP 1, pp. 285-371.

1891. "The Architecture of Theories," in EP 1, pp. 285-297
1892a. "The Doctrine of Necessity Examined," in EP 1, pp. 298-311
1892b. "The Law of Mind," in EP 1, pp. 312-333 and CP 6, pp. 86-113.
1892c. "Man's Glassy Essence," in EP 1, pp. 334-351
1893b. "Evolutionary Love," in EP 1, pp. 352-371 and CP 6, pp. 190-215.
1893c. "Reply to the Necessitarians: Rejoinder to Dr. Carus," The Monist, vol. 3, July, pp. 526-570, also CP 6, pp. 390-435.

1892h. "Why Do We Punish Criminals?," WP 8, p. 341-344.

Lowell Lectures on The History of Science, 1892-1893

Lowell Institute lectures most fully published in Eisele's Historical Perspectives (HP), pp. 141-295 with fragments published in EP 2 and CP 7.

1892-1893a. "Peirce-Lowell Institute Correspondence," HP, pp. 141-142.
1892-1893b. "Preface," HP, pp. 143-145.
1892-1893c. "History of Science from Copernicus to Newton," HP, pp. 146-148.
1892-1893d. "General Review of the History of Science," HP, pp. 149-156.
1892-1893e. "Lectures I and II: Early History of Science," HP, pp. 156-187.
1892-1893f. "Lecture III: Egyptian Science," HP, pp. 188-200.
1892-1893g. "Lecture V: Further Ancient Science – Chaldean and Greek Astronomy," HP, pp. 201-215.

1892-1893h. "Lecture VI: Pythagoras – German Historical Criticism," HP, pp. 216-226.
1892-1893i. "Lecture VIII: Archimedes," HP, pp. 227-238.
1892-1893j. "Lecture IX: Post-Hellenic to the Fifteenth Century," HP, pp. 239-257.
1892-1893k. "Lecture X: Copernicus (Coppernicus)," HP, pp. 258-265.
1892-1893l. "Lecture XI: Part I: Galileo," HP, pp. 266-279.
1892-1893m. "Lecture XI: Part II: Galileo," HP, pp. 280-286.
1892-1893n. "Concluding remarks to lectures on the history of science," HP, pp. 287-289.
1892-1893o. "Johan Kepler," HP, pp. 290-295.
1892-1893p. [Fragments of Lowell Lectures], EP 2, p. x, CP 7, pp. 175-178.

Elements of Mathematics, 1895

Draft of a textbook from manuscripts as prepared by Eisele and published in her edited collection, The New Elements of Mathematics. Vol. II, pp. 1-232.
1895a. Preface (1)
1895b. Preface (1)
1895c. "Introduction, on Mathematics in General," NEM II, pp. 7-33.
1895d. "Sequences," NEM II, pp. 34-60.
1895e. "The Fundamental Operations in Algebra," NEM II, pp. 61-74.
1895f. "Factors," NEM II, pp. 75-83.
1895g. "Negative Numbers," NEM II, pp. 84-90.
1895h. "Fractional Quantities," NEM II, pp. 91-101.
1895i. "Simple Equations," NEM II, pp. 102-130.
1895j. "Ratios and Proportions, NEM II, pp. 131-142.
1895k. "Surds," NEM II, pp. 143-164.
1895l. "Topical Geometry," pp. 165-191.
1895m. "Graphs and Perspective," pp. 192-232.

New Elements of Geometry Based on Benjamin Peirce's Works and Teachings, 1895

Draft of a textbook from manuscripts as prepared by Eisele and published in her edited collection, The New Elements of Mathematics. Vol. II, pp. 233-473.

1895n. "Preface," NEM II, pp. 235-238.

Book I Fundamental Properties of Space
1895o. "Chapter I Continuity," NEM II, pp. 241-254.
1895p. "Chapter II Uniformity, NEM II, pp. 255-258.
1895q. "[Chapter III], NEM II, p. 259.
1895r. "Chapter IV Homoloids, NEM II, pp. 260-263.
1895s. "Chapter V Measurement," NEM II, pp. 264-268.
1895t. "Chapter VI The Constitution of Space," NEM II, p. 269.
1895u. "Chapter VII Branches of Geometry, " NEM II, p. 270.

Book II Topology
1895v. "Chapter I Generation, Intersection, Enclosure," NEM II, pp. 273-288.
1895w. "Chapter II Connectivity," NEM II, pp. 289-295.
1895x. "Chapter III, Polygons and Polyhedra," NEM II, pp. 296-307.
1895y. "Chapter IV Knots, NEM II, pp. 308-315.

1895z. "Reversion and Perversion," NEM II, pp. 316-317.

