Moving Pictures of Thought II:
Graphs, Games, and Pragmaticism's Proofs

Ahti-Veikko Pietarinen

Department of Philosophy

University of Helsinki

P.O. Box 9, FIN-00014 University of Helsinki

Finland

ahti-veikko.pietarinen@helsinki.fi

Abstract

Peirce believed that his pragmaticism can be conclusively proven. Beginning in 1903, he drafted several attempts, ending by 1908 with a semeiotic proof. Around 1905, he exposes the proof using the theory of Existential Graphs (EGs). This paper modernises the semantics Peirce proposed for EGs in terms of game-theoretic semantics (GTS). Peirce's 1905 proof is then reconstructed in three parts, by (i) relating pragmaticism to the GTS conception of meaning, (ii) showing that Peirce's proof is an argument for a relational structure of the meaning of intellectual signs that our interpretative and strategic practices give rise to, and (iii) bringing out the key links between EGs and pragmaticism.

Key words: Peirce, pragmaticism, proof, existential graphs, game-theoretic semantics, meaning.

1. Introduction

In 1907 Peirce announced that he had arrived at "an ample supply of seductive persuasions to pragmatism" and "two or three scientific proofs of its truth" (CP 5.468, 1907, *A Survey of Pragmaticism*). However, he thought such a proof inexorably hard to produce:

And if I may trust my most cautious logic, such a proof I have worked out and perfected. "What is it, then? Produce it." Unfortunately, like many another intricate proof, it only becomes evident upon close, severe, and long study. … I must wipe out my proof, then, and assuming it nil, come down to an appeal like the following. (MS 322, February/March 1907, *Pragmatism*)[1]

What then follows is an appeal to his pragmaticism as a certain method of "perfectly ascertaining" the meanings of all intellectual concepts. The method is, he states, a special application of the experimental method of physical sciences, expressed in the age-old maxim, "By their fruits ye shall know them" (MS 324: 14–15, 1907, *Pragmatism*; cf. 325: 11–12, n.d., *Pragmatism Made Easy*). This maxim can, according to Peirce, be self-applied to test its own truth.

In his manuscript *The Bed-Rock Beneath Pragmaticism*, which Peirce is likely to have completed by March 1908, he poignantly recounts how he, "for a considerable series of years", had "remained in a distressing state of doubt on the subject, earnestly pressing my inquiry deeper and deeper, but never finding my Eldorado,---which was a scientific demonstration of the truth, or else the error, of pragmatism of [some] stripe" (MS 300: 11).[2] A couple of months earlier, he had remarked to his trusted friend Francis C. Russell that "the article to be written is the most difficult to present of any that I have ever written. It is the first part,---the lemma,---to my proof of the truth of pragmaticism" (MS L 387: 3, 7 December 1907).

Soon after, he announced that he had solved the issue. The proof was achieved by replacing "by a scientific and logical proof the merely rhetorical defence I made of the principle in my two original articles in the Popular Science Monthly of Nov. 1877 and Jan. 1878, such being the only sort of argument which would be at all admissible in a popular journal" (MS 296, March 1908, *The First Part of an Apology for Pragmaticism*).

What is this proof that Peirce claimed to have worked out and even perfected? What does it mean that it is scientific and logical? In Volume 2 of the *Essential Peirce* (pp. 398-433), The Peirce Edition Project has partially transcribed the letter and manuscript 318, together with closely related drafts, in a chapter entitled *Pragmatism*. There Peirce provides a fairly detailed yet complex argumentation for the truth of pragmaticism. I will term it the late or semeiotic proof, which followed the publication of his 1905-1906 *Monist* series. Nathan Houser (1998) skeletonises the key parts of Peirce's argumentative scheme in the introductory chapter to the volume. Pietarinen and Snellman (2006) relate the argument to modern conceptions of logic.

What has been absent is a systematic account of that argumentation which would relate Peirce's pragmaticism to logical notions that make resolutely clear the scientific character and the value of the proofs.[3] What has been equally absent is a thoroughgoing explanation of the role his Existential Graphs (EGs) play in the proof. Peirce's own account emanates from the drafts of papers written during 1905 and which were intended as the continuation of the *Monist* series he began composing in 1904. The key manuscript that I am focussing my attention to is number 280. Amidst a number of drafts, manuscript 280 represents one of the most significant stages in his attempts to compose the paper entitled *The Basis of Pragmaticism*. It was never published and

apparently Peirce never even seriously considered offering it for publication. What was published in its stead was *Prolegomena to an Apology for Pragmaticism* (*PAP*).

The present paper reconstructs this middle proof of pragmaticism by relating it to the verificationistically interpreted game-theoretic conception of meaning.[4] If that conception is accepted, then pragmaticism must be accepted. In particular, the proof is shown to exemplify the game-theoretic conception of meaning which Peirce offered as the operational conception for the interpretation of the diagrammatic assertions of EGs.

At the bottom of that conception lies a model-theoretic and calculistic analysis of language. The three basic tenets of such analysis are: (i) Application of game theory makes the notion of truth conceivable and practical. (ii) Language is a re-interpretable system. (iii) Semantics is effable, that is, the relationship between language and the world can be articulated and theorised about by applications of language. The analysis is model theoretic, since the purpose of Peirce's game-theoretic semantics is to link assertions with the world and its universe of discourse and to provide conditions for their truth. It is calculistic, because new systems, methods and logics may be created for the analysis of language as the need arises in the course of fulfilling the purposes of scientific inquiry.

