WHAT ABOUT THE THREE FORMS OF INFERENCE?

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1. Introduction

In the following, I shall develop some considerations relative to empirical inferences, in which, however, some general properties of inference in general are pinpoint. For this reason, in the present paper I will use the term "deduction" in a very different way from its actual understanding as *formal deduction*. In other words, I use the word *deduction* here not to denote a logical inference but a type of inference that is widely used in every-day life and even in the empirical sciences.

My examination can be considered a further development of Peirce's work on Aristotle's logic and theory of inferences [see especially Peirce 1878 and 1895]. This means that I mainly refer to Aristotle only indirectly, through Peirce's own examination, and, for this reason, though Aristotle constitutes the background of the present discussion, I will refer directly to him only occasionally, that is, where I think that some specific developments of his philosophy are particular relevant for a full understanding of my argumentation. Obviously, the issue of the meaning of Aristotle's theory of inference deserves a specific work, and I hope to have the opportunity and the ability to come back to this problem in a further paper.

2. Deduction

In general terms, an inference can be considered as a certain combination of three propositions, two premises and a conclusion. It is true that the number of these propositions can be arbitrary, but, as I will demonstrate in continuation, the general form of any inference can be reduced to a combination of three propositions (although not less). Let us consider a very simple example:

> All wood is combustible.
> Things having a cortex are wood.
> Therefore, things that have a cortex are combustible.

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The conclusion is what we *expect*, given the premises. In other words, it represents a perceptual event that we presume will occur in our experience: that is, the next thing we come across that have a cortex will be combustible. This may be called the (expected) result, on the basis of the premises.

What kind of propositions do these premises represent? Let us consider the first one (which is traditionally called the *maior*). It represents a general, that is, *conditional* knowledge that we assume, given either our past experience or some other previous considerations that do not directly enter into the above inference. The second one (traditionally called the *minor*) has a totally different character. It represents the way in which we *identify* the things that we call wood. In other words, in order to have a possible future result (a possible experiential event) we not only need a general knowledge, but also to perform an actual operation that enables us to select things (wood, in our example), about which the conditional proposition expresses a property (being combustible).

Summarizing, we have the following structure:

Conditional knowledge (resulting from *past* experiences or previous hypotheses).
Identification (an *actual* procedure).
Result (expected *future* event).

For the reasons indicated above, "having a cortex" represents for us a *distinctive mark* by which we identify wood. In the most ordinary situation, these distinctive marks are perceptual marks (like a certain smell, or colour, or form, and so on). However, as knowledge (in evolution and in development) progresses, they can also become more general features by which we identify also abstract objects, as we shall see below. We should not confuse distinctive marks with properties. Marks are not necessarily properties and in fact, mostly are not. For instance, a male dog may identify other male dogs through the scent of their released urine. This scent is not, however, an immediate property of these dogs. An identification card is a mark, not a property, of the person to whom it refers. A distinctive mark need only have some (eventually causal) connection with the individual objects we are dealing with – in Peirce's terminology, [1895; 1908; see also Auletta 2002], it is an index, not an icon.

The origin of the distinctive mark is in the fact that any natural thing can be considered (not only by humans, but also by animals) as an object provided with a certain (survival) value. This concept has been introduced in the specialized literature under the name of *affordance* [Gibson 1979]. For instance, a tree may represent a possibility to nest for a bird. Obviously, an affordance is not a property, even if it has a certain connection with properties (for instance, a tree with certain characters).

What does matter, however, is that through such distinctive marks we are able to establish an *equivalence class* of objects, that is, a class of objects which, from the point of view of our expectation, can be considered to be on the same plane, even if individually they may show some, even important, differences, (for example, wood may have different shapes, colours, consistency, and so on). Such an equivalence class corresponds to what Aristotle calls secondary substance [*Cat.* 2a35-3a21]. This establishing of an equivalence class is the proper meaning of the operation I have called identification. In order that wood can enter as a general concept into a network of universal and abstract reasoning (the conditional knowledge), it first needs to be univocally identified through its distinctive mark.

The ideal case would obviously be the one in which the equivalence class of individuals determined by a given distinctive mark could be identified with certainty by the mark itself, (in which the distinctive mark *only* pertains to these individuals and *not* to any others). This instance would probably equate to Aristotle's concept of *idion* (that which is peculiar to something). However, this certainty is very difficult to attain in empirical matters, because it would require a complete knowledge of all the possible objects we could experience, so as to exclude the possibility of objects that are not wood having such a mark (the cortex). For this reason the conclusion of such an inference, as far as our ordinary experience is considered, can only be an expectation: we expect this result, although *not being absolutely sure* (that is, only conditionally sure) that it will occur.

We call an inference with such a general structure, *deduction*. As already stressed, I use the word *deduction* here to denote a type of inference that is widely used in every-day life or in the empirical sciences. In my modest opinion, there are reasons to suppose that this was also the original aim of Aristotle, but that is a matter that cannot be adequately discussed here.

We have seen that deductions, in the way I am referring to them here, lead to an expectation. But what expectation does the conclusion of a deduction express exactly? Once the equivalence class is established, on the basis of our general knowledge, we assigns to it a *property* (to be a combustible). A property is understood here as a true and, as far as our ordinary experience is concerned, intrinsic feature of the objects in question. However, a property does not apply to a single (equivalence) class of objects, in contrast with a distinctive mark. The fact is, oil and its derivatives are also combustible. For this reason, a property is a true property only when it comprehends different (equivalence) classes of objects, and is therefore a universal (a genus, in Aristotelian language, what is common to several species). A genus seems to be a class on the same foot of an equivalence class; for instance, we can build or consider the class of combustible things. However, this is not a secondary substance, which would be identified through a distinctive mark and be qualified by *many* properties. On the contrary, a true genus is identified through a *single* property. The fact that both properties and equivalence classes can be formally represented by classes, has contributed to produce some confusion, as far as it has induced the idea that they are some interchangeable. It is possible that some of Aristotle's own expressions can lead to this confusion [for instance, *Cat.*, 1b10.-15]. The context in which this confusion may be arisen could be the problem of the definition by making use of genus and *differentia specifica* [see in particular the commentary on *Posterior Analytics* of J. Barnes, pp- 174-75].

Thus, as a conclusion of a deductive inference, we expect that the individuals we will come across in our future experience, which are characterized by a certain distinctive mark (that of having a cortex), will show the expected property, i.e. to be combustible. I also stress that the individuals grouped in the equivalence class share various different general properties. Wood, for instance, is not only combustible, but also a vegetal material, and so on.
In summary, a deductive inference comprehends three terms

Property (a universal that determines more than a single equivalence class of objects).
Equivalence Class (a class of objects determined by a distinctive mark).
Distinctive mark (a non-property feature connected with single objects).

For the reasons indicated above, we must not confuse a deduction with a proof, nor with a chain of substitutions, as sometimes happens in logic or mathematics. In order to prove an unknown result we can, in fact, also make use of forms of inferences that are not deductions. Once the result is achieved, we can best seek to give a logical or mathematical form to this proof by building a chain of substitutions that could, in principle, also be computed by a machine (a computer). This does not correspond, however, to a deduction as I understand it here. As I have said, a deduction can be considered as a mechanical computation only if we secure complete knowledge of all possible objects of experience and thought, as well as of their properties, so that our expectation will be automatically satisfied (and thus becoming no longer an expectation). So far, we can understand formal deduction as a limiting case of deduction (understood in the way I noted above), especially when we have to do with ideal objects, like those of mathematics, and this perhaps justifies the use I have made of the term.

Since deduction consists in the expectation of a future result that should follow the two premises given, it is a typical form of reasoning until we are confronted by evidence to the contrary. In other words, we are reinforced in our *habitus* and pursue this line of reasoning, especially when we have already performed many successful deductive inferences, in which the expectation has been also fulfilled many times. For this reason, deduction can be considered a sort of "inertial" inference, that is, the most economical one given a previous knowledge that we believe to be true and a present identification of a certain equivalence class.

