

Introduction: Diagrammatical reasoning and Peircean logic representations*

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Along with Gottlob Frege, Bertrand Russell, and David Hilbert, Charles S. Peirce is considered one of the founders of modern logic (Lukasiewicz 1970 [1961]: 111; Barwise and Etchemendy 1996: 211; Quine 1995: 23; Hintikka and Hilpinen 1997: ix). Independently of Frege, he developed the concepts of quantification and quantifying logic (Hintikka and Hilpinen 1997: ix; Quine 1995: 31; Putnam 1982: 297). He was author of the term and concept of “First-Order Logic” (Putnam 1988: 28), and “Trivalent Logic” (Fisch and Turquette 1966; Lane 2001), besides his anticipating Henry Sheffer’s “Stroke Function” by more than thirty years (*W* 4: 218–221; Houser 1997: 3), and he was working with the computational correspondence between truth functions and electrical circuitry that was later independently developed by Claude Shannon (*W* 5: 421–422; Gardner 1982). He insisted on the relevance of logic in both metaphysics and epistemology and, thus, is a founding father of what Jaakko Hintikka has called the tradition of “logic as calculus” as a current competing with the major modern tradition of “logic as a universal language” (Frege, Russell, Wittgenstein, Quine, etc.). His algebraical logical notation developed in the 1880s was the first draft of a modern formal logic and developed, through Schröder and Peano, into the standard formalism used today. Later, he also developed an alternative logical notation using topological forms (existential graphs) that anticipated hybrid systems of notation — heterogeneous logic — based on graphs, diagrams, maps, networks, and frames (Roberts 1973; Shin 1994; Barwise and Etchemendy 1995; Allwein and Barwise 1996).

Peirce’s system of existential graphs (EGs) is a geometric-topological logic notation. According to Gardner (1982 [1951]: 55–56), the existential graph (EG) is the most ambitious diagrammatical system ever built, and the most understandable and versatile system of geometrical logic ever constructed. Developed in different periods, starting in 1882 (Roberts 1973: 18) this *revolutionary* system (Shin 1994: 11) or group of systems (Alfa, Beta, and Gamma Graphs), not only overcomes several limitations of Euler and Venn diagrams (*CP* 4.356), but also allows for the beginning of the diagrammatization of modal logic (Houser 1997: 3). To Peirce, the merit of EGs is double: first, they

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1 allow to chart logical reasoning in its finest detail, making visible every single
2 step in the reasoning process (as against notations aimed at quick, results-
3 oriented heuristics); second, they aim at portraying logical structure as iconical;
4 that is, as ontologically valid, as possible. Recently, EGs have made possible
5 the development of experiments with graphs in artificial intelligence, in areas
6 such as semantic networks and knowledge representation (Sowa 1984, 1992).
7 According to several researchers, working with the computational treatment of
8 graphs, the EGs form “the first articulate model of knowledge and information
9 processing” (Dickson et al. 1997: 2).

10 For a Peircean point of view, however, it is important to underline that the
11 common-sense, everyday opposition between diagrammatical and symbolic
12 representation systems, or between heterogeneous and homogeneous logics,
13 does not hold. Rather, the latter appear as a special subset of the former, and
14 even the most formalist, finitist representation systems must conserve some
15 minimum of intuitive representation (e.g., a line subdivided in places that may
16 be occupied by symbols to be manipulated according to rules on that line). This
17 primacy of geometric representation reopens the connections between logic,
18 on the one hand, and phenomenology, semiotics, cognition, and the heuristics
19 of actual scientific and everyday thought processes, on the other.

20 In the mature version of Peirce’s philosophy from the years around 1900,
21 diagrams play two main roles. First and more general, diagrams and diagram-
22 matical reasoning as such play a central and often overlooked role: all deduc-
23 tive reasoning, according to this doctrine, takes place by means of diagrams
24 that furnish an observation-based approach to abstract, ideal, and logical issues
25 (Stjernfelt 2007). This basic epistemological diagram doctrine thus covers all
26 sorts of maps, graphs, formalisms, algebras, etc. Second, the development of
27 EGs demonstrates the fertility of this viewpoint within the core discipline of
28 logic: Alpha and Beta graphs have been shown to be complete and consistent
29 representations of propositional logic and first-order predicate logic, respec-
30 tively, while the unfinished Gamma graphs are a goldmine of sketches involving
31 modal logic, temporal logic, speech act logic, second-order predicate logic, etc.

32 The interest in the development of hybrid notation systems — “hetero-
33 geneous logic” — based in graphs, diagrams, maps, nets, frames, etc., is
34 amazing. We are witnessing the foundation of research centers dedicated to
35 the creation and development of these systems, an increasing number of books
36 issued upon the subject, articles published in specialized journals, besides the
37 creation of a scientific field based on the EG — conceptual graphs — and the
38 holding of conferences dedicated to this area.

39 This volume aims to propagate the awakening interest in Peirce’s existential
40 graphs and the related issue of diagrammatical reasoning in general. The spe-
41 cial issue covers a continuum from specific studies in Peirce’s Alpha, Beta, and
42 Gamma Graphs, on the one hand, to more general papers on diagrammatical

1 reasoning and graphical representations of logic and semiotics, on the other
2 hand.

3 Here, the reader will find contributions on a wide range of topics, from de-
4 tailed investigations into Peirce's systems to general surveys of the role of dia-
5 grams in reasoning processes: Alpha, Beta, and Gamma systems, Reasoning
6 with Peircean graphs, Diagrams in Peirce's theory of cognition, Pragmatism
7 and existential graphs, Philosophical concerns about Peircean diagrams,
8 Existential graphs and conceptual graphs, Graphical logic representations, and
9 Diagrammatic reasoning.

10 We hope the reasonings in this special issue will contribute to the further
11 development of diagrams, and of Peircean scholarship in general.

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