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Identifying Peirce's "Most Lucid and Interesting Paper"

Introduction

If one wishes to acquire a deeper understanding of the work of a distinguished thinker, very often that person's self-descriptions will provide important clues. In Peirce's case, there are a large number of these autobiographical remarks. One that seems to me to be the most promising and useful came in a long letter of 1913 to F. A. Woods:

> It was 17 years ago, lacking between 2 and 3 calendar months, that it first forcibly struck me . . . that my paper of Jan. 1897 ["The Logic of Relatives, *The Monist* 7:161-217] . . . required considerable modification. Not that I had said anything *false* but that I had failed to state the matter in the simplest and best form. Thereupon, I wrote the most lucid and interesting paper I have ever written; but I had no way of publishing it. The editor to whom I sent it refused it on the ground that I should soon make some further discovery . . . . (MS L 477: sheets 30-32, following the numbering system in Robin 1967 and 1971)

I shall argue below that the paper to which Peirce referred in that letter is MS 482, "On Logical Graphs." The argument would be facilitated, however, if a synopsis of its contents were presented first.[1]

I. Analysis of MS 482

The folder for this MS seems to be composed of a single rough – but apparently nearly complete – copy of a paper, the final title of which is "On Logical Graphs," together with some rejected draft sequences and pages. A copy of a finished article is not known to exist; it is likely that the fair copy was sent to Carus (see part II below), and either was not returned, or has been lost. The surviving manuscript contains 227 sheets. Also, C. J. W. Kloesel (personal communication) has identified MSS 518-A and S-35 as part of the folder for 482, which adds approximately 30 more sheets of rejected draft pages. So this is a relatively large file, indicating that Peirce had put a good deal of labor into the project, running through several drafts before being satisfied.

There are two lengthy continuous runs which, as Peirce's section numbers indicate, comprise the finished form of the essay: 482:2-30 a beginning (PP 1-30) bearing the title 'On Logical Graphs' comprising § 1-10 and 482:38-45 (labeled as § 11).

A number of continuous runs of draft pages were assembled. (The author will gladly provide a list to interested parties.) Study of these has shown that in spite of PP number variations in the draft sheets, their content closely parallels that of the finished main paper (composed of sections 1 through 11). Moreover, no really new content items were found in the rejected draft sheets. However, some alternate phrasing and other interesting items appear there. Some of these will be mentioned below. In addition, there are many single sheets, some of which might yet be fitted into some continuous run.

SYNOPSIS OF SECTIONS 1-11: ON LOGICAL GRAPHS

§ 1. PP 1=482:02. Definition of 'graph' and associated technical terms ('spot', 'color', 'bonds', 'lines', 'faces', 'simple-bonded graph', 'loose end'). The Listing Numbers of a graph {after Johann Benedict Listing, the founder of topology: see Listing 1847 and 1861}; topological considerations such as dimensionality, the continuum. The first Listing number is chorisis (the number of separate pieces), the second is cyclosis (the number of independent rings). Graphs of chorisis 1 are called 'connected wholes'. Graphs of cyclosis 0 are called non-cyclic. PP 2=482:03 Listing's census theorem applied to a simple-bonded graph of the lowest dimensionality is that the chorisis of a graph minus its cyclosis equals the number of spots less the number of connecting bonds (bonds with loose ends not being counted).

§ 2. Definition of valental graph as one with a determinate number of bonds on determinate sides. Places of attachment of bonds are called 'ends'; ends not attached by bonds are called the 'ends of the graph'. Chemical graphs are valental graphs. The number of loose ends of a graph is its valency. PP 3=482:04 Designations representative of the valency of a graph are: valency 0 = medad; 1 = monad; 2 = dyad; 3 = triad, etc.;)2 = polyad; 2N = artiad; 2N+1 = perissid. Beside the foregoing Listing census theorem, the following second census proposition holds of valental graphs: "The valency of a graph equals the sum of the valencies of its spots less twice the number of connecting bonds. It follows as a corollary that no perissid can be composed exclusively of artiads; and this constitutes a fundamental distinction between artiads and perissids." Additional topological results are discussed, and expressed in an equation. "We may (as the equation shows) conceive of a tetrad spot as composed of two triads, of a pentad spot as composed of three triads, etc." PP 4=482:05 Other topological properties are discussed. "These four kinds of spots {medads, monads, dyads, and triads} are strikingly different in their topological properties. As for spots of higher valencies {than three}, they may naturally be conceived to be composed of triads. . . ."