Peirce's theory of EGs is a curious synthesis of syntactic, semantic and pragmatic features that not only compose the meaning of propositions (intellectual concepts and signs) but also open up broader philosophical outlooks. Jaakko Hintikka (1973, 1997) has applied game-theoretic and model-theoretic methods to a wide range of philosophical and logical questions in a comparable fashion.[5]

2. Moving Pictures of Thought: Existential Graphs

Peirce maintained that the visual representation of assertions by means of his EGs put before us "a moving picture of the action of the mind in thought" (MS 298: 1, 1905, *Phaneroscopy*). Yet he added that he would not stop to defend this claim because the defence would be "too tedious". No detailed defence is forthcoming elsewhere in his work, either. He deflects the issue by saying, "It is so elaborate and so unfamiliar in substance, that any tolerable clear exposition of it would occupy more pages than it would be decent to ask our good and admirable editor to allow … that theory, even if it were developed, would probably seem still more dubious to you than does the proposition that, to my mind, it sufficiently justifies" (MS 298: 17).

These pronouncements are nevertheless significant in that they comprise the starting point in the argument in which Peirce promised to demonstrate the truth of pragmaticism (MS 298:

4). The role of EGs in that suggested argument has not been recognised in full, and one obstacle surely is that he offers no obvious explanation as to how these graphs lend us truly moving pictures of the action of the mind in thought.

Elsewhere, Peirce stated that "Every logical evolution of thought should be dialogic" (CP 4.551). This goes with his assertion that, presuming EGs "furnish a moving picture of the intellect" (MS 298: 10 a.p.) and that they provide a "system for diagrammatizing intellectual cognition" (MS 292: 41, 1906, *Prolegomena to an Apology for Pragmaticism*, Draft), the statement should not be taken to imply that it is human thinking that is in operation here. One needs to take into consideration the fact that "all thought is dialogical, and is embodied in signs". This is the "essence of the thought", the realisation of dialogical performance in the mind free from the accidents of any singular human mind that does the thinking. There needs to be "self-development and growth" in thought, "without which a 'moving picture could mean nothing'" (MS 298: 11 a.p.).

A consequence of this is that all thought must be embodied in signs. This is in accordance with the overall communicative character of his theory of signs. It is also the opening premiss of the 1907 late or semeiotic proof Peirce outlined in MS 318. Reconstructions of that late proof have been provided in Houser (1998) and Pietarinen and Snellman (2006).

3. The Semantics and Pragmatics of Existential Graphs: Games

All this can be made more precise. The 'movement' of the 'pictures of thought' may be conveniently viewed as actual moves in the sense of game-theoretic actions. Games lend themselves to the diagrammatic and semeiotic meaning of propositions in a natural way. Since pragmaticism is intended to be a theory of the meaning of all thoughts, intellectual concepts and generalities that have propositional content, its correctness hinges on the correctness of the game-theoretic approach to the meaning of the logical diagrams of the theory of EGs.[6]

A semantic game G is played according to any beta graph $\varphi \in G$, on a model $M = (D, I)$, in which D is the universe of discourse and I an interpretation. $G(\varphi, M)$ is a perfect-information, zero-sum game between two players, the Graphist (the utterer) and the Grapheus (the interpreter).[7] Peirce explains the idea as follows:

In our make believe, two parties are feigned to be concerned in all scribing of graphs; the one called the *Graphist*, the other the *interpreter*. Although the sheet that is actually employed may be quite small, we make believe that the so-called sheet of assertion is only a particular region or area of an immense surface, namely that it is the field of 'distinct vision' of the interpreter. It is only the Graphist who has the power to scribe a graph, and the graphs that he scribes are true, because the truth of the true consists in his being satisfied with it. The interpreter, for his part, has the power, with

more or less effort, to move the graph-instances over the sheet, out of his field of distinct vision or into it if they are not quite out of his sight. (MS 280: 29–30).

This passage sets the stage for the subsequent development of logical semantics. The "field of distinct vision" delineates the common ground of the two participants of the interaction. In other words, the players are mutually familiar with what there is in the universe of discourse. At the same time the universe can be extended with new elements as the field of vision is being explored and refocused. What in Peirce's colourful terminology gets a somewhat phenomenological bent is a natural idea from model theory of elementary enlargements and embeddings of structures.

The game rules are as follows:

1. *Juxtaposition Rule*:

    a. The juxtaposition of graphs on a positive area: the Grapheus chooses one subgraph in φ. $G(\varphi, M)$ goes on according to that choice.

    b. The juxtaposition of graphs on a negative area: the Graphist chooses one subgraph in φ. $G(\varphi, M)$ goes on according to that choice. Winning conventions will change.

2. *Ligature Rule*: The outermost end or a portion of a ligature on a positive (resp. negative) area: the Graphist (the Grapheus) chooses an element from D and attaches its name to that end. $G(\varphi, M)$ goes on according to that choice. Attachment to hooks is denoted by a dot, and the ligature is removed.

3. *Winning Conventions*: When a spot S is reached, its value determines the winner of a play of a $G(\varphi, M)$:

    a. If S is true, the Graphist wins the play, and the payoff of the play is $(1, -1)$.

    b. If S is not true, the Grapheus wins the play, and the payoff of the play is $(-1, 1)$.

4. *Winning Rule*: The existence of a winning strategy in $G(\varphi, M)$ determines the truth-value of $\varphi \in G$ in M:

    a. φ is true in M iff there exists a winning strategy for the Graphist in $G(\varphi, M)$.

    b. φ is false in M iff there exists a winning strategy for the Grapheus in $G(\varphi, M)$.

The overall motivation and format of these rules is familiar from the tradition of game-theoretic semantics (GTS, Hintikka 1973). Our interest here concerns the justification that this is indeed how Peirce intended the EGs to be interpreted. That the kinds of games Peirce had in mind are truly

semantic is confirmed by his remark that "[The Graphist is] the author of truth (for we have seen that falsity is what he forbids and truth what he permits)" (MS 280: 29).

Furthermore, Peirce feels that such games are indispensable in logic:

The reason why it is necessary to imagine a Graphist as well as an interpreter [Grapheus] is [that] logic cannot be successfully studied without perfectly clear ideas. Now the graphs and the sheet of assertion are represented as signs; but if they are signs, they must, according to the principles of pragmaticism, function as such. For it will be found to be a corollary from that principle that existence consists in action. (MS 280: 29-30)

In this remarkable passage Peirce comes clean of there being a robust connexion between the semantic and pragmatic (game-theoretic) interpretation of EGs and the chief principles of his philosophy of pragmaticism.

4. The Proof of Pragmaticism

Pragmaticism can at heart be regarded as a theory of meaning of intellectual signs and concepts. It is clear that a mere classification of signs does not yet yield deep enough explanatory insight into the details of the theory. What Peirce has to say about various kinds of signs may be attractive in its own right, but the manifold classificatory schemes that he manufactured in his spare time do not improve our understanding of his logical philosophy, lest the relationships of these schemes to the notions of contemporary logic are spelled out in detail (Hilpinen 2004, Houser et al. 1997, Pietarinen 2006a). For Peirce, pragmaticism is logical semeiotic, logic is semeiotic, and semeiotic is the study of logical analysis of intellectual signs of all kinds.

Indeed, Hilpinen (1982) showed that in his theory of meaning, Peirce anticipated game-theoretic semantics (see also Hintikka 1996, Pietarinen 2006a). In the light of some noteworthy passages from the unpublished manuscript drafts, that suggestion can now be carried further. Some of the most palpable anticipations appear to make his studies virtually a full-fledged theory of contemporary logical semantics. Let us begin with the following passage from MS 280:

A critical analysis of the nature of a sign would show that the action requires a source of concepts to be conveyed, and therefore *in some sense a mind* from which the concepts, propositions, and arguments are conveyed to the mind of the interpreter; and *the two minds* must be *capable of coming to an understanding and of observing it* when it is reached. This supposes *a power of deliberate self-controlled thinking*. Now nothing can be controlled that cannot be observed while it is in action. It is therefore requisite that both minds but especially the [Graphist-mind] should have *a power of self-observation*. Moreover, control supposes a capacity in that which is to be controlled of acting in accordance with

definite tendencies of a tolerably stable nature, which implies a reality in this governing principle. But these *habits*, so to call them, must be capable of being modified according to some ideal in the mind of the controlling agent; and this controlling agent is to be the very same as the agent controlled; the control extending even to the modes of control themselves, since we suppose that the [Grapheus-mind] under the guidance of the [Graphist-mind] discusses the rationale of logic itself. (MS 280: 30-32, 1905, *The Basis of Pragmaticism*, added emphasis)

The relationship between Peirce's theory of pragmaticism and GTS is, in a nutshell, as follows. "The two minds" are the Graphist and the Grapheus, or the Verifier and the Falsifier, or the Utterer and the Interpreter, who undertake to show the material truth or the falsity of the given assertion. What "capable of coming to an understanding and of observing it" means is that the payoffs, determined at the terminal histories of any play of the game, are commonly known by the players. The "power of deliberate self-controlled thinking" and the "power of self-observation" refer to strategic thinking and planning. Self-control, together with the "definite tendencies of a tolerably stable nature", can be correlated with the existence of certain winning strategies, or habits of acting for a purpose. Such stable tendencies associated with acting for a purpose are the quintessence of reaching equilibria as that notion is used in contemporary game theory. The concept of a dialogue, in which strategies (habits) can change and evolve in the course of playing the game, comes to the fore in the last sentence, which at the same time ties the idea of a dialogue in with no less than "the rationale of logic itself".[8]

Essential to habits is the experimentation that we perform in the mind with those signs that are liable to provide new information. Such signs thus contribute to the formulation of general recommendations and plans needed in decision-making tasks. Such signs are typically diagrammatic, and the most common diagrammatic signs are visual. Visual diagrams are signs that are cognitively the most economic and the most fertile ones partaking in thought experiments. According to Peirce, every experiment is an operation of thought: "The [logical] activity takes the form of experimentation in the inner world; and the conclusion … is that under given conditions, the interpreter will have formed the habit of acting in a given way whenever he may desire a given kind of result" (CP 5.491, 1907, *A Survey of Pragmaticism*).

This is the conclusion Peirce sets out to demonstrate by one of his "seductive persuasions" for the truth of pragmaticism. The conclusion at the same time states the Maxim of Pragmaticism, which is the core expression of the principle of pragmatistic meaning. Peirce formulated and reformulated the maxim over the years, but its essence remained invariable.

Habits are real generals out there in the wild. They are relational mappings from possible, conceivable situations to actions. These relations, no means salient to human beings, need

to be sought for, discovered, pointed out, hit upon and mediated by something. The role of these tasks is fulfilled by signs.

Peirce speaks of a habit of making good guesses and conjectures. Such actions are not merely blind guesses or creators of some inexplicable powers for hypothesis generation. The intellectual guesswork that we need to do in science is not blind because we have epistemic access to those habits. We also have mechanisms at hand for changing or improving on them whenever such occasions arise: "The essential function of a sign is to render inefficient relations efficient, … not to set them into action, but to establish a habit or *general rule* whereby they will act on occasion. ... [A] sign is something by knowing which we know something more" (CP 8.332, 1904, *Peirce to Lady Welby*).

Signs themselves do not map situations into actions. But they do provide some vital guidelines by which we search for information, and by which we can then find objects of signs in all situations consistent with the evidence we have.

As soon as the objects of signs are found, the interpreter can proceed further in the interpretation of signs. Most interpretations are logical and rely on self-controlled processes. Pragmaticism concerns the establishment of habits as logical interpretants that emerge in self-controlled action:

Under given conditions, the interpreter will have formed the habit of acting in a given way whenever he may desire a given kind of result. The real and living logical conclusion *is* that habit; the verbal formulation merely expresses it. … But *action* cannot be a logical interpretant, because it *lacks generality*. … Consequently, the most perfect account of a concept that words can convey will consist in a *description of the habit* which that concept is calculated to produce. But how otherwise can a habit be described than by a *description of the kind of action to which it gives rise*, with the specification of the conditions and of the motive? (CP 5.491, 1907, *A Survey of Pragmaticism*; MS 318, *Pragmatism*; EP 2:418, added emphasis)

Again, we can arrive at the conclusion that expresses the Maxim of Pragmaticism. The relationship between habits and the maxim is that habits are the beliefs of agents and refer to those circumstances, actual and possible alike, upon which agents are prepared to act on any occasion. Just as possible scenarios or figments of worlds represent those states of affairs for which we must be prepared, so do habits, grown and unravelled as we explore the contingencies, pointing out the hypothetical states of affairs that constitute the practical bearings or conceivable effects of the concepts we interpreters strive to understand and evaluate.

Habits involve strategic behaviour and action, and it is in this junction that pragmaticism fuses well with a game-theoretic constitution of meaning. Note the impact of the

snippet from the previous passage: "[A]ction cannot be a logical interpretant, because it lacks *generality* … But how otherwise can a habit be described than by a *description of the kind of action to which it gives rise*, with the specification of the conditions and of the motive?" Elsewhere Peirce writes in a similar fashion, for instance, how "no multitude of individual acts could constitute the habit" (MS 290: 22, 1905, *Issues of Pragmaticism*).

In game theory, strategies are identified through the individual actions they give rise to. Strategic rules themselves are nonetheless general though they can only be described or explicated with reference to particular actions, but not reduced to them. Terminal points are assigned with payoffs, in terms of which equilibria are computed via solution concepts. Payoffs are the perfect technical devices for realising what Peirce took to be accomplished by "first logical interpretants" by which we "proceed to trace out the alternative lines of conduct which the conjectures would leave open to us" (MS 318: 45). No individual set of actions, no matter how large, is in itself representative enough of what the optimal future courses of actions in any conceivable circumstance may be. Only a completely general strategy, that is, a function from situations to actions, can reveal such recommendations.

That Peirce meant by habits the same as what game-theoretically conceived strategies accomplish is almost conclusively shown by the fact that according to him, actions need be defined not only in view of probable situations, but also in view of those that lie on 'off-equilibrium' paths: "Now, the identity of a habit depends on how it might lead us to act, not merely under such circumstances as are likely to arise, but under such as *might possibly occur*, *no matter how improbable* they may be (No matter if contrary to all previous experience [Marginal note, 1893])" (CP 5.400, 1877, *How to Make Our Ideas Clear*, added emphasis).

Beliefs incorporate the considerations of what would happen if we were to act according to habit, not in any particular situation, but in all possible, even zero-probable, situations. Peirce's notion of a habit as a general plan or recommendation of action is virtually the same as what in game theory is meant by a strategy.[9]

Hence Peirce's interpretation of assertions and logical constants in his theory of logical semantics is, for all practical purposes, that of GTS. If the Grapheus believes two assertions, he is entitled to choose the weaker, and in interpreting quantifiers, he may choose an element from his field of vision to be the interpretation of a universal assertion. The Graphist, in turn, may choose an element from the domain of her field of vision, mutually agreed to be such with the Grapheus, to be the interpretation of an existential assertion.

