ISSA Proceedings 2002 – Charles S. Peirce's Theory Of Abduction And The Aristotelian Enthymeme From Signs

1. What is abduction? A first attempt:

There is hardly a feature in Charles S. Peirce's thinking, that is more closely associated with his name, and certainly none that he was more proud of himself, than his alleged discovery of a new type or mode of logical reasoning commonly referred to by the name of abduction. In a retrospective note in 1902 in this respect he even declared himself "an explorer upon untrodden ground." (CP 2.102)**(i)**. Whether or not this boasting judgment was indeed justified, we shall have to see.

To start with, I shall try to give an outline of what Peirce's famous theory of abduction really is about. This is not an easy task, for several reasons. First, there is the unfinished, fragmentary and sometimes chaotic state of Peirce's writings. The great bulk of his huge, monumental oeuvre was never actually published during his lifetime and only survives in manuscripts. So even some of the most important texts relevant to our problem have only been edited very recently or are still awaiting publication. Furthermore, as Peirce kept returning to the problem of abduction and revising it again and again for nearly half a century from the mid 1860s until shortly before his death in 1914, not only are references to abduction scattered all over the many thousands of pages of his oeuvre, but in the course of this long period the whole theory underwent substantial changes and modifications in concept as well as in terminology.

As for terminology, 'abduction', the name by which the theory is most commonly known, is in fact only used in a relatively late period by Peirce himself. Instead, in the earliest phase he speaks of 'inference a posteriori', then for a long time prefers to call it 'hypothesis', until in 1893, in a short advertisement for his *Grand Logic*, a book which was in fact never printed, he first introduces 'abduction' (*How to Reason*, NEM IV, 353-358). But in 1896 he again proposes a new term 'retroduction'. In 1901, finally, he firmly establishes 'abduction' by differentiating

between the hypothesis itself and abduction as the locical process leading to it (*Hume on Miracles*, CP 6.525). In writings of the years 1904-1906, 'abduction' is still occasionally used, but from 1906 onwards Peirce again speaks of retroduction only, without explaining why he totally abandoned 'abduction'. Some other odd terms like e.g. 'presumption' do occur sporadically, too.
As for the concept itself, most scholars who treated the subject, as most prominently K.T. Fann (Fann, 1970), but also A. Burks (Burks, 1946), P.R. Thagard (Thagard, 1977), D.R. Anderson (Anderson, 1986) and R.J. Roth (Roth, 1988), held that there is no unified theory of abduction in Peirce, but rather two different successive concepts with a transitional period in between in the 1890s. This view has recently been challenged by A. Richter in favor of a more continuous progressive change with some of the most essential features, however, remaining unchanged throughout (Richter, 1995, esp. 172-174).

Let us take a closer look. Peirce's interest for what he later came to call abduction seems to have sprung from three main roots. First, there is an intensive reading of Kant (he started reading the *Critique of Pure Reason* at the age of 16!), which put into his mind the problem of how to generate synthetic judgments. Second, there is his great interest in the logic of Aristotle and his medieval successors which put him on the track for possible extensions of Aristotelian syllogistic. As a third important source, we may add his considerable expertise in science. He started reading chemistry at Harvard University in 1859. It was certainly in this context that he first came across the problem of how to attain explanatory hypotheses.
A popular description of what Peirce's theory of abduction amounts to, is that it is a kind of backward inference, or, as Peirce himself once stated, "rowing up the current of deductive reasoning." But, one might object, this is not a new idea. For in Aristotle already, there is induction (epagogé) as the reverse form of reasoning in contrast to deductive syllogistic. Peirce, however, maintains that induction cannot be the only alternative to deductive reasoning. Aristotle, on the other hand, was pretty assertive that the dichotomy of deduction and induction was exhaustive. So were the Epicureans, so was Francis Bacon in the 17th century, and so was J.St. Mill in the early 19th, whose title *A System of Logic, Ratiocinative and Inductive* in this respect is rather telling.