§ 3. Definition of polar graph. Bonds of such graphs have a positive and negative end. Definition of unbalanced polar graph. PP 5=482:06 Examples of chemical graphs that are unbalanced polar medads.

§ 4. PP 6=482:07 The graphs of logic are unbalanced polar valental graphs. "Each spot stands for a character, and has a number of hands {loose ends} equal to the number of subjects requisite for the embodiment of that character." Comparison of logical graphs with relatives such as "_______ gave ______ to _______." The individuals in a relative are denoted by the loose ends, or bonded loose ends, of a graph. PP 7=482:08. The writer and reader of a graph. The theory of selectives applied to graphs.

§ 5. Illustration of the foregoing graphical discussion with figures expressed in entitative graphs. Several sentences graphed as examples. PP 8=482:09 Examples of graphed English sentences continued.

§ 6. PP 9=482:10 With topological considerations in mind, techniques for reading entitative graphs. PP 10-11=482:11-12. Reading techniques continued.

§ 7. PP 12=482:13 The purpose of these graphs is to facillitate the logical analysis of thought; examples of the fruitfulness of these graphs for that purpose: symmetry of relation plus the illative connection.

§ 8. PP 13=482:14 Second intentional characters are those brought to our knowledge not by observation of their subjects, but by observation of logical forms. Relatives of second intention are required in logic in order that the elementary requisites of a logic may be fulfilled; they are also required in mathematics. A good logic invites inspection of its logical forms. PP 14=482:15 More examples of English sentences expressed as graphs. PP 15=482:16 Examples continued. PP 16=482:17 Modes of graphical expression of some important concepts: the triad of diversity and an "important arithmetical dyad." PP 17=482:18 Examples continued. "These examples {of entitative graphs} will suffice to show the expressive power of our single sign of the connection of relatives when it is aided by the three fundamental arithmetical relatives."

§ 9. PP 18=482:19 For the reasons stated in § 7 and 8, "the above statement of the theory of the logical graphs is correct, yet there are certain simplifications which are permissible abbreviations." Examples of such simplifications. PP 19=482:20 Simplification examples continued. PP 20=482:21 Simplification examples continued. Statement of what later became the Double Cut rule (double negation) in Existential Graphs. PP 21=482:22 Fifth simplification example. Recognition of the circle as "the sign of precise denial." PP 22=482:23 Recognition that copulation (conjunction) can be represented by writing the conjuncts side by side. Six simplifications have been achieved.

§ 10. PP 23=482:24 "The ratiocinative transformations of graphs appear to be of seven kinds, corresponding to steps which I have independently recognized in inference." Discussion of seven such transformation patterns. All these illative processes are subject to the principle of contraposition which as applied to graphs is as follows: "If any illative process is valid within an even number of enclosures, its reverse is valid within an odd number, and vice versa." Application of these seven transformation forms to entitative graphs in view of the principle of contraposition: for example, PP 24=482:25 within odd enclosures any part of a medad may be struck out {later to become the EG Erasure rule} and within even enclosures any arbitrary attachment may be made {later to become the EG Insertion rule; note that this is in terms of entitative graphs – in EG, one would have the same two rules, but the positions of 'odd' and 'even' would be exchanged}. Examples. PP 25-27=482:26-28 More examples and discussion of inference patterns. PP 28=482:29 Examples and discussion continued. Comparison of features of graphs with algebra. PP 29=482:30 Continued comparison with algebra. Iteration and {implicit} Deiteration. PP 30=482:31 Concluding examples from previous page.

§ 11. {using PP 59-66=482:38-45} PP 59=482:38 "Rules of Simplified Graphs; Part A. Definitions; Rule I. Of Entitative and Existential Graphs." Definitions of Relative, logical graph – "a diagram composed of lines and of spots of various colors which is intended so to exhibit the composition of an assertion or relative so that its logical relations can be studied" – and simplified logical graph. A simplified logical graph can either be interpreted as an Entitative or an Existential Graph. These two interpretations are given in the discussion here, with their parallel nature being indicated in certain phrases of the discussion by writing appropriate comments about them one above the other, the lower being the existential interpretation. PP 60=482:39 "Rule II." Definitions involving letters and circles; "Rule III." Odd and even enclosures; circles. PP 61=482:40 Discussion of circle continued. Parallel of the two systems shown in many top-bottom phrases in several sentences. PP 62=482:41 "Rule IV." Nexes and bonds. PP 63=482:42 Nexes and bonds continued. PP 64=482:43 "Part B. Theorems." "Rule V. Theorems necessary for Delineation." PP 65=482:44 "Rule VI. Fundamental Illative Transformations." The rules of illative transformation with parallel interpretations for entitative and existential graphs. PP [66]=482:45 "Rule VII. Derived Illative Transformations." Some general theorems with parallelism between the two systems shown.

We now turn to some interesting passages from the various runs of rejected draft pages. It is clear from these draft sheets that one of the major intellectual moments in the composition of the paper occurred when Peirce sought for ways to simplify Entitative graphs. As that process continued, he began to see that out of simplified Entitative graphs, the better system of Existential Graphs appeared. For instance, at PP 29=482:67 we find:

> These simplifications work such a metamorphosis of the graphs that their rules require restatement, as follows:
>
> RULES OF SIMPLIFIED IDEOGRAPHS
>
> 1. A *logical graph* is . . . . {the discussion then continues in the vein of § 11 where Existential Graphs appear as the "simplified logical graphs."}

In a draft section (PP 27=482:71) that parallels § 9 of the main paper, Peirce wrote the following, which is very important, for it is most likely a record of the birth of Existential Graphs from Simplified Entitative Graphs.

> § 9. The rules of interpretation might be reversed, as follows: Evenly enclosed pieces to be understood as conjoined copulatively, oddly enclosed pieces disjunctively. Evenly enclosed bonds to show that the subjects are to be suitably chosen {existentially quantified}; oddly enclosed bonds to show that the subjects may be taken no matter how {universally quantified}. Oddly enclosed graphs are negative.
>
> In this case, the monad spot would signify "______ is." The encircled monad spot would be absurd. The dyad spot would signify "______ and ______ are one and the same individual." The node, or triad spot, would signify "______ and ______ and ______ are one and the same individual."
>
> This system would have two advantages. First, it would

give, as nearly as possible, the right interpretation to a graph not a medad. Thus, Fig. 67 would mean 'Somebody loves somebody.' {This is the way one writes such a sentence in the finished Existential Graph system.}

Fig. 67

Secondly, the mere writing together of propositions would assert them all. {Again, this is the convention of Existential Graphs.} It would have the disadvantage of giving too complicated an expression to a simple hypothetical; but "If A is true then C is true" could be written as in Fig. 68 {again, the technique of Existential Graphs}.

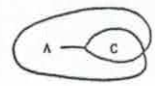

Fig. 68

where C is twice enclosed, and "All wise men are virtuous" as in Fig. 69 {also the technique of Existential Graphs}.

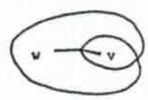

Fig. 69

"All wise men love all but virtuous men" is shown in Fig. 70 {which is also the way of Existential Graphs}.

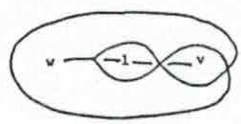

Fig. 70

> The rules of inference given in the next section {see § 10 in the finished essay} would be merely reversed. {It is possible that this reversal may also have been inspired by the contraposition principle.}

Another important sequence showing a parallel aspect of the birth of Existential Graphs may be found at PP 53=482:36:

> Evidently, all forms of graphs might, with perfect consistency, be understood to precisely deny those propositions which they have hitherto been interpreted as asserting; and furthermore, the meanings of all letters might be reversed. Thus arises a second system of interpretation according to which each graph means what upon the first system it would mean if two changes were made in it, namely, if, first, a circle were drawn around each letter, and if, second, a circle were drawn around the whole graph. This second system of interpretation may be called the *existential,* that hitherto considered the *entitative* system of interpretation. {Compare PP 57-59=482:32-35 and PP 58=482: 37.}

Other themes of interest may be found expressed a bit more fully in the rejected drafts. For instance, PP 29=482:51 begins with: "§ 5. *Triads the primitive form of relatives.*" Peirce went on to write that triads are the most important of all relatives. For, out of triads all polyads can be constructed: from two triads a dyad can be made; from one triad a monad can be made; from an even number of triads a medad can be made. After drawing graphs of the above, Peirce gave the following important observation.

> When, therefore, it is recognized that the prime utility of a notation for the logic of relatives is not to construct a *calculus,* or handy method for the solution of special logical problems {a mechanical algorithm, in other words}, but

> is rather to help us in the study of that logic in its generality, so that that notation is the best which carries analysis the furthest and presents the smallest number of diverse logical forms, we shall prefer not to use any elementary, unanalyzed relatives except triads. It is true that pentads, heptads, or any other perissids, or odd-ads, would answer equally well. But nobody will demur to the choice of the lowest in adicity. No artiad, or even-ad, can produce anything but an artiad. For the compound of an m-ad and an n-ad is a $(m + n - 2l)$-ad, where l is the number of bonds by which each is joined to the other. For the same reason, two monads can only produce a medad. Hence, the triad is the lowest form of relative from which all others can be derived. If logic has any significance for metaphysics, which is good Kantian doctrine, this logical principle must have its metaphysical analogue, or, rather embodiment.

At PP 30=482:112, Peirce mentioned that there is no reason other than convenience why the graphs are drawn in two dimensions – they could be done in three dimensions.

General conclusions. The surviving MS 482, in its two main continuous runs, represents a single unified paper, sections 1-11. The diversity of PP numbers represents an artifact of composition which was probably rectified on the fair copy. This thesis is sustained by the continuity of content and of § numbers in the two main runs.

The reconstructed paper from MS 482 illustrates how Peirce moved from a very general form of pure mathematics (topology) to an application of that in logical analysis (the graphical system of logic) to an anticipated application to metaphysics (the Kantian step, realized elsewhere in Peirce's writings).

That this reconstructed essay can with confidence be identified as Peirce's "most lucid and interesting paper" is argued in part II.

II. An Identification Hypothesis

We now turn to consider evidence that tends to confirm that the "most lucid and interesting paper" is MS 482. The evidence is circumstantial, but I will argue that this identity can be established with a high degree of confidence. This will also be an opportunity to state this thesis clearly so as to expose it to possible disconfirming evidence, a development that would be welcomed here in the spirit of science.

The first class of evidence consists of a number of instances in which Peirce referred to his development of the conception of Existential Graphs, probably in December of 1896, upon reading proofs for his *Monist* paper of 1897. These instances are so similar, and the events mentioned in them are so unique, that one can confidently infer that all these instances are discussions of the same MS. Here is a list of all such known occasions (omitting MS L 477, the letter to Woods of 1913, quoted at the beginning of this essay).

> {MS 500:02 – 6 December 1911} My dear Risteen: I mentioned to you, while you were [here] last year, that I have a diagrammatic syntax which analyzes the syllogism into no less than six inferential steps. I now describe its latest state of development for the first time. I am glad to think that my account of it will have one such a reader as you. C.S.P.
>
> This syntax, which I have hitherto called the "System of Existential Graphs," was suggested to me in reading the proof sheets of an article by me that was published in the *Monist* of Jan. 1897; and I at once wrote a full account of it for the same journal. But Dr. Carus would not print it. I gave an oral account of it, soon after, to the National {500:03} Academy of Sciences {probably *P* 1140 and 1141, using the reference system in Ketner 1977}; and in 1903 for my audience of a course of Lectures before the Lowell Institute {see *P* 1005}, I printed a brief account of it. An account of slightly further development of it was given in the *Monist* of Oct. 1906 {*P* 1128}. In this I made an at-

tempt to make the syntax cover Modals; but it has not satisfied me. The description was, on the whole, as bad as it well could be, in great contrast to the one Dr. Carus rejected. . . .

{MS 1589:02 – late} The system of existential graphs is intended to afford a method for the analysis of all necessary reasonings into their ultimate elements. No transformations are permitted except *insertions* and *omissions,* and the results of series of permissible insertions and ommissions. The peculiar formal signs are the fewest with which it is possible to represent all the operations of necessary reasonings.

The system was invented in January of 1897. The Monist refused to publish an account of it.