Moreover, Peirce's views on beliefs, thinking and truth are considerably clarified against the backdrop of GTS. The existence of a belief is the existence of a habit of acting in a

certain way in different circumstances, not necessarily in the actual circumstances but in those which refer to future occasions:

It is not all signs that have logical interpretants, but only intellectual concepts and the like; and these are all either general or intimately connected with generals, as it seems to me. This shows that the species of future tense of the logical interpretant is that of the conditional mood, the '*would be*.' … The logical interpretant should in all cases be a conditional future. (EP 2: 410)

The idea of a logical interpretant living in the future is reiterated such that "the Object is the cause, the Interpretant the effect of the sign. As effect it extends into futurity, therefore the logical interpretant must be, in some sense, in the *future tense*" (*Peirce to Papini*, p. 6, 10 April 1907, cf. MS 318: 45).

Logical constants contribute to habits by making the selections of assertions and individuals possible. This is 'the specification of the conditions' at the back of the description of actions, which in turn describes the habits (CP 5.491; EP 2: 418). The specification of the "motive" is in the verificatory and falsificatory activities of the Grapheus and the Graphist linked with assertions. On the other hand, non-logical constants contribute to habits by providing them with the points at which the interpretation terminates.

Finally, experience tests the outcome of our habits:

Another thing: in representing the pragmaticist as making rational meaning to consist in an experiment (which you speak of as an event in the past), you strikingly fail to catch his attitude of mind. Indeed, it is not in an experiment, but in experimental phenomena, that rational meaning is said to consist. … The phenomenon consists in the fact that when an experimentalist shall come to act according to a certain scheme that he has in mind, then will something else happen, and shatter the doubts of sceptics, like the celestial fire upon the altar of Elijah. (EP 2:340, April 1905, *What Pragmatism Is*)

To define the truth by doubt and belief as a final logical interpretant or opinion leads to the concept of truth according to which a belief is true if, and only if, should we follow the habit, no experience we encounter can force us to doubt it, because if we had an experiential reason to doubt it, it would not be a final interpretant or final opinion. This is the case if, and only if, a winning strategy exists in the game associated with the assertion expressing that belief.

*   *   *

Given the foregoing remarks, the argument for the truth of pragmaticism can now be broken down into the following steps of application of GTS:

1. A graph φ is true in M iff there exists a *winning strategy* for the Graphist in a semantic game $G(\varphi, M)$.

2. The Graphist has a winning strategy in $G(\varphi, M)$ iff there exists a *habit of action* associated with φ by which we can choose suitable courses of actions and seek and find suitable elements from our universes of discourse.

3. Juxtaposition, polarities of areas and continuous connections between subspaces contribute to the habit by giving it *form*.

4. Spots contribute to the habit by giving it *points of termination*.

5. φ is true in M iff there exists a habit of action associated with φ by which we can choose suitable courses of actions and seek and find suitable elements from our universes of discourse, and the constituents of φ contribute to the habit by giving it form or points of termination.

6. The constituents of φ contribute to the truth-conditions of φ by giving form or points of termination to some habit associated with φ by which we can choose suitable courses of actions and seek and find suitable elements from our universes of discourse, and φ has truth-conditions only if there exists a habit for φ by which we can choose suitable courses of actions and seek and find suitable elements from our universes of discourse.

7. If the truth-conditions for φ constitute its meaning, the constituents of φ are meaningful by giving form or points of termination to the habit associated with φ, and φ is meaningful by being associated with the habit by which we can choose suitable courses of actions and seek and find suitable elements from our universes of discourse.

8. $\rightarrow$ Constituents of φ are meaningful by giving form or points of termination to the habit associated with φ, and φ is meaningful by being associated with the habit by which we can choose suitable courses of actions and seek and find suitable elements from our universes of discourse.

From the point of view of the above argumentation, pragmaticism is located between correspondence theory and verificationism: the link between the true assertion and the world is mediated through habits or strategies, but these habits or strategies will not remain unaffected by our knowledge of the facts. The game rules are epistemic to the extent to which Peirce takes habits

to be good or bad according to the normative ideals in the minds of agents proficient in self-control, since "habits, so to call them, must be capable of being modified according to some ideal in the mind of the controlling agent" (MS 280: 30). These ideals have been shaped via experience, common knowledge and collateral observation through evolutionary time.[10]

5. The Importance of Existential Graphs

Why did Peirce choose Existential Graphs as his preferred medium for the proof? Note that he never held EGs to be necessary for the proof to go through, since similar argumentation would turn out valid for any intellectual concept, purport or generality. But he thought that his earlier statement regarding the principle of pragmaticism[11] "can with advantage be a little differently worded" if we take seriously that the system of Existential Graphs provides "a moving picture of the action of the mind in thought" (MS 296). "The study of that system", he avers, "must reveal whatever common nature is necessarily shared by the significations of all thoughts", and existential graphs "furnish a test of the truth or falsity of Pragmaticism" by disclosing "what nature is truly common to all significations of concepts" (MS 298). That nature can then presumably be compared with the nature that pragmaticism asserts is common to all significations.

These are all highly substantial remarks and merit a separate discussion (Pietarinen 2009b). Briefly put, the following six points speak in favour of the choice.[12]

(1) The sheet of assertion, or more generally, the Phemic Sheet, is an icon of the universe of discourse. "In representing the field of attention", Peirce explains, the sheet "represents the general object of that attention, the Universe of Discourse" (CP 4.561n1, 1906, *The Bed-Rock beneath Pragmaticism*). The same idea is expressed in the earlier quotation in which Peirce mentions the "field of vision" constitutive of the players' actions. The sheet is also "an image of the universal field of interconnected Thought" (CP 4.553n1; Pietarinen 2007). It is under these notions that logic and phenomenology can be seen to shake hands.

What is more, for the game to be playable, the domain of a universe must be readily available to the players and mutually agreed upon by them. It may contain not only objects of assertions but also of modalities and of non-declaratives such as questions and commands.

(2) One of Peirce's major quests in composing the accounts of the proof of pragmaticism was to find and characterise the "indecomposable element[s] of thought" (MS 284: 43, 1905, *The Basis of Pragmaticism*; MS 325: 3, n.d., *Pragmatism Made Easy*). The indecomposable elements of thought have "a structure analogous to the valencies of a rheme" (arities of predicate terms). They are not rhemes, because rhemes are indefinite propositions (MS

284: 43). But the spots of EGs are the iconic counterparts of rhemes. Hence they serve the purposes of being the images of what is indecomposable in cognition.

Indecomposability is also related to the negative part of the reduction thesis: that no triadic relation can be composed of monadic and dyadic relations alone. Thus spots with empty hooks and with no identity lines attached to their hooks are the diagrammatic counterparts of what Peirce thought resides in cognition as its indecomposable elements.[13]

(3) Existential Graphs give precise form to habits, and diagrammatic assertions are interpreted by habits. The interpretation of graphs is "endoporeutic" (MS 293: 53, 1906, *Prolegomena*; MS 650: 18, 19, 1910, *Diversions of Definitions*; MS 669: 4, 1911, *Assurance Through Reasoning*). It proceeds from the outermost area on which a graph-instance lies towards the indecomposable spots (Pietarinen 2006a, Chapter 6). The juxtapositions of subgraphs, the outermost portions of ligatures, enclosures (cuts and their areas), scrolls, and positive and negative areas, are all iconic and topological counterparts to those logical constructions that constitute that form.

(4) The players must recognise whether and when the objects that they seek in the universe in the course of the game have actually been found. This happens only if the non-logical components, that is, the spots, contribute to the activities of seeking and finding those objects. But spots contribute to those activities by providing termination points to players' habitual activities.

(5) A precise logical understanding of modality is essential to Peirce's argumentation. His 1905 restatement of the principle of pragmaticism is succinctly that "the possible is what *can become actual*" (MS 288: 135, 1905, *Materials for Monist Article 'The Consequences of Pragmatism'*). Possibilities are real in that they exert counterfactual force to our actions in the actual world. The foremost problem of the composition of concepts that Peirce addresses in *PAP* is how actual objects can be linked with possible objects (Pietarinen 2005a,b). Peirce's approach to this problem was to draw ligatures linking areas and spots scribed on the sheet representing actuality with areas and spots scribed on the sheet representing various kinds of modalities.[14] The reformulation of the Maxim of Pragmaticism in these terms was suggested to Peirce right after he had taken seriously the assertion that the EGs indeed are our "moving pictures of thought".

(6) Accordingly, a continuous connection obtains between the actual and the possible quite in the same fashion as a continuous connection obtains between various parts of actuality. "'Identity' means a continuity" that admits of "a variety of presentation or representation" Peirce contends (MS 300: 44-45). Identity, given by the connections between different areas of different kinds of sheets, is composed of "possibilities of points" (CP 4.640, 1908, *The Amazing Mazes*), whereas actual points inhabit the extremities of identity lines. His example illustrating the kind of

cross-world identity that is implicated here involves not only modality but also higher-order abstraction of modal properties:

"Tully is distinguishable from whatever is distinguishable from Cicero" really means that "Tully is distinguishable from whatever there can possibly be that would be distinguishable from Cicero"; just as the equivalence of the Graph asserting that "A rose possesses the quality redness" with the graph that asserts simply, "A rose is red" is to be explained by [the] fact that no "quality redness" exists in the universe, this quality being merely an object in the potential mode. (MS 298)

Thus possibilities are real and modalities are logical constants that prompt actions in the correlated pragmatic and game-theoretic interpretation just as other logical constants do.

Therefore, the meaning of logical and non-logical constants depends on the effects they have on the structure of the strategic activities of the 'make believe' players. In the light of Peirce's remarks on the continuous connection between the possible and the actual and the composition of the lines of identities as modal continua out of possibilities, we are in a position to appreciate the complexities of how the truth of pragmaticism supports the truth of synechism.

6. Conclusions

Peirce's argument for the truth of pragmaticism is an articulation of a theory of logical semantics with notable pragmatic overtones. It is a defence of the comprehensiveness of the logical analysis of signs as well as a demonstration of the ubiquitousness of pragmatic aspects of meaning, which are found in interactive structures produced by our interpretative and strategic practices and actions.[15] The purpose of actions is to hoard information that enables objects to be picked from the universe of discourse to satisfy intellectual signs. The meaning of an intellectual sign is in the habits that shape such structures and possibly change them, in which case the meanings will change. It is the interaction between the Graphist and the Grapheus (the agent/system/utterer and the environment/interpreter) that produces a geometry which describes the meaning of the assertion.