2. Peirce's earliest concept and Aristotelian syllogistic:
In his *Harvard Lectures On the Logic of Science,* a series of 11 lectures delivered

in spring 1865, but not published until 1982, Peirce criticizes Aristotle for this view. In Lecture 2 of the series (W I, 175-188) he expounds his own concept: ”There is a large class of reasonings which are neither deductive nor inductive. I mean the inference of a cause from its effect or a reasoning to a physical hypothesis. I call this reasoning a posteriori.” (W I, 180). He opposes this kind of reasoning to reasoning a priori, i.e. deduction, and a particulari, i.e. induction. He characterizes the now three modes by different orders of propositions: Whereas in a priori reasoning (i.e. deduction, see Lecture 8, W I, 267) a Conclusion is inferred from a Major and a Minor premise, in induction it is the Major that is inferred from both the Minor and the Conclusion. This, however, leaves space for a third possible ordering of propositions, where the Minor is inferred from the Major and the Conclusion. This exactly is Peirce’s reasoning a posteriori.

He himself illustrates this by the following example (W I, 180; 267):
Suppose we know (a) that ether waves give certain fringes, and (b) that light is ether waves. We can deduce (c) that light, too, will give these fringes. This procedure Peirce calls an a priori inference. If, however, from the observed fact (c) and from our knowledge of (b) we infer (a), that all ether waves, be they light waves or others, give such fringes (i.e. that the two properties that are combined in the case of light are combined generally), our procedure will be inductive.

But suppose the following sequence, in Peirce’s own words:
”We find that (c) light gives certain peculiar fringes. Required an explanation of the fact. We reflect that (a) ether waves would give the same fringes. We have therefore only to suppose that (b) light is ether waves and the marvel is explained.” (*Harvard Lecture 8,* W I, 267, letters added by me). This was in fact quite the way Huygens actually discovered the wave theory of light.

Of these three modes of reasoning, of course, each attains a different degree of certainty. In Peirce’s words: ”Inference a priori is as we all know the only apodictic procedure; yet no one thinks of questioning a good induction, while inference a posteriori is proverbially uncertain” (W I, 186). Indeed, the history of physics has demonstrated that things are far more complicated for the physical nature of light. Another favourite example of Peirce’s taken from the history of science is the discovery of the ellipsoid orbit of the planet Mars by Kepler: From observing that the planet passed through certain points in the sky, and his mathematical knowledge that whatever moved along an ellipsoid would pass exactly through these points, he concluded that the planet in fact moved along an

ellipsoid orbit (see Richter, 1995, 83-93).

It has become clear by now that Peirce's third mode of reasoning among other things offers a very convenient model for explaining the way in which scientific discoveries are made. Apart from the Kantian terminology, the whole theory is clearly based on Aristotelian logic. To use a popular model example, that is often used, but is not strictly compatible with Aristotelian syllogistic proper, because it uses an individual term: We have syllogistic deduction, when from the fact that all human beings are mortal, and Socrates is a human being, we infer that Socrates is mortal. Inductively we will proceed, if from the fact that Socrates is mortal and Socrates is a human being, we infer that all human beings are mortal. In fact, based upon only one example, this induction would be very weak, even if we happened (as it is the case) to hit the truth. If, however, we observe that a certain Socrates is mortal, and happen to know that all human beings are mortal, and from these propositions conclude that Socrates is a human being, we will infer a posteriori or abductively. Our hypothesis may be right, of course, but we could as well be mistaken, and the Socrates in question could be, say, a dog.

Everybody acquainted with Aristotelian syllogistic will be able to tell, where these respective weaknesses originate from. What Peirce terms induction, is formally equivalent to an Aristotelian syllogism in the third figure. But third figure syllogisms may only yield particular results, no universal ones. In our example we could thus only have correctly inferred that *some* human beings were mortal. In a similar way, Peirce's famous third mode of reasoning clearly corresponds to Aristotle's second syllogistic figure. But valid syllogisms of the second figure may only yield negative results. If we met somebody who was *not* mortal, we could irrefutably conclude that this individual could *not* be a human being. In producing universal conclusions in the third figure, and affirmative ones in the second, induction as well as a posteriori reasoning fail to comply with the strict rules of Aristotelian syllogistic.