{MS 479:02 – 1903, perhaps the single most important source of clues for the identity of the most lucid and interesting paper}

On Logical Graphs

The word graph was introduced into algebra either by William Kingdon Clifford or by the great Sylvester, – I believe they attribute the invention to each other reciprocally, – to designate a diagram of dots and lines, similar to those by which the chemists represent the constitution of compounds, used as an icon of the relationships involved in invariants. Similar diagrams, though not called graphs, were employed by Kempe in his remarkable memoir on Mathematical Form to represent relationships of all kinds between individuals. I subsequently proposed (*Monist* Vol VII, pp. 161-217, see CP 3.456f.) a system capable of representing all facts of relation between classes as well as between individuals; but this was no sooner seen by me in type than I perceived that it was one of a pair of twin systems {479:03} of which the other was to be preferred, and I wrote at once an elaborate paper on the subject, for which I vainly endeavored to find an asylum. At that time, I drew up an elaborate definition of a graph, contemplating all sorts of possible generalizations; but I have since bestowed a great deal of study upon the matter both in its details and in its general aspects, and have been led to prefer a very much simpler definition which includes diagrams already in general use among logicians, – being one of the few things which all schools unite in finding valuable, and this catholic confession would seem to be an argument in favor of that intuitional theory of reasoning which was so forcibly argued by Friedrich Albert Lange {see Lange 1877}.

I propose to use the term *logical graph* to designate any diagram which iconizes logical relations by means of geometrical relations.

{MS 483:02, 1898-9} On Existential Graphs

By C. S. Peirce

In the *Monist* for January, 1897, I have sketched a system of graphs to serve the purposes of a logical calculus; and in another paper, which will probably be published before the present memoir, I have shown that these graphs may be understood according to two systems of interpretation, the Entitative and the Existential and have given a philosophical development of the former system {probably a reference to the last section of MS 482}. My purpose now is to explain the existential system by itself so as to exhibit its remarkable simplicity, avoiding as much as possible the philosophy of logic. . . .

{MS 485:02 – 1898, On Existential Graphs, adds nothing new, seems to be a draft related to 483, of a paper on the "existential system by itself."}

{MS 488:02 – 1898} Positive Logical Graphs

The system of logical graphs here described is essentially

> the same as that which was sketched by me in a paper in the Monist for January 1897, except that the interpretation is nearly reversed. I shall distinguish the present system as positive, since it proceeds upon the principle that writing a proposition down asserts it. . . . {This seems to be one more attempt, similar to that of MS 483, to produce a paper on the existential system (here labeled the positive system) by itself.}

I conclude that these passages refer to one paper that Peirce wrote shortly after he saw the galleys for his January 1897 *Monist* article. If that conclusion is correct, then on the basis of these passages, the paper he wrote must have the following properties:

(1) It must include a parallel account of the twin systems of Entitative and Existential graphs.

(2) It must contain a definition of a graph, "contemplating all sorts of generalizations."

(3) If possible, it should show how Existential graphs and Entitative graphs are related.

(4) If the MS mentions the phrase "Existential Graph" that will be a confirming factor.

I submit that MS 482 fulfills all of these properties admirably. Furthermore, in searching the MSS on existential graphs, I have found no other MS which has all these properties.

In a presentation before the Peirce session of the Deutsche Gesellschaft für Semiotik in München (October 1984), C. J. W. Kloesel has stated (page 11):

> Professor Ketner thinks that it {MS 482} fits the description {of the most lucid and interesting paper}, and I have also thought so. Entitled "On Logical Graphs," the manuscript consists of a consecutive run of thirty numbered pages (which were once connected and may have been so for purposes of mailing) and nearly two hundred scattered pages representing rejected and alternate drafts, with

> some page numbers running as high as 70 and 80. Unfortunately, the system of graphs presented in these pages is the entitative rather than the existential one, and I am almost certain that the greatest part of the manuscript, if not the whole, was written in 1896 {no evidence is given for this last assertion}.