The relational structure depicts all the conceivable effects (payoff distributions at terminal histories) that an intellectual concept may have. The existence of habits (winning strategies) agrees with the truth of assertions according to those conceivable effects. Recall the conclusion of Peirce's argumentation: "[T]he most perfect account of a concept that words can convey will consist in a description of that habit which that concept is calculated to produce. But how else can a habit be described than by a description of the kind of action to which it gives rise?"

(CP 5.491; MS 318; EP 2: 418). Outside of philosophy, a similar concept of meaning has recently become influential in computational and logical theories of interaction and communication (see e.g. Majer, Pietarinen & Tulenheimo 2008).

Acknowledgments

References

Esposito, Joseph L. 1980. *Evolutionary Metaphysics: The Development of Peirce's Theory of Categories*. Athens: Ohio University Press.

Fisch, Max 1986. The 'proof' of pragmatism. In: Max Fisch, *Peirce, Semeiotic, and Pragmatism: Essays by Max H. Fisch*. Bloomington: Indiana University Press, 362-375.

Hilpinen, Risto 1982. On C. S. Peirce's theory of the proposition: Peirce as a precursor of game-theoretical semantics. *The Monist* 65, 182-188.

Hilpinen, Risto 2004. Peirce's logic. In: Dov M. Gabbay and John Woods (eds), *Handbook of the History and Philosophy of Logic* 3. Amsterdam: Elsevier, 611-658.

Hintikka, Jaakko 1973. Language-games for quantifiers. In: Jaakko Hintikka, *Logic, Language-Games and Information*. London: Oxford University Press, 53-83.

Hintikka, Jaakko 1996. The place of C. S. Peirce in the history of logical theory. In: Jacqueline Brunning and Paul Forster (eds.): *The Rule of Reason: The Philosophy of Charles Sanders Peirce*. Toronto: University of Toronto Press, 13-33.

Hintikka, Jaakko 1997. *Lingua Universalis vs. Calculus Rationalis: An Ultimate Presupposition of the Twentieth-Century Philosophy*. Dordrecht: Kluwer.

Hookway, Christopher 2004. The principle of pragmatism: Peirce's formulations and examples. *Midwest Studies in Philosophy* 28, 119-136.

Houser, Nathan 1998. Introduction. In: EP 2: *xvii-xxxviii*.

Houser, Nathan, Roberts, Don D. and Van Evra, James (eds), 1997. *Studies in the Logic of Charles Sanders Peirce*. Bloomington: Indiana University Press.

Kilpinen, Erkki 2006. The habitual conception of action and social theory. *Semiotica*, to appear.

Majer, Ondrej, Pietarinen, Ahti-Veikko and Tulenheimo, Tero (eds.), 2008. *Games: Unifying Logic, Language, and Computation*. Dordrecht: Springer.

McCarthy, Jeremiah 1990. An account of Peirce's proof of pragmatism. *Transactions of the Charles S. Peirce Society*, 63-113.

Peirce, Charles S. 1931-58. (CP) *Collected Papers of Charles Sanders Peirce*. 8 vols., ed. by Charles Hartshorne, Paul Weiss, and Arthur W. Burks. Cambridge, Mass.: Harvard University Press.

Peirce, Charles S. 1967. (MS) Manuscripts in the Houghton Library of Harvard University, as identified by Richard Robin, *Annotated Catalogue of the Papers of Charles S. Peirce* (Amherst: University of Massachusetts Press, 1967), and in The Peirce Papers: A supplementary catalogue, *Transactions of the C. S. Peirce Society* 7 (1971), 37-57.

Peirce, Charles S. 1998. (EP) *The Essential Peirce* 2. Peirce Edition Project, Bloomington: Indiana University Press.

Pietarinen, Ahti-Veikko 2005a. The composition of concepts and Peirce's pragmatic logic. In: E. Machery, M. Werning and G. Schurtz (eds.), *The Compositionality of Concepts and Meanings: Foundational Issues*, Ontos-Verlag, 247-270.

Pietarinen, Ahti-Veikko 2005b. Compositionality, relevance and Peirce's logic of existential graphs. *Axiomathes* 15, 513-540.

Pietarinen, Ahti-Veikko 2006a. *Signs of Logic: Peircean Themes on the Philosophy of Language, Games, and Communication* (Synthese Library 329). Dordrecht: Springer.

Pietarinen, Ahti-Veikko 2006b. Peirce's contributions to possible-worlds semantics. *Studia Logica* 82, 345-369.

Pietarinen, Ahti-Veikko 2007a. Peirce and the logic of image. *Semiotica*, to appear.

Pietarinen, Ahti-Veikko 2007b. To Peirce Hintikka's thoughts. *The Epistemology and Methodology of Jaakko Hintikka*, November 2007, Copenhagen: The Carlsberg Academy.

Pietarinen, Ahti-Veikko 2009a. Why is the normativity of logic based on rules? In C. de Waal & K. Skowronski (eds.), *Charles S. Peirce's Normative Thought*, Bloomington: Indiana University Press.