Peirce is fully aware of his connection to Aristotelian syllogistic. His early account of the three modes of reasoning in Harvard Lecture 2 can thus be conveniently illustrated by *Table 1* (hand-out, section B, letter a):

(1)	a priori:	a posteriori (Hypothesis):	Induction (a particulari):
	Major	Major	Conclusion
	Minor	Conclusion	Minor
	→ Conclusion	→ Minor	→ Major

Table 1

Peirce does not literally draw this table anywhere, but he describes it clearly enough, using the terminology as given. But in his paper *An Unpsychological View of Logic* from the same year 1865 as the *Harvard Lectures*, and in many respects parallel to them, he presents a slightly varying table (hand-out, letter b) – *Table 2*:

(2)	a priori:	a posteriori:	Induction:
	Rule	Rule	Result
	Case	Result	Case
	→ Result	→ Case	→ Rule

Table 2

The overall structure remains the same, but terminology has changed. Peirce now introduces his famous triad of Rule, Case and Result. This new terminology he adopts has the great advantage of classifying the three propositions involved in a syllogistic inference according to their material content rather than their functional position in a posited primary deductive syllogism. This helps avoiding the awkward and confusing way of referring to the conclusion of an induction as the Minor and to the conclusion of an a posteriori inference as the Major. Now in an a posteriori inference the conclusion will be a Case, inferred to from a Rule and a Result as premises. Thus, if it is a rule that waves give certain fringes, and light being waves is a case of this rule, then the result will be that light, too, will give such fringes. The corresponding a posteriori inference will then consist in concluding that light, to judge from the effects (results) it produces, may therefore be supposed to be a case of this rule and be subsumed under this rule. In fact, in Harvard Lecture 8, Peirce temporarily tries the term ‘subsumption’ instead of ‘case’ (W I, 259-262).

In his earliest writings of the mid 1860s Peirce himself explicitly relates his three modes of reasoning to the three figures of the Aristotelian syllogism, associating Hypothesis, as he accidentally calls it, or reasoning a posteriori to the second figure. A formalized presentation of Aristotle’s three figures would be as follows (see hand-out, section A) *Table 3:*

(3)	First Figure:	Second Figure:	Third Figure:
	M P	P M	M P
	S M	**S M**	**M S**
	S P	S P	S P

Table 3

For convenience, the figures are given here in the nowadays usual form with three distinct propositions each. Aristotle, of course, used to contract the whole argument into one sentence and preferred to speak about predicates applying to certain subjects instead of subjects being designated by predicates (Patzig, 1959, 13). But given in this form, it is evident that this table perfectly illustrates Peirce's three modes of reasoning**(ii)**.

To explain, let us turn to another favourite example of Peirce's, the so-called beans-in-the-bag example (W I, 430f.; 437f.; cf. hand-out, letter c). Suppose we have a bag full of beans that are all of white colour, which is our Rule. We can produce a Case by blindly picking a sample of beans out of the bag. The Result will be that these beans will turn out to be white. This, of course, is deduction:

4.
Rule: All beans in this bag are white.
Case: These beans are from this bag.
Result: These beans are white.

By making two of the propositions change places, we can produce either induction:

5.
Result: These beans are white.
Case: These beans are from this bag.
Rule: All beans in this bag are white.

Or else, hypothesis or reasoning a posteriori:

6.
Rule: All beans in this bag are white.
Result: These beans are white.
Case: These beans are from this bag.

Thus, in Peirce's view, hypothesis (as well as induction) can be generated out of a

valid deductive syllogism by making two of the propositions change their places. The initial deductive syllogism (4) he would call the explaining syllogism of the hypothesis (6) (cf. *Lowell Lectures* 5, W I, 427).

Scholars have been quick to remark that such a procedure is not compatible with Aristotelian syllogistic proper, since, as we remarked earlier, no positive conclusion may be drawn in the second figure, just like no universal one may be drawn in the third. This is an important point we should keep in mind.