There is more than one contestable item in that discussion. First, that analysis of the contents of the folder for MS 482 seems dubious. As I have argued in part I, there is considerable evidence internal in the MS for the existence there of a single unified article. Second, the "nearly two hundred scattered pages" are not scattered if one studies their contents with a knowledge of Peirce's way of using mathematics and with a knowledge of his graphical logic. Also, one should recall § 11 of the main draft: it cannot be part of the rejected drafts portion of what remains in the folder for MS 482, because of Peirce's clear use of section numbering and the clear continuity of content, both of which unify § 1-11. But we must think that § 11 is not part of the main draft if Kloesel is correct. Thirdly, it is simply wrong that there are no Existential Graphs in MS 482, and that only entitative graphs are to be found there. The very creation of Existential Graphs out of simplified valental graphs is recorded there. Furthermore, § 11 displays the parallel presentation of the "twin systems" of entitative and Existential Graphs by a technique of writing the two interpretations above and below each other. The phrase "existential graph" occurs several times in MS 482. Kloesel ends his paper with a suggestion that the MS for the most lucid and interesting paper is not yet found. My proposal is that if MS 482 quacks like a duck and walks like a duck, then we may be inductively confident (until something better comes along) that it is the duck we seek. And an existing very ducklike being ought not to be placed in disfavor simply because one can imagine the possibility of there being a more ducky but as yet nonexistent quacker.

When was MS 482 written? I conclude from the above cited passages that the ideas crucial to its creation were developed in December of 1896 and put into writing in January of 1897. Kloesel cites a number of letters from Peirce's correspondence which seem to me clearly to support the above mentioned sequence for its creation and writing. If one accepts my evidence and argumentation that MS 482 is indeed that paper, and given that Kloesel and I agree on its approximate dating, then I think we have an accurate and confident determination of the date and identity of Peirce's most lucid and interesting paper.

III. The Meaning of It All

Why bother to address the question of identifying the extant MS for this particular paper? Part of the reason was suggested at the start of this essay. We now wonder if Peirce's evaluation of this piece as one of his best can be justified. Space will not allow a proper answer to be worked out here. I only want to report the possibilities I see, and to encourage other Peirce scholars to take a look.

First, this MS seems indeed to be a clear record of the birth of Existential Graphs out of mathematical topology. As such, it shows in some detail how Peirce used mathematics to develop logic/semeiotic. Second, it illustrates his method of proceeding by means of diagrammatic thought, and thus gives major clues showing how semeiotic could be an observational science (compare Peirce 1931-1958 at 2.227). Third, it provides a connecting link from mathematics through phaneroscopy to logic. Fourth, it shows the principal means by which semeiotic (logic in general, including Analytic, Critic, and Methodology) inherits from mathematics its experimental, inductive properties. Fifth, it displays in diagrammatic form Peirce's proof that relations of valency four or higher can be reduced to combinations of triads. That is related to an important thesis in his theory of categories – that there is reason to believe that the categories of First, Second, and Third are complete (that no Fourth is needed). Sixth, it outlines a diagrammatic proof that triads are not reducible to combinations of dyads only. That is related to a central thesis of semeiotic, that signs – which are trivalent relations – are not reducible to mechanical forms (which would be combinations of bivalent relations).

Seventh, it shows the working of valency analysis, which is the foundation of Cenopythagoreanism, which is Peirce's doctrine of classification by means of external form – a basic tool in his effort to classify signs, and in phaneroscopy. Eighth, it provides fundamental material for understanding Peirce's late approach to the problem of how concepts are combined. (These last two issues are pursued in Ketner 1986.)

Thus, my suggestion is that the mystical numerology of the above attempt to identity the paper Peirce valued so highly is an effort that is well worth the candle, because scholars who are working on some aspect of the above themes will now have a major new heretofore unpublished and unnoticed resource to consult. Moreover, this source is one we can with confidence assert to be central in Peirce's late work, and one which had his stamp of approval.

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NOTE

1. Hereafter page numbers written by Peirce are cited as 'pp'; numbers assigned to the individual sheets in this and other Peirce MSS by the Institute for Studies in Pragmaticism will be cited as '482:48' which means MS 482, the 48th individual sheet of paper. This method yields an unambiguous way to discuss the extant material. I use '[ ]' to indicate emendations to Peirce's text; '{ }' are used to insert my own occasional explanatory comments, in lieu of footnotes. I acknowledge with gratitude permission from the Harvard Department of Philosophy to publish from the Peirce manuscripts under their care.

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