Pietarinen, Ahti-Veikko 2009b. The proof of pragmatism: Comments on Hookway", *Cognitio* 9, 85-92.

Pietarinen, Ahti-Veikko and Lauri Snellman 2006. On Peirce's late proof of pragmaticism. In: Tuomo Aho and Ahti-Veikko Pietarinen (eds), *Truth and Games*, Helsinki: Acta Philosophica Fennica, 275-288.

Roberts, Don D. 1973. *The Existential Graphs of Charles S. Peirce*. Mouton: The Hague.

Roberts, Don D. 1981. Peirce's proof of pragmaticism and his existential graphs. In: Kenneth L. Ketner et al. (eds.), *Proceedings of the C. S. Peirce Bicentennial International Congress*. Graduate Studies Texas Tech University, Lubbock: Texas Tech Press, 301-306.

Robin, Richard S. 1988. Some questions concerning Peirce's 'proof' of pragmatism. In: Regina Claussen and Roland Daube-Schackat (eds.), *Gedankenzeichen: Festschrift für Klaus Oehler zum 60. Geburtstag*. Tübingen: Stauffenburg Verlag, 295-303.

Robin, Richard S. 1997. Classical pragmatism and pragmatism's proof. In: Jacqueline Brunning and Paul Forster (eds), *The Rule of Reason: The Philosophy of Charles Sanders Peirce*. Toronto: University of Toronto Press, 139-152.

---

[1] Reference is to Peirce (1967) by manuscript and page number. Other references to Peirce's work are likewise standard.

[2] Date according to Max H. Fisch's notes deposited in The Peirce Edition Project, with the admission that this MS 300 may have been composed as early as October and November of 1907.

[3] Earlier studies concerned with Peirce's proof of pragmaticism include Esposito (1980), Fisch (1986), Hookway (2004), McCarthy (1990), Roberts (1981) and Robin (1988, 1997).

[4] The first one is in the 1903 Harvard Lectures, using perception and abduction as the key notions.

[5] Pietarinen (2007b) charts the similarities between Peirce's and Hintikka's logical and philosophical viewpoints. In the light of these interrelations, Hintikka's *œuvre* has a good claim to be an intellectual reincarnation of Peirce's bequest.

[6] This section assumes familiarity with the basic notions and terminology of the logic of Existential Graphs. See e.g. Roberts (1973), Hilpinen (2004) and Pietarinen (2005b, 2006a) for some explanations.

[7] The Grapheus is Peirce's alternative and equally common term to name the opponent of the Graphist, the interpreter.

[8] Pietarinen (2009a) discusses this remarkable passage further, taking up the statement that habits "be capable of being modified according to some ideal in the mind of the controlling agent". This links logic with normative esthetics, revealing the precise sense in which Peirce understood normativity of logic to hinge on esthetic ideals.

[9] Hintikka (1999, p. 100) notes, "I suspect, in other words, that inside each Peircean habit there lurks (at least in the area of epistemology) a strategic rule trying to get out." See also a discussion of Peirce's notion of habit in Kilpinen (2006) and Pietarinen (2006a).

[10] Thus there are also some marked differences between Peirce's and Hintikka's semantic games. The study of those differences will no be undertaken here.

[11] "If we consider what effects that might conceivably have practical bearings we conceive the object of our conception to have, then our conception of those effects will be the [our] whole concept of the object" (MS 298).

[12] Retrospectively, Peirce gave an account of the history of the *Monist* series stating that he "did not design to give any full account of Existential Graphs" but "decided to insert an article on Existential Graphs", which was *Prolegomena to an Apology for Pragmaticism*, to "measure what may be called the philosophy of the system" and to convey "a much fuller and more convincing apprehension of the nature of my proof" (MS 300: 14-16). Prior to *Prolegomena*, the unpublished series of *The Basis of Pragmaticism* (MS 279-284) begins with a yet fuller but somewhat less systematic account of graphs and their meaning than the published 1906 version of the *Prolegomena*, while *Prolegomena* adds the modal part (the 'tinctured' graphs). Peirce held *Prolegomena* to be a sketch of the proof written to prevent "a

development of thought not likely to be independently reproduced in a century" from passing "into complete oblivion" (MS 300: 14 a.p.). (The present paper was written in 2005-2006 though it likely will not to appear before 2010.)

[13] Pietarinen (2007a) argues that spots are what Peirce referred to as images in EGs: they are those terminal points of interpretation that contribute to the form of habits but are not themselves interpreted by habits as they depend on psychological, singular and physiognomic processes which kaleidoscope the surface of the phaneron.

[14] This is the iconic counterpart to the problem of the cross-world identification (Pietarinen 2005a, 2006b). See e.g. MS 295 (44-45, 71 a.p.), in which Peirce seeks an argument that tinctures are connected with the pragmatic meaning of modal EGs.

[15] Peirce's manuscript 330 (*The argument for Pragmatism anachazomenally or recessively stated*, c.1906, date by André DeTienne) goes on to outline the semeiotic proof in a reverse order. It concludes that "The only essence of the concept---its logical interpretant---is the generalized habit of conduct" (p. 2). We forego an analysis of this draft here and leave only a scholarly note: might this draft be what Peirce commented on as "a proof" that he had earlier "worked out and perfected" (MS 322: 13)?