Fewer have noticed that Peirce's procedure is inconsistent with Aristotelian syllogistic also in another respect, namely in that in his examples he freely uses individual terms like "these beans", "this man" etc. or even proper names like Enoch and Elijah. His way of talking about 'cases' even seems to require that. Aristotle, however, makes quite clear in book I chapter 27 of the Prior Analytics that his syllogistic is primarily about terms that may be predicated of others as well as others may be predicated of them. And this definitely rules out individual terms and proper names (Patzig, 1959, 11-18). This, too, will become important and should be kept in mind.

Peirce himself is fully aware of the fact that hypothesis, interpreted that way, cannot produce a valid syllogism. But this, from his point of view, is no problem at all. It is enough for an hypothetical inference to be *probable*. For this shortcoming is made up for by great advantages. While a valid deductive syllogism is in fact truth-preserving, but adds nothing at all to our previous knowledge, hypothesis does increase our knowledge by making us attain new sentences we have not previously known. Peirce therefore classifies hypothesis as scientific or ampliative reasoning as opposed to the merely explicative reasoning of pure deduction (CP 2.445-791).

With all this in mind, let us now briefly follow the track of hypothesis or abduction as it develops in Peirce's later writings.

3. Later developments:

In the fifth in his series of Lowell Lectures, delivered in 1866 and titled *The Logic of Science; or, Induction and Hypothesis*, in which he returns to many of the topics of the Harvard Lectures, Peirce extends the use of his switchboard method from the standard first figure syllogism called mood Barbara in the terminology of medieval scholastic logicians to all valid moods of syllogisms, of which he counts

twelve, four of each figure. In trying to mark off cogent deductive reasoning from ‘scientific inferences’ he discovers that the ”explaining syllogism […] produced by a mere transposition of the propositions making up an inductive or hypothetic argument, may be in any figure and any mood of Aristotelian syllogism.” (W I, 435). Thus negated and quantified propositions, too, come in. We get twelve valid deductive moods, each with its corresponding induction and hypothesis, which could be arranged in a table, as Ansgar Richter has done in full using the beans example (Richter, 1995, 33-35).
Additionally to mood Barbara we discussed above under (6), from this table we give two representative examples of the other two figures:

7.
Second figure syllogism, mood Camestres:
Rule: All beans in this bag are white.
Result: These beans are not white.
Case: These beans are not from this bag.

8.
Corresponding hypothesis:
Rule: All beans in this bag are white.
Case: These beans are not from this bag.
Result: These beans are not white.

9.
Third figure syllogism, mood Bocardo:
Result: Some of these beans are not white.
Case: These beans are from this bag.
Rule: Some beans in this bag are not white.

10.
Corresponding hypothesis:
Result: Some of these beans are not white.
Rule: Some beans in this bag are not white.
Case: These beans are from this bag.

It is evident, that, while the syllogisms are all cogent, all the hypotheses only yield probable results. This extended procedure, however, unfortunately blurs the hitherto undisputed association of hypothesis with the second syllogistic figure

and with inferring a case. Indeed Peirce himself does not seem to have pursued this line of thought extensively later on.

Rather, in *On the Natural Classification of Arguments* (1867), the oldest text on hypothesis generally accessible previous to the publication of the *Harvard and Lowell Lectures* in 1982, Peirce introduces a kind of statistical factor. The interchange of propositions still is his method of forming an hypothesis out of a syllogism. But, as for induction a conjunction of several single instances is needed to make it really plausible, for hypothesis, on the other hand, a conjunction of common predicates will strengthen the case for the subsumption of a certain case under a general rule. The 'explaining syllogism', therefore, too, has to be of a special kind each for induction and hypothesis (CP 2.509; cf. 511) (hand-out, letter d) *Table 4*:

(11)	Deduction:	Hypothesis:
	Any M is P'P'	Any M is P'P'
	Any S is M	interchange of second premise and conclusion Any S is P'P'
	Any S is P'P'	Any S is M

Table 4

P'P' denotes the conjunction of all common predicates P', P ''. P ''' etc. of S and M. The more elements this conjunction contains, the more convincing the hypothesis will be. It is required, however, that the predicates P', P ''. P ''' etc. are chosen at random and are independent from each other. Consequently, in *Upon Logical Comprehension and Extension* (1867, W II, 70-86) this explanation of induction and hypothesis is combined with the concept of the comprehension and extension of a term. While induction increases the breadth (extension) of a term, hypothesis increases its depth (comprehension). Both increase our knowledge, while mere deduction does not (see Richter, 1955, 48-50).

Over a decade later, in *Deduction, Induction and Hypothesis* (1878), where he tries to integrate his theory of hypothesis into his overall concept of pragmatism (Richter, 1995, 69-72), Peirce returns to this thought. He now describes it like this: "Hypothesis substitutes, for a complicated tangle of predicates attached to one subject, a single conception." (CP 2.643) But then he tries still another way of looking at the problem. He observes that when we proceed from a necessary deductive syllogism in the mood Barbara, by inferring from the denial of its Result

the falsity of either Case or Rule we get (valid) syllogisms of the second and third figure in the moods Baroco and Bocardo respectively. But, if we follow the same procedure starting from a *probable* deduction, we get hypothesis and induction. In the case of hypothesis, the example runs as follows (CP 2.627) (hand-out, letter e):

11.
Probable deduction (≈Barbara):
Rule: Most of the beans in this bag are white.
Case: This handful of beans are from this bag.
Result: Probably, most of this handful of beans are white.

12.
Hypothesis (≈Baroco):
Denial of Result: Few beans of this handful are white.
Rule: Most beans in this bag are white.
Denial of Case: Probably, these beans were taken from another bag.

Thus, hypothesis is firmly reattached to second figure reasoning again, even though its probabilistic character, which would normally be eliminated by the negation involved, is now only assured by the modal qualifyers in the 'explaining syllogism'.

Peirce gets back to Aristotelian formalism and to the statistical approach of *On the Natural Classification of Arguments in A Theory of Probable Inference* (1883), a paper that grew out of his intensive studies of the theory of probability and probability calculus around those years. There, from a deductive syllogism in the mood Barbara he first derives what he calls a 'statistical deduction' of the following form (CP 2.701 = W IV, 414) (hand-out, letter f):
Rule: The Proportion r of the M's are P's.
Case: S', S'', S''' etc., are a numerous set, taken at random from among the M's
Result: Hence, probably and approximately, the proportion *r* of the S's are P's.

The probability of the result is here quantified statistically. The corresponding form of hypothesis thus runs (CP 2.721 = W VI, 419):

14.
Rule: Every M has, for example, the numerous marks P', P'', P''', etc.
Result: S has the proportion r of the marks P', P'', P''', etc.

Case: Hence, probably and approximately, S has an r-likeness to the class of M's.

Here r denotes the intensity of likeness mathematically calculated from the statistical proportion of relevant marks (Richter, 1995, 75-80).

In Peirce's later writings from the 1890s onwards it is more the interpretation of hypothesis or abduction as a mental and creative act (see e.g. Herrero Blanco, 1988; Kapitan, 1990; Marostica, 1993), as guess-work or conjecture (cf. CP 2.755; 6.530; see Frankfurt, 1958, 596; Fann, 1970, 35-38), its application in science (cf. CP 1.65ff.; see Shanahan, 1986), the problem of its fallibility (cf. CP 1.8-14; 1.141-175) and the problem of how to select the best hypothesis (cf. CP 2.775; 6.472; 6.526; Brown, 1983; Richter, 1995, 127-134) that move to the centre of his interest, much less its logical structure. In that very period, on the other hand, the term 'abduction' makes its first appearance as a new name for what earlier was called hypothesis (How to Reason (1893), NEM IV, 353-358; see Richter, 1995, 103f.).

Formalized descriptions of abduction or retroduction now appear in shapes more and more detached from the rigid tables of classical 'Aristotelian' logic. For instance, in the *Cambridge Conference Lectures on Reasoning and the Logic of Things* of 1898, Peirce expresses the 'explaining syllogism' in the shape of the modus ponens of propositional logic (CCL, 140; Fann, 1970, 52; Richter, 1995, 113f.) (hand-out, letter g):

15.
If m is true, π, π', π'' are true.
m is true.
I: π, π', π'' are true.

The corresponding retroduction, however, still is established by Case and Result changing places:

16.
If m were true, π, π', π'' would follow as miscellaneous consequences.
But π, π', π'' are in fact true.
I: Provisionally, we may suppose that m is true.

What we have here, is backward inference from consequents to antecedents (which, by the way, is one of the ways ancient sources used to describe an

inference from signs).

In 1903, when Peirce delivers his much-famed *Harvard Lectures on Pragmatism*, his expression of the logical form of abduction is even more concise (CP 5.189; Richter, 1995, 138) (hand-out, letter h):

17.
The surprising fact C is observed;
But if A were true, C would be a matter of course,
Hence, there is reason to suspect that A is true.

We still recognize the form of backward inference, which recalls the expression in terms of propositional logic of the *Cambridge Conference Lectures*. But what has totally disappeared, is the connection to the Aristotelian type of categorical syllogistic, that, as we have seen, was so important in the beginning in the heuristic process of the discovery of a third mode of reasoning.

4. The term 'abduction' and Aristotle's Prior Analytics:
How did Peirce in the 1890s hit upon the idea of renaming his third mode of reasoning by the name of 'abduction'? The reason, again, is Aristotle. For in chapter II 25 of the *Prior Analytics* (69 a 20-36) Peirce seriously believed to have discovered a premonition of his own concept. In this passage Aristotle comments on a special mode of reasoning he calls apagogé. He describes it as an inference, in which either (a) it is obvious that the first term applies to the middle, but that the middle applies to the last is not obvious, yet more obvious than the conclusion, or (b) the last term is connected to the middle by not many intermediates.

Peirce had translated this passage as early as 1867 in his article on 'Abduction' for the *Dictionary of Logic* , where he had rendered apagogé by 'abduction', following Julius Pacius' Latin translation 'abductio' in 1597, but had left it almost without any comment (W II, 108). Only in several writings in and around 1901, as e.g. in his article on 'Reasoning' for Baldwin's *Dictionary of Philosophy and Psychology* (CP 2. 776), in *On the Logic of Drawing History from Ancient Documents* (CP 7.249-255) as well as in the fifth of his *Lectures on Pragmatism* (1903) (CP 5.144; cf. *A Syllabus of Certain Topics of Logic*, PLZ 94f.), Peirce almost insisted on Aristotle there having expounded something very similar to his own theory of hypothesis**(iii)**.

But what does Aristotle really say? First of all, the meaning of apagogé here must not be confused with its other, more popular sense, i.e. the reductio ad absurdum (although both types of arguments are in a way indirect and involve a shifting of argument). The examples Aristotle offers may be formalized as follows:

18.
Whatever is knowledge, can be taught.
Virtue (e.g. justice) is knowledge.
Therefore virtue can be taught.

19.
Whatever is rectilinear, can be squared.
A circle can be transformed into a rectilinear figure by the intermediate of lunes.
Therefore a circle can be squared.

In the first example, of course, that virtue is knowledge is not obvious (but still more plausible than the conclusion). But if one is willing to accept this, one may deduce that virtue can be taught. In the example of the squaring of the circle (apart from the fact that it is, of course, mathematically wrong) the minor premise is granted only via a little detour. In both cases, we do not attain truth, yet get nearer to it. It is evident, however, that what Aristotle presents are just special cases of deductive reasoning, not abductions in the Peircean sense (Richter, 1995, 50-53).

Peirce, nevertheless, maintains that the passage can be read as a description of his third mode of reasoning, if only one replaces ”a single wrong word” (CP 2.776) by another one that has been substituted for it, thereby disturbing the sense of the whole. Of committing this blunder he accuses ”stupid Apellicon” (CP 5.144), the ancient editor of Aristotle’s works (cf. CP 2.776; 7.251). Precisely, in the second example he wants the major term to read not ”what can be squared”, but ”equal to a sum of lunes”, thus arriving at the following abductive inference (CP 7.251; see Kempski, 1988)**(iv)**:

20.
Whatever is equal to a constructible rectilinear figure, is equal to a sum of lunes.
The circle is equal to a sum of lunes.
Therefore, the circle is equal to a constructible rectilinear figure.

Peirce’s argument surely is bad. It is *petitio principii*. But nevertheless, this

alleged parallel is the main reason, why Peirce in 1901 suddenly adopts the term ‘abduction’. Of course, abduction together with deduction and induction makes an almost perfect triad.

In a letter to Lady Welby from 1905 he still declares himself convinced of his conjecture, which he calls ”evident” (PW 187). But, as a logician, he must have known that *petitio principii* never is a good argument. And indeed, in a letter to Calderoni from the very same year he admits that it is ”a doubtful theory, I confess.” (CP 8.209) We cannot but agree. And right from that time onwards, Peirce begins to abandon again ‘abduction’ as his favourite term.

5. Aristotle’s enthymeme from signs: a possible parallel:
On closer inspection, thus, chapter II 25 of the *Analytica priora* is not a suitable model for Peirce’s abduction. Another model, however, would have been very close at hand. I am referring to Aristotle’s concept of the enthymeme as the rhetorical counterpart of syllogism. Thanks to several important scholarly contributions, our understanding of the Aristotelian enthymeme has been considerably furthered in the course of the 20th century (Seaton, 1914; McBurney, 1936; Bitzer, 1959; Grimaldi, 1972; Sprute, 1982; Conley, 1984; Burnyeat, 1994; Green, 1995). Today we no longer believe that the main feature distinguishing an enthymeme from a syllogism is the omission or suppression of one of its premises. Both enthymemes and syllogisms may or may not be uttered incompletely.

An enthymeme, for Aristotle, truly is a logically imperfect, not necessarily formally incomplete syllogism. The central passages where Aristotle expounds his concept of the enthymeme are *Rhetoric I* 2, 1357 a 30-b 25, and *Prior Analytics II* 27, 70 a 2-38, i.e. only two chapters further down from Peirce’s notorious apagogé passage. An enthymeme, Aristotle defines, is an inference (or syllogism) from probabilities or/and signs (*Rhetoric I* 2, 1357 a 32; *Prior Analytics II* 27, 70 a 10). There are thus two kinds. The enthymeme from probabilities turns out to be a first figure syllogism proceeding from a major premise which is not universally true, but valid only for the most part, or is commonly accepted.

More important for us (and, seemingly, for Aristotle, too) are the enthymemes from signs. These, according to Aristotle, are of threefold appearance, and in the *Prior Analytics* he explicitly associates them with the three syllogistic figures.

Let us look at the illuminating examples given for each in *Rhetoric* and *Prior Analytics* respectively (in a formalized pattern, bracketed propositions not explicitly stated) (cf. Hood, 1984, 39f.; 42; Weidemann, 1988).

21.
First figure:
(Whoever has fever is ill.)
This man has fever.
This man is ill.

22.
(Women who have milk have had a child.)
This woman has milk.
This woman has had a child.

23.
Second figure:
Pregnant women are sallow.
This woman is sallow.
This woman is pregnant.

24.
(Whoever has fever breathes hard.)
This man breathes hard.
This man has fever.

25.
Third figure:
Socrates is wise.
Socrates is just.
Wise men are just.

26.
(Pittacus is wise.)
Pittacus is good.
Wise men are good.

It leaps to the eye, how this parallels Peirce's three modes of reasoning. While the first figure argument is a plain deduction (Aristotle calls this a necessary and

irrefutable sign), and the third figure one clearly describes induction, the one in the second figure is in many respects the exact model of Peirce's hypothesis or abduction. Both only yield results of a certain probability. Both infer backward from effect (here a sign) to cause. Both are, strictly speaking, logically invalid, but extremely useful in pragmatic circumstances (like e.g. forensic investigation or medical examination). Both are set in a pragmatic context (science in Peirce, rhetoric in Aristotle), where useful results weigh more than logical consistency. Most of Aristotle's examples even stem from medical science, where, typically, explaining hypotheses have to be formed from visible symptoms. But, two other highly important, but mostly overlooked distinctive features of this enthymeme over against syllogism proper are that it draws affirmative conclusions in the second figure, and that it allows for individual terms (as is almost inevitable in practical rhetoric). In this respect, too, it perfectly anticipates Peirce's abduction. Hence, this ground was seemingly much less "untrodden" than it appeared to Peirce. But only very recently and very tentatively has this salient affinity of Aristotle's second figure sign enthymeme to Peirce's abduction been observed and investigated in Peircean scholarship (see e.g. Sabre, 1990; Bybee, 1991, 296-299; Lanigan, 1995).

6. An explaining hypothesis:

If this similarity is as striking as we have tried to show it is, how could it then be that Peirce himself, who knew his Aristotle almost by heart, did not notice it? This is all the more surprising, as Peirce is famous for having invented semiotics, for supplementing his logic with an elaborate theory of signs and even assigning to rhetoric the highest rank within the whole discipline of semiotics (Thagard, 1978; Deledalle, 1984; Tursman, 1987; Herrero Blanco, 1988; Richter, 1995, 145-158). Any type of argument from signs should have occurred to him as a godsend. But even when he interprets arguments as signs themselves, he associates abduction with icons rather than indexes. He leaves it to Felicia E. Kruse to call for an opening of the abductive concept towards indexicality (Kruse, 1986). Aristotle's enthymeme from signs could have provided to him a first rate model for his theory of abduction, but he didn't see it.

Even if one scrutinizes his papers searching for smallest traces of the enthymeme, the results are disappointing. 'Enthymeme' is an extremely rare word with Peirce. And wherever the term is mentioned in passing, mostly in contrast to 'complete' arguments, it is usually accompanied by its stereotype definition as a 'truncated'

or ‘incomplete’ syllogism. So already in *On the Natural Classification of Arguments* (1867): ”incomplete, rhetorical, or enthymematic argument” (W II, 24f. = CP 2.466; similarly in *Preliminary Sketch of Logic*, 1869, W II, 295; *On the Algebra of Logic,* 1880, CP 3.166). Later on in *The Aristotelian Syllogistic* (1893): ”syllogism with a suppressed premiss” (CP 2.449; cf. *Notes on Explicative Reasoning,* 1901/02, CP 2.582). Only in his article on ‘Enthymeme’ for the *Century Dictionary* (1886) Peirce at least seems to understand Aristotle’s concept (W V, 404). But never is there any deeper interest.

An explanation for this striking neglect of the enthymeme is probably not far to seek. For the book Peirce, as a young boy, learned his first lessons in logic from was Richard Whately’s *Elements of Logic* (W I, xviii). But Whately was one of the most die-hard champions of the truncated syllogism definition of the enthymeme in the 19th century (Whately, 1827, 265). Small wonder then, that young Peirce got biased in that respect by the great Oxonian’s authority for the rest of his life and could never develop an unprejudiced view of the enthymeme.

Put into syllogistic form, the line of argument we just took would run as follows: Whoever defines the enthymeme as a truncated syllogism only, will not be able to recognize its similarity with Peircean abduction. But Peirce evidently did not recognize this similarity to his concept of abduction. Therefore, we might reasonably assume that he will have regarded an enthymeme as nothing but a truncated syllogism. And this, too, is a perfect inference of the abductive kind.

NOTES

[i] For convenience, references to Peirce’s writings are given by the sigla explained in the references section. References to the Collected Papers are to volume and paragraph, as is common usage, all others to volume and pages.

[ii] Peirce thoroughly analyzes the Aristotelian syllogism in its threefold appearance in his Memoranda Concerning the Aristotelian Syllogism (1866, W I, 505-514).

[iii] Cf. also Lessons from the History of Science (1896) (CP. 1.65).

[iv] Probably, in 69 a 28f., he may also have read ”by additionally assuming knowledge of AC, which we didn’t have before” instead of ”by introducing the additional term, while before we had no knowledge of AC” (cf. W II, 108; cf. Kempski, 1951, 62f.; Richter, 1995, 54, note 138).

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