CHARLES UNIVERSITY IN PRAGUE

FACULTY OF HUMANITIES

Department of Electronic Culture and Semiotics

Bc. Dalibor Lošťák

C. S. Peirce on Science and Practice

Thesis

Supervisor: **Mgr. Michal Karla**

Prague 2015

Prohlášení

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Poděkování

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Abstract

In this paper we present C. S. Peirce's take on the difference between science and practice in order to identify the role practice plays in his view of the universe. This take is based on a number of notions about the general nature of signs, inquiries, inferences and arguments, which we discuss. We then survey Peirce's classification of science, show the factors it is based on and examine the mutual relations of the various fields of scientific study. This lets us finally posit practice in the realm of qualities and reactions and show the limits of scientific inquiry into certain matters. We illustrate our findings on a number of examples.

Abstrakt

V této práci presentujeme C. S. Peircovo stanovisko ohledně rozdílu mezi vědou a praxí za účelem identifikace role, jíž praxe hraje v jeho náhledu na vesmír. Toto stanovisku je založeno na řadě poznatků o obecné povaze znaků, zkoumání, inferencí a argumentů, jež diskutujeme. Následně rozebíráme Peircovu klasifikaci vědy a poukazujeme na faktory, jež ji zakládají, a na vzájemné vztahy rozličných oblastí vědeckého studia. To nám umožňuje konečně umístit praxi do sféry kvalit a reakcí a ukázat omezení vědeckého zkoumání jistých záležitostí. Tyto naše závěry ilustrujeme řadou příkladů.

Keywords: science, practice, Peirce, semiotics, sign, argument, theory, classification, inference

I Introduction

Charles Sanders Peirce was an American scientist whose contributions to various fields of inquiry, especially mