

Diagrams and Drawings in Charles S. Peirce: Creativity and Reasonableness

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The American philosopher and scientist Charles S. Peirce (1839-1914) considered diagrammatic reasoning as the possibility of reasoning correctly and fruitfully. That kind of reasoning meant for him to put a sensitive element at the center of our reason, an element that allows us to understand, connect, and improve our ideas. Making a diagram was for Peirce much more than giving a visual form to concepts. The use of diagrams and graphic elements is not something auxiliary, a mere transcription of thought into drawings; diagrams consist rather in processes, in the ordering of thought, in its spatio-temporal arrangement, which is just what allows us to understand and increase our thinking. The arrangement of the parts gives us a mastery of far more complicated forms of connection (NEM 4, xx, 1911), to the point that diagrams become one of the keys to explain creative processes.

In this text, we will first deal with Peirce's notion of diagrams; then, we will focus on the role diagrammatic reasoning plays in the Peircean notion of creativity. Finally, we will take as an example the illustrations and drawings used by Peirce himself in some letters of his European correspondence.

1. Peirce's Notion of Diagrams

Peirce repeated on numerous occasions throughout his many works that diagrams *illustrate* the general course of thought (see, for example, *CP* 4.530, 1906). This idea corresponds to his belief that reasoning is not a mechanical function, nor a closed mental faculty. Peirce's notion of reason, very distinct from the isolated conception of reason derived from rationalism, may be called "reasonableness"¹.

Peircean notion of reason is not something which dissects problems, nor it is merely consciousness. The essence of reason lies for Peirce in *thirdness*, allowing us to connect things together, to compose (cf. *CP* 6.343, 1908). For its development, reasonableness depends upon feelings, imagination, and instinct, and it relies upon a broader way of thinking that may even be illustrated in our minds and in our imagination with drawings and diagrams, as he wrote in his "Neglected Argument for the Reality of God". Peirce mentioned there a particular occupation of the mind that he called *usement*. This peculiar activity, which consisted in letting the mind wander without rules or purpose, was at the root of all reason and was, for Peirce, of extraordinary fertility. It was in that activity, so contrary to what is sometimes meant by

¹ The notion of "reasonableness" in Peirce has been studied in S. Barrena, *La razón creativa. Crecimiento y finalidad del ser humano según C. S. Peirce*, Rialp, Madrid, 2007. The term "reasonableness" appears very late in Peirce's texts, since his usage of it covers only the ten years, between 1899 and 1908. Cf. J. Nubiola, "What Reasonableness Really Is", *Transactions of the Charles S. Peirce Society* 45/2 (2009), pp. 125-134.

'rational', in which logical analysis, according to Peirce, can achieve its full efficiency. Peirce wrote:

Enter your skiff of Musement, push off into the lake of thought, and leave the breath of heaven to swell your sail. With your eyes open, awake to what is about or within you, and open conversation with yourself; for such is all meditation. It is, however, not a conversation in words alone, but is illustrated, like a lecture, with diagrams and with experiments (*CP* 6.461, 1908).

But, what is a diagram, according to Peirce? A diagram is for him an arrangement of a set of rationally related objects. The diagram has for Peirce an iconic nature, that is, it is a sign that “represents its object in resembling it” (*CP* 6.471, 1908). In the case of the diagram, the similarity it shows is the relationship between the parts of something: the function of a diagram is to represent relations of the parts of the object or objects through visible relations analogous to them (*CP* 4.433, c.1903). Therefore, a diagram is an icon of intelligible relations that must be analogous to the relations in the object (*CP* 4.531, 1905).

That similarity does not imply for Peirce a physical or sensuous resemblance, but only an analogy between the relations of the parts of each (*CP* 2.279, c.1895). The icon does not tell us either if its object is real or not. Peirce affirms: “a sign may be iconic, that is, may represent its object mainly by its similarity, no matter what its mode of being” (*CP* 2.276, 1903). Peirce explained in 1905 that a diagrammatic system must be as simple as possible, that is, with as small a number of arbitrary conventions as possible, as iconic as possible, and as analytical as possible (*CP* 4.561, 1905).

On the other hand, diagrams are for Peirce the central part of deduction, which is nothing but diagrammatic reasoning. Around 1896, Peirce explained deduction as follows:

Deduction is that mode of reasoning which examines the state of things asserted in the premisses, forms a diagram of that state of things, perceives in the parts of that diagram relations not explicitly mentioned in the premisses, satisfies itself by mental experiments upon the diagram that these relations would always subsist, or at least would do so in a certain proportion of cases, and concludes their necessary, or probable, truth (*CP* 1.66, c.1896; see also *CP* 2.778, 1901).

Diagrammatic reasoning therefore consists in drawing a diagram of a hypothetical state of things and proceeding to observe it. This observation suggests to us that something may be true, and we formulate it with greater or lesser precision, and then we proceed to investigate whether it is true or not. For this, it is necessary to form a plan of research that, says Peirce, is the most difficult part because, for that, the most important characteristics of the diagram must be selected, and the appropriate abstractions must be introduced.

Thus, diagrammatic reasoning implies the elaboration of a diagram — constructing a representation—, its observation, experimentation and a correct analysis of the results (*NEM* 4, 47 and following; *L* 75, 1901). In this illustration with diagrams lies precisely the effectiveness of thought (*CP* 6.461, 1908), because it is difficult to go further without the visual component. It can be said that the visual representation contributes decisively to the development of thought, since it supposes comprehend the structure and order of the parts, and that understanding allows —as we have already said— to experiment and reach new consequences and generalizations. **The law of the mind, says Peirce, in any science, art, or practical life, is that ideas are connected by icons as forming sets** (*NEM* 4, xx; *MS* 1008, 1911).

2. Diagrams and Creative Thinking

We will take now a closer look at the role of diagrams in creativity. For Peirce, the necessary character of deductive —diagrammatic— reasoning consists in that it must be applied to all possible cases, but it is not incompatible with the imaginative study of the diagram that is formed, but rather requires it.

The soundness of diagrammatic reasoning and its disconnection from reality are not opposed to observation or creative imagination, but, on the contrary, it demands and needs them, perhaps even more than other kinds of reasoning, since the diagrammatic representation, that is, the iconic representation, of the facts is realized in the imagination: “We form in the imagination some sort of diagrammatic, that is, iconic, representation of the facts, as skeletonized as possible” (*CP* 2.778, 1901). Therefore, diagrammatic reasoning requires “the perfect imaginability, on the one hand, and the extreme familiarity, on the other hand, of spatial relations” (*CP* 4.246, c.1902); it requires observation and experimentation on a diagram that we have created, so we know everything about its conditions (*CP* 3.560, 1898).

Perhaps it has not been sufficiently considered that deductive reasoning is also creative, that — although at first glance it might seem contradictory — there is something new in it. By making a diagram, we play with it, we approach it from new perspectives, and it is possible to detect unnoticed and hidden relations among the parts of the diagram other than those used in its construction (*CP* 3.363, 1885); we see its limitations and new possibilities arise. The reasoner's hypotheses are creatures of his own imagination, but he discovers in them relations which sometimes surprise him (*CP* 5.567, 1901).

Peirce argues that, by visualizing ideas, that is, by giving them a diagrammatic distribution, we better understand the organization of their parts and increase our capacity for analysis and synthesis; we better understand the structure and order of our conceptions. Diagrams are not just a passive representation or a transcription of thought into drawings; they are not a mere image or illustration, but something active that generates new thought. Diagrams are processes that will allow us to examine relations, to detect anomalies and, ultimately, to understand and make our reasonings grow. Subsequent research has supported Peirce **in his claim that visual and muscle images provide the best reasoning** (*NEM* 4, 375; cf. Kent, 1997, 446)².

Creativity supposes for Peirce the cooperation between abduction —the logical operation by which the first hypotheses are originated— and diagrammatic reasoning. An internal dialogue between images and ideas is needed, because without a verbal and logical description our diagrams and hypotheses would be useless. Again, we can quote

² In this sense, Peirce connects with the Medieval tradition of representing conceptual content in a schematic or visual way. Saint Bonaventure wrote: “Consequently perceptions received by the ears or by thought alone can be most easily retained if they are also conveyed by the mediation of the eyes, (...) so that we may keep hold by an act of sight, as it were, of things that we can scarcely embrace by an act of thought (Bonaventure, 1891). People were expected not only to see the images, but to question them, play with them, and even subject them to a probationary investigation (Bouché, 328). Examples include the tree diagrams used by several thinkers, among others by Raimundo Lull, which not only increased the meaning of philosophical questions but also represented intellectual operations and simulated natural phenomena, and could be seen as “diagrammatic experiments” (Higuera, 2019).

Peirce: creativity springs from an inner conversation not only with words but illustrated with diagrams and experiments like a lecture (CP 6.461, 1908).

In Peirce's scientific method, suitable for any research, different kinds of signs are combined in the abductive, deductive and inductive phases³; and it is necessary to assume that the deductive phase is as important as the abductive one. The experience is key to creativity, but so is the experimental analysis, which for Peirce plays a great part both in logic and in the history of science (CP 7.277, n.d.). If abduction allows the contact with reality and provides us the data from which the first ideas will emerge, deduction allows us to handle those ideas, to order them, analyze them and experiment on them without the limits of reality, so that all the fecundity they contain can be obtained. Knowledge cannot advance without abduction, but neither can we think in a rigorous and fertile way without diagrammatic or deductive reasoning (NEM 4, 49, 1902).

In conclusion, to reach the creative achievement requires an imaginative play of ideas, for which it is of great help to use signs “of non-symbolic thought”, says Peirce: “pictures, diagrams or other images such as have to be used to explain the significations of words” (CP 6.338, 1909). For Peirce, truth is derived largely from the observation of creations of our own visual imagination, which we may set down in form of diagrams (CP 2.77, c. 1902; 2.782, 1901; cf. Oostra, 2003, 8).

3. Some examples from Peirce's first trip to Europe

Consistent with his belief, in the writings and correspondence of Peirce abound diagrams and drawings⁴. These are figures that clarify the meaning of the text or even form part of it. Peirce, in fact, affirmed that he *thought* in visual diagrams (Oostra 2003: 2-3; Kent 1997).

Peirce made five trips to Europe —between 1870 and 1883— as part of his scientific work at the service of the United Coast and Geodetic Survey⁵, and the letters from the first European tour in 1870 and 1871 are particularly rich in drawings. Those images are not something secondary to the thread of the narrative. They not only illustrate what Peirce was describing, but also serve sometimes as diagrams that help to clarify the thought and to emphasize the ideas he wanted to convey. For example, in the letter from Rome on October 14th, 1870, to his mother, Peirce made a map of the route that he followed in the city (Fig. 1). That sketch not only serves as an illustration of what he just has written, but also gives an idea of the length of the route he had done that day. Peirce reinforced with the drawing the idea expressed in his words a few lines before: I “have been very successful today, I think, in utilizing every moment.”

In several cases, Peirce's drawings were related to geometry or forms of the places he visited. On September 22, 1870, in a letter to his wife, Peirce drew the terraced vineyards in the hills of Sicily, whose horizontal lines produce a peculiar effect

³ For a detailed explanation of Peirce's scientific method and its relation to creativity see S. Barrena y J. Nubiola, “Abduction: The Logic of Creativity”, T. Jappy (ed.), *The Bloomsbury Companion to Contemporary Peircean Semiotics*, Bloomsbury, London, 2020, 185-203.

⁴ This topic has been developed by the authors in “Drawings, Diagrams, and Reasonableness. Peirce's Letters from his First Visit to Europe (1870-71)”, in F. Engel, M. Queisner and T. Viola, eds., *Das bildnerische Denken: Charles S. Peirce*, Akademie Verlag, Berlin, 2012, 175-185.

⁵ These five trips to Europe and the European correspondence have been thoroughly studied by the Grupo de Estudios Peirceanos, Universidad de Navarra:
<https://www.unav.es/gep/CorrespondenciaEuropeaCSP.html>

on the visitor. In the page 4 of the same letter, Peirce drew two drawings to illustrate his descriptions to his wife. In the first place, he drew a diagram of the various craters of Etna, which were, in turn, small mountains, and also added an exotic cactus below, "the Indian fig a tropical- looking juiceless thing". In this last case and in other places, Peirce's pictures became more figurative, trying to convey how was something that he had seen. We could say they played the role of photographs, still uncommon in those days.

On the letter of September 2nd, 1870, Peirce drew for his mother a sophisticated form of a tablet covered with Arabic script in the mosque of Hagia Sophia. Peirce wrote:

In the mosque the tablets with Arabic writing on them excited the particular admiration of my friends & they declared that the art of Arabic chirography was on a level with painting & that such things were to be compared with the pictures of Raphael. There was one tablet which (...) I should have supposed to be a mere ornament, but they read it.

But perhaps the most striking design and most unknown of the drawings included in those letters is the one that he made on the verso of his letter from Syracuse on September 22nd, 1870. Peirce drew with a pencil, as children sometimes like to do, the contour of his own right hand and pointed out numerous bites caused by fleas in the hotel where he was staying. All this served to emphasize that "Syracuse is a disgusting place" and to implore the compassion of his wife. The picture is much more graphic than any complaint and finely exemplifies the role of the drawings in the European letters.

Conclusion

Diagrams for Peirce are not only a way of expressing reasonings, but a way of making signs grow. Not only thought generate diagrams, but diagrams generate thought.

According to Peirce, thought is illustrated, and drawings and diagrams, built with the help of the imagination, are a central part of the activity of our mind. Images, beyond illustrating, compel us with a physical force. The diagrammatic representation allows us to order, understand, imagine and act on the signs, that is, to continue thinking. In diagrams, therefore, resides the fertility of our reason and — along with abduction and induction — the creative achievement.

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