Book III Graphics

1895aa. "Introduction Algebraical Lemmas," NEM II, pp. 321-351.
1895bb. "Chapter I A Ray and a Plane," NEM II, pp. 352-356.
1895cc. "Chapter II The Fundamental Propositions of Graphics," NEM II, pp. 357-368.
1895dd. "Degrees of Freedom," NEM II, pp. 369-384.
1895ee. "Projection," NEM II, pp. 385-396.
1895ff. "Notations for Graphics," NEM II, pp. 397-418.
1895gg. "The Phimus," NEM II, pp. 419-426.

Book IV Metrics

1895hh. "Part I. The Philosophy of Metrics," NEM II, pp. 429-457.
1895ll. "Chapter I The Principles of Measurement," NEM II, pp. 429-444.
1895mm. "Chapter II Primary Theorems," NEM II, pp. 445-457..
1895nn. "Part II. Benjamin Peirce's Presentation of the Propositions of the Elements," NEM II, pp. 458-473.

1896a. "The Logic of Mathematics: An Attempt to Develop My Categories from Within," CP 1, pp. 227-276.

The Second Monist Series, 1896-97

Two papers on logic reviewing different volumes of Ernst Schroeder's Exact Logic.

1896d. "The Regenerated Logic," The Monist, vol. 7 (October), pp. 19-40 also CP 3, pp. 266-287.
1897a. "Logic of Relatives," Monist, vol. 7 (January), pp. 161-217, also CP 3, pp. 288-345.

1897b. "Logic as Semiotic: The Theory of Signs," in Philosophical Writings of Peirce, J. Buchler ed. New York: Dover, pp. 98-119.

The Cambridge Conference Lectures of 1898
Reasoning and the Logic of Things

1898a. Reasoning and the Logic of Things: The Cambridge Conference Lectures of 1898, K. L. Ketner, ed., Cambridge, Harvard University Press, 1992. Excerpts also found in EP 2, pp. 11-56, CP 1, pp. 339-363, CP 5, pp. 399-422, CP 6, pp. 1-5, 46-66, 132-146, CP 7, pp. 284-312.
1898b. "Philosophy and the Conduct of Life," in Peirce 1898a, pp. 105-122.
1898c. "Types of Reasoning," " in Peirce 1898a, pp. 123-142.
1898d. "[Exordium for Lecture Three]," in Peirce 1898a, pp. 143-145.
1898e. "The Logic of Relatives," in Peirce 1898a, pp. 146-164.
1898f. "First Rule of Logic," in Peirce 1898a, pp. 165-180.
1898g. "Training in Reasoning," in Peirce 1898a, pp. 181-196.
1898h. "Causation and Force," in Peirce 1898a, pp. 197-217.
1898i. "Habit," in Peirce 1898a, pp. 218-241.
1898j. "The Logic of Continuity," in Peirce 1898a, pp. 242-268.

1898k. "The Logic of Continuity," CP 6, pp. 138-139.

Logic of History, 1901

There are two manuscripts and three incomplete published versions of this monograph. Peirce applies his extensively developed conception of scientific inquiry and the economy of research to reconstructions of the lives and works of Aristotle, Plato, and Pythagoras.

1901a. "On the Logic of Drawing History from Ancient Documents Especially from Testimonies," handwritten manuscript, 690a, 263 pp.
1901b. "On the Logic of Drawing History from Ancient Documents Especially from Testimonies," type written manuscript, 690b, 175 pp.
1901c. "On the Logic of Drawing History from Ancient Documents Especially from Testimonies," CP 7, pp. 89-174 (with application to Aristotle only).
1901d. "On the Logic of Drawing History from Ancient Documents Especially from Testimonies," HP 2, pp. 705-800 (with applications to Plato and Pythagoras).
1901e. "On the Logic of Drawing History from Ancient Documents Especially from Testimonies," EP 2, pp. 75-114 (applications not included).

1902a. "On the Economics of Research," Memoir No. 28 of "Carnegie Institution. Application for a Grant," NEM IV, pp. 26-29, also HP, pp. 1022-1041.
1902b. "[Excerpts from Earlier Drafts of Carnegie Application]," "On the Economics of Research," Memoir No. 28 of "Carnegie Institution. Application for a Grant," NEM IV, pp. 62-64.
1902c. "Theory," CP 7, pp. 60-61.

Minute Logic of 1902

A partially completed book which has been published in separate sections in the Collected Papers with Peirce's titles. It runs to more than 380 pages in this version. Editors's titles are in brackets.

Chapter 1 Intended Characters of this Treatise
1902d. "Logical Promises," CP 2, pp. 3-5.
1902e. "Of Minute Accuracy," CP2, pp. 5- 9.
1902f. "Different Methods in Logic," CP 2, pp. 9-41.
1902g. [Partial Synopsis of a Proposed Work in Logic], CP 2, pp. 42-56.
1902h. "Clearness of Ideas," CP 2, pp. 56-66.

Chapter 2 Prelogical Notions
1902i. "Classification of the Sciences," CP 1, pp. 83-137, CP 7, pp. 223-248.
1902j. "Why Study Logic," CP 2, pp. 67-119.

Chapter 3 The Simplest Mathematics
1902k. "The Simplest Mathematics," CP 4, pp. 189-262.

Chapter 4 Ethics
1902l. [Ultimate Goods], CP 1, pp. 314-321.
1902m. [Reality and Existence]," CP 6, pp. 237-245.

1902n. "Of the Practical Sciences," CP 7, pp. 40-43.

Harvard Lectures on Pragmatism, 1903

Seven lectures given in 1903 which were arranged by William James. The titles of the lectures vary in the several editions of the lectures. Here the titles follow those of the Peirce Edition Project, EP 2, pp. 133-241. The lectures are also found in CP 5, pp. 13-131 and P. A. Turrisi, ed. Pragmatism as a Principle and Method of Right Thinking; the 1903 Harvard Lectures on Pragmatism, Albany: SUNY Press 1997).

1903a. "Lecture I: The Maxim of Pragmatism," EP 2, pp. 133-144.
1903b. "Lecture II: On Phenomenology," EP 2, pp. 145-159.
1903c. "Lecture III: The Categories Defended," EP 2, pp. 160-178.
1903d. "Lecture IV: The Seven Systems of Metaphysics," EP 2, pp. 179-195.
1903e. "Lecture V: The Three Normative Sciences," EP 2, pp. 196-207.
1903f. "Lecture VI: The Nature of Meaning," EP 2, pp. 208-225.
1903g. "Lecture VII: Pragmatism as the Logic of Abduction," EP 2, pp. 226-241.

Lowell Lectures of 1903

1903 "What Makes Reasoning Sound?," first of eight lectures, EP 2, pp. 242-257.
1903i. "Principles of Philosophy," CP 1, pp. 3-18.
1903j. "[The Reality of Thirdness]," from lecture III, editor's title, CP 1, pp. 173-178.
1903k. "[Degenerate Cases]," from lecture III, editor's title, CP 1, pp. 277-286.
1903l. "[Ideals of Conduct]," from lecture I, editor's title, CP 1, pp. 326-338.
1903n. "[Variety and Uniformity]," from lecture VI, editor's title, CP 6, pp. 67-75.
1903o. "[Kinds of Induction]," from lecture VII, editor's title, CP 7, pp. 65-75.
1903p. "Eighth Lecture: Abduction: Part 2. Pythagoras," in HP 2, pp. 1011-1021.

A Syllabus of Certain Topics of Logic

A large document composed to supplement the Lowell Lectures of 1903

1903. "An Outline Classification of the Sciences," EP 2, pp. 259-262.
1903. "The Ethics of Terminology," EP 2, pp. 263-266.
1903. "Sundry Logical Conceptions," EP 2, pp. 266-288.
1903. "Nomenclature and Divisions of Triadic Relations, as Far as They are Determined," EP 2, pp. 289-299.
1903m. "[Nomenclature and Divisions of Dyadic Relations]," editors' title, CP 3, pp. 366-387.

1903. "John Dewey, Studies in Logical Theory," CP 8, pp. 145-147.

The Third Monist Series, 1905-1906

Three articles appearing in 1905 and 1906 and related material as published in EP 2, CP 4, and CP 5. Some of the material appears in CP 4, pp. 411-463, CP 5, pp. 272-313, CP 5, pp. 3-9, 317-375.

1905a. "What Pragmatism Is," The Monist, vol. 15 (April) pp. 161-181, and EP 2, pp. 331-345.
1905b. "Issues of Pragmaticism," The Monist, vol. 15 (October), pp. 481-499. EP 2, pp. 346-

359.
1906a. "Prolegomena to an Apology for Pragmaticism," The Monist, vol. 16 (October), pp. 492-546, also CP 4, pp. 411-463.
1906b. "The Basis of Pragmatism in Phanerscopy," in EP 2, pp. 360-370.
1906c. "The Basis of Pragmatism in the Normative Sciences," in EP 2, pp. 371-397.
1907a. "Pragmatism," in EP 2, pp. 398-433.
1907b. "The Kernel of Pragmatism," CP 5, pp. 317-321.

1907d. "Guessing," a manuscript re-titled "[Later Reflections]" by the editors of the Collected Papers, CP 7, pp. 27-34.
1908. A Neglected Argument for the Reality of God, 1908, EP 2, pp. 434-450.