3. Abduction

It is still possible that, soon or later, our expectation is contradicted by experience, that is, that we find at least one item that has a cortex but does not burn. This represents a negative result. How should we react to such an experience? We are faced here with a *problem* (a contradicted expectation) which can find a solution only if we change one of our premises [Peirce 1877]. Usually, when we are faced with such a problem it is advisable firstly to save the conditional knowledge, due to its general character. A conditional proposition that is thus preserved in the face of a negative test of experience becomes a *law* or a rule, while the negative experience itself is understood to be a *correction* of our previous knowledge. In this way, we are forced to infer a *specification* of our previous knowledge. An inference with these characteristics is called an *abduction* [Peirce 1866; 1878], which can be summarised as

> Law (a knowledge that is *actually* confirmed after a negative result).
> Correction (a *previous* negative result that corrects our knowledge).
> Specification (a *further* determination that is inferred).

Coming back to the previous example, we can state

> All wood is combustible.
> There is at least one thing that has a cortex but which is not combustible.
> Therefore, there are things that have a cortex which are not wood.

It is evident that this conclusion (Therefore, there are things that have a cortex which are not wood) is the negation of the second premise (the *minor*) of the previous deduction, whose conclusion (Therefore, things that have a cortex are combustible) was contradicted by experience. The correction offered by this negative experience is assumed as the *minor* premise (There is at least one thing that has a cortex but which is not combustible) of the abduction. Why is this a specification? Because it shows that *not all* individuals having a cortex are wood, resolving in a negative way a certain potential ambiguity that was still present in our deduction. In reality, we had previously assumed that our identification procedure was univocal, although admitting that we could not cover all objects and situations of our possible experience, and therefore being aware that we could be not sure that there would never exist an individual having a cortex that is not wood.

Let us consider briefly the two inferences (deduction and abduction) on an abstract plane by means of the graphical representation of classes shown in Fig. 1:

Deduction is here presented on the left (a), abduction on the right (b). A, B, and C correspond to the three terms of the deduction: A to the distinctive mark, B to the equivalence class, and C to the property. It is evident that, in the deduction, we positively expect that all individuals that we will encounter

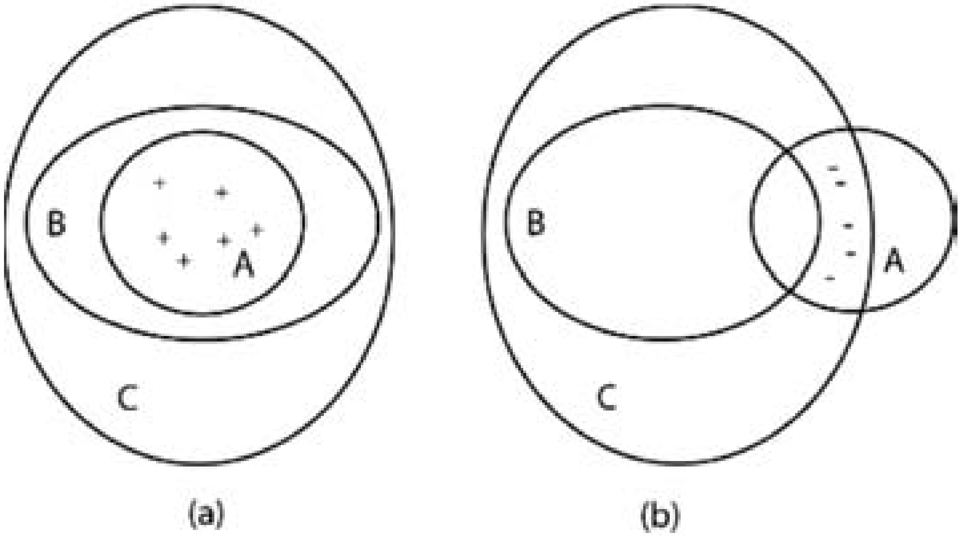

FIG. 1.

in our experience, which are characterized by the distinctive mark A that determines the equivalence class B (in the sense that, ideally, A would coincide with B, even if, as I have already remarked, this is barely the case in an empirical domain), will also show the property C; (for this reason they have been marked by positive signs, the crosses). In the abduction (b), however, based on the law that all individuals in the equivalence class B have the property C AND the fact that not all individuals showing the feature A have the property C, we infer that at least some individuals showing the feature A are not in B, even if some of them could be still in C, due to the circumstance that the negative *minor* is a particular proposition; (this has been shown by the minus signs).

We can schematically portray the conclusion of the abduction in the way shown in FIG. 2.

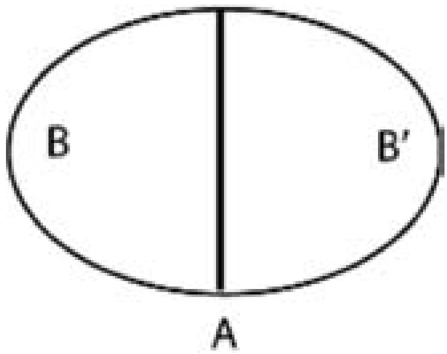

FIG. 2.

The figure shows that the previous distinctive mark A covers now two areas, the previous equivalence class B (or at least a part of it) and at least a part of B', the complement of B. In this way, the former distinctive mark ceases to be a distinctive mark to become a true property, that is, a universal class that comprehends heterogeneous (equivalence) classes, B and B'. In other words, abduction is an inference resulting in the *splitting* of a previous distinctive mark, or one by which we infer a *new property*.

Obviously, there is nothing in the abduction itself that assures us that there are A that are also B (that is, that there are things with cortex that are also wood). However, this is the (partial) result of previous experiences led by deduction, so that we have no *a priori* reason to suppose that, from the fact that there is at least one A that is not B, it follows that there are no A that are B (or that all A are B'). Logically speaking, this would represent a fallacy of the part to the whole.

Let us go back to the conclusion of the abduction. Since we have transformed a distinctive mark into a property, this gives rise to the need of finding a new distinctive mark that will be able to identify the objects in the class B' that are, up to this point, completely undetermined. In other words, the conclusion of an abduction is an implicit invitation to find, in the *future,* a new distinctive mark capable of specifying the new equivalence class of objects (those having the cortex but not being wood) that we have inferred. Following our example, it could consist in a class of objects that have a cortex but are not wood, due to their being artificially produced or even genetically transformed.

We have many historical examples of abduction. I wish to consider here the fact that in a very known paper of Einstein and co-workers [Einstein *et al.* 1935], it was supported the idea that any interdependence among physical systems is of causal order, so that, in order to ascertain whether a system is in causal connection with another system it was sufficient to study if a certain action on one of the pair would induce or not a change in the other one. In this case, Einstein considered interdependence as a distinctive mark of the existence of a causal connection. However, Schrödinger [1935] was able to derive that quantum systems show interdependency *without* causal connection. This was a true abduction [Auletta 2006]. In this way, interdependence was no longer a distinctive mark, but became a property that characterize both classical (when there is causal connection) and quantum systems (where causal connection may fail). Now the job was to find a new distinctive mark in order to univocally identify quantum systems that are connected in this way. This was provided later by Bell [1964], who proposed an inequality that, if violated, is the mark of the existence of non-classical (quantum) interdependencies.

Aristotle called abduction *hypothetical reasoning* [*An. Pr.,* 41a21-b1], and stated that, when something is assumed that contradicts a hypothesis and it is proved that such an assumption leads to an impossible conclusion, one has, in this way, proved the original hypothesis to be true by *reductio ad absurdum*. If we consider this form of inference as reducible to a formal deduction, Aristotle's conclusion is correct. However, we can also consider this way of reasoning a correction of a previous hypothesis, rather than an indirect proof of the same, in the way I have sought to do. In both cases, however, the form of inference starts from the negation of the conclusion of a previous inference, and in this way Aristotle's point of view is finally correct. Perhaps, it is also legitimate to regard deduction as the inference that leads to a conclusion that contradicts experience or some previous knowledge, and abduction as the original inference we wish to support, on which way my analysis would cover Aristotle's one or at least Aristotle's approach could be considered as a limiting case of the former examination.

Resuming, a hypothesis can be said to be an inference in which we infer a new property by confirming a general knowledge after a negative experience.

4. Induction

Let us consider a different situation: one in which we are making different experiences that contradict the expectation of our previous deduction. In this case, there are probably reasons to suppose that the problem is not the identification of wood but rather the assumption that wood is combustible. This conclusion is particularly reinforced when we find that, by using different distinctive marks (and therefore identification procedures), it is still not true that all wood is combustible. In this case, our actual and prolonged experience cannot be taken simply as a correction, but rather as a true *rejection* of our previous knowledge. Moreover, the previous identification procedure is no longer exclusive and, potentially, is become only one among many possible procedures; therefore, it has changed is character and it consists now rather in building a *statistical sample*. For this reason, the conclusion is constituted by an extension of our previous concepts. Summarizing, we have

> Rejection (an *actual* accumulation of many negative evidences).
> Sample (a *previous* identification that becomes part of a statistics).
> Extension (an enlargement of concepts that is *inferred*).

An inference of this form is called an *induction*. Let us consider again our very simple example. In this case, we will have:

> There are many things that have a cortex that are not combustible.
> Probably, all things that have a cortex are wood.
> At least in some cases, wood is not combustible.

In order to fully understand such an inference, let us again have recourse to the set relations, by comparing in this case deduction (a) and induction (b) as shown in Fig. 3.

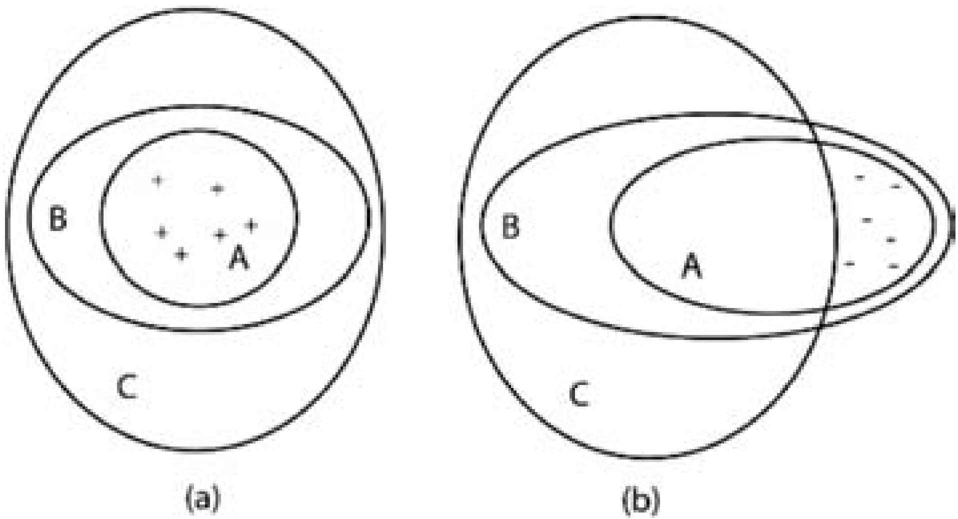

FIG. 3.

We see that in induction (b), the conclusion of our previous deduction (that things having the mark A have the property C), is once again (as in abduction) contradicted. However, this time the individuals with the mark A still allow us to pick out the objects B, but, the conclusion is that the previous equivalence class B is no longer contained in C, but covers at least part of C', the complement of C; (again I have made use of minus signs to display such a conclusion).

We can summarize this conclusion in the way shown in FIG. 4.

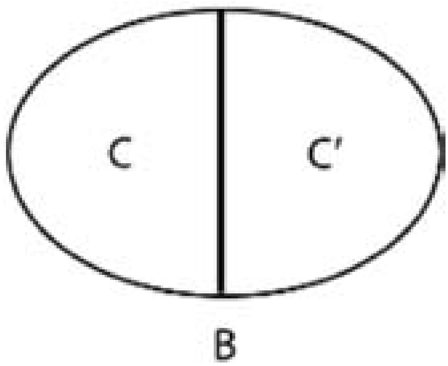

FIG. 4.

We now see that B is no longer an equivalence class (which must necessarily be a class of similar objects), but comprehends in itself the objects characterized by the feature C and those characterized by the feature C'. We apparently have a situation that is analogue with that determined by abduction, because here it seems also that B becomes a new property. However, this is illusory, since B is now constituted by the *merging* of two *already existing properties*. In fact, C already existed. However, no property does exist that does not implicitly imply the existence of its complement (C'), since any property is a property precisely because it determines an object in a certain way and *not* in another (*omnis determinatio est negatio*). Therefore, neither C, nor C' are new properties, and the same can be said for their merging. This merging consists instead in increasing the *extension* of the previous equivalence class B, that is, in enlarging the number of items that fall into this class (by including cases that are also in C'). However, any increase in extension is necessarily a decrease in intension, i.e. a loosening of the constraints characterizing the previous equivalence class.

The conclusion of an induction is therefore the following: Since we no longer have a law that rules the relations between a previous equivalence class (B) and a property (C), but rather an increase in number and heterogeneity of the items that are covered by B, a new knowledge is called for, one capable of explaining such a situation. In other words, the conclusion of an induction is implicitly the expectancy of a *future* law able to throw light on this new situation. Let us go back to the previous example. The conclusion was that at least in some cases wood is not combustible. Why is wood sometimes combustible and sometimes not? A possible hypothesis is that sometimes it is too humid to burn, or that, in certain circumstances, there is a chemical reaction that does not allow wood to burn.

In Aristotle's analysis of induction [*An. Pr.*, 68b8-37], it is said that induction is complete when what we call here *distinctive mark* and what we call *property* are convertible. In other words, when we know that nothing with cortex is combustible and nothing that is combustible has a cortex. This shows that Aristotle understood very well the mechanism of induction, and also, implicitly, its openness, at least in the many cases in which it *cannot* become complete. In those cases, as I have pointed out, we are no longer dealing with equivalence classes, but with classes that should become (in a further step of inquiry or reasoning) properties.

Since Aristotle in the same context speaks of induction as a form of syllogism, but distinguishes scientific syllogisms from inductions, we can see that the term *syllogism* should be translated rather as *inference* [see also *An. Pr.*, 24a28-b12]. If I am right, Aristotle's theory should be considered rather as a general theory of inferences than as a theory of formal deduction in the modern sense. If this is true, the three syllogistic figures should be considered, not as three types of formal deduction, but as models of the three forms of inference (deduction, abduction, and induction), in the way the young Peirce [1866] already understood.

5. The Three Inferences Compared

While deduction is a form of reasoning that we use until we are confronted by evidence to the contrary, and is therefore an inertial inference, both abduction and induction are broadening forms of inference and therefore have to do with true learning. However, while abduction infers a new property, induction enlarges the number of items that comprehend a certain feature. This means that while in deduction we expect a result, and in abduction we expect a sample (an equivalence class determined by a new distinctive mark), in induction we expect a new law:

Deduction: The expectation of a result (of an event).
Abduction: The inference of a new property (expectation of an identification).
Induction: The inference of a new extension (expectation of a law).

Moreover, while deduction consists of assuming a conditional knowledge, in abduction we assume a certain correction, and in induction we assume the statistical correctness of a certain sample [see Lonergan 1957, Ch. 4]. Finally, in deduction we perform an identification, in abduction we make of a conditional knowledge a true law, and in induction we perform an act of rejection.

This means that in all three inferences we must have (1) a conditional knowledge that, in the course of successive experience, either turns out to be a law or will be rejected, (2) an identification procedure that is either refuted by successive correction due to experience or is confirmed as a statistical sample, and finally (3) a result, which can be the expectation of an event, of an identification procedure, or of a law. We may generalize this by saying that the necessary components of *any* inference can be cast in the following way [Peirce 1866; see also Auletta 2005]:

Law-like proposition.
Sampling.
Expectation.

As a matter of fact, no inference can be formulated without a law or at least a hypothetical regularity; otherwise it would be a mere cluster of unrelated words. However, a law alone does not suffice in order to have an inference, since it would only represent the formulation or definition of a law, rather than an act of reasoning. In order to be an inference, it must be shown that this law can be applied at least to a possible case. This is the role of the sample. However, these two propositions would still not represent an inference, since an application of a law to a possible case is an example of a law, and not an act of reasoning. In order to have a true inference we must add an expectation. This justifies on a general theoretical plane, Aristotle's choice of inferences as a three-proposition or three-term mode of reasoning.

It is interesting to note that in each of the three inferences the most general term, the property (C), remains untouched. This is a very important point, because it shows that in *any* reasoning the universal features are always *presupposed* and never questioned or created. When we think of induction as an act of creation of a new universal, it shows that we have not really understood how inferences work. I have explained instead that induction consists in a *merging* of already existing universals (and, as a consequence, in a broadening of extension). If I am right, even the law that is demanded as a conclusion of an induction can be successively formulated only if there are already, within our previous knowledge, other (and perhaps even more general) universals than the property in question which could account for such a result. All experience we can do, instead, since it is always experience of individual objects and events, is to correct or reject our system of knowledge (falsify it, in current language). At best, (in deduction), no evidence is shown that things are different from what we have hypothesized, and in this way deduction is conditionally true until we face a negative evidence.

Therefore, the whole task of knowledge is to apply universals that we *already* possess to future experiences (and here we are Platonists) or, in the case of negative feedback, to modify our previous knowledge by either specifying it in a better way or enlarging the number of possible items to which some categories apply (and we are here Aristotelians).

6. Some Consequences

There are some interesting consequences to be drawn from the previous examination. What are fictional entities or theoretical concepts? Both are ruled to a certain extent by the same laws and, in particular, can be considered as clusters of properties. For instance, Madame Bovary is built by collecting different attributions (physical appearance, age, sex, birth place, residence, and so on), and is even *defined* by this collection. On the contrary, objects of ordinary experience (which reduce neither to fictional entities, nor to theoretic concepts) are individuated by their distinctive marks and are never exhausted through the properties that we attribute to them. Let us consider an example of the transformation of a fictional concept to an "experiential" concept. Let us consider the example of an *atom*. The concept of an atom was purely speculative (a philosophical fiction) in ancient philosophy and was, in fact, defined by a set of properties (motion and shape). Later, starting with Dalton's work, it began to become an operative concept (changing some features in the process); that is, a fiction with some prediction power, in other words, a true theoretical concept. Only at the beginning of the 20th century experiments began to be made in which the atom was individuated by some distinctive marks: a system composed of some electrons and a nucleus, in contrast, for instance, to later quantum dots, the artificial atoms that are composed of sole electrons. In this way, it became an *experiential object* to which one could refer to. This is exactly the function of distinctive marks: to confer a reference on a given class of objects.

In this way, while when dealing with fictional entities the reference is secondary (only once Madame Bovary is created by her author does she become a referent of ordinary discourse), about experiential objects it is primary (we refer to them even when our categorial apparatus is insufficient or false) [Auletta 2003a-b]. Therefore, fictional entities are objects at a second level (a cluster of properties). This explains in a very simple way why the individuals we find in our experience (even those that are produced artificially) can be considered *natural objects* and equivalence classes dealing with them (the concepts we use to deal with experiential objects) as *natural classes* [Peirce 1902]. As a matter of fact, artificial objects (which are produced by humans) can also be considered a part of nature.

It may be noted that there are no equivalence classes of fictional entities or of theoretical concepts. In truth, there are no instances of them, which is another way of saying that there are no distinctive marks to identify them. Any such class is built, instead, through some property (as, for example, the class of Cyclopes through the property "To be a giant with a single eye").

An interesting case is represented by natural numbers. Are they fictional or natural? Frege defined the concept of number as a class of equivalence classes [1884, §§ 46, 68, 72]. Let us consider the number three. It is first built by regrouping even heterogeneous objects whose number is three. Then, it is formed by building an equivalence class between all the sets of three objects. Is the fact that three objects are three a property of the three objects taken singularly? The answer is clearly no. However, it is a feature of the group of the three objects. In fact, the three objects may be similar (three apples) or dissimilar (one apple and two oranges). They can also be grouped differently (a unity and a par). For this reason, it is a sort of distinctive mark of this group that allows one to build an equivalence class of such groups. Therefore, abstract objects such as numbers are an equivalence class, not of individuals, but *of groups* individuated by analogues of distinctive marks. Perhaps we may say that, while fictional or theoretical objects represent a widening of knowledge along a "vertical" line (in terms of hierarchies of classes), abstract objects represent a widening of equivalence classes in a "horizontal" direction.

Let us now consider the way in which we ordinarily build a category from subcategories. As well as this, super-categories can be built from other categories. For instance, we may build different biological categories such as that of living being, animal, *mammal*, or feline. In general, these categories are built at the start as classes determined by a single property. The job of successive experience and knowledge is to eventually find additional and independent properties that may transform such a genus in a true secondary substance.

Many of the confusions that arise here stem from the fact that this circumstance is not sufficiently considered. This is the reason why we feel the need to find definitions of these categories as a way to identify them univocally, when it is difficult to find specific distinctive marks.

Similarly, we may build arbitrary categories by grouping together different sorts of objects. If we are not able to find additional properties and a distinctive mark in order to constitute a true equivalence class, this category represents instead an aggregate.

If all this is true, the ancient Aristotelian extensional logic is still quite appropriate in accounting for inferences, while the new, modern, intensional point of view, according to which *predicatum inest subjecto* [see, for instance, Leibniz C, pp. 233, 236, 265, 272, 393], only applies well to fictional and theoretical (i.e. second-level) objects. In fact, only these objects can be truly defined. This examination shows that one of the biggest errors of Leibniz was to consider both fictional and natural objects as objects of the same kind, both defined by the intersections of properties. In this way, properties become features that intrinsic to the objects in a stronger sense than that believed by Aristotle. It is not by chance that Leibniz speaks of the individual properties (like to be the king of France in a certain year of the 18$^{\text{th}}$ century, being married with Marie Antoinette, an so on) of individual objects (like Louis the 16$^{\text{th}}$) [1686]: individual properties (and their intersections) are indeed able to pick up individuals far better than generic properties. However, according to my examination, properties are universals, not individual. Natural individuals represent instead an irreducible ontological difference (their individuality) that cannot be understood otherwise as an *actus essendi* [St Thomas, *STh*, I, q. 3, a. 4; *De potentia*, 7, 2, ad 9] or as a *haecceitas* [Duns Scot, *Ord*. II, dist. 3; see also Peirce 1896; 1906]. It is their irreducible individuality that makes the referential act concerning natural beings also irreducible.

Abstract: *Deduction, abduction, and induction are analysed. They are shown to consist in the connections between three terms: distinctive marks, equivalence classes, and properties. The general way in which these connections are established is through law-like hypotheses, sampling, and expectation. Moreover, each inference is shown to consist in a different form of expectation. Some of the ensuing consequences are shown, in particular those concerning fictional and abstract entities, class hierarchy, and extensional versus intensional logic.*

Keywords: *Abduction, Deduction, Induction, Inferente, Logic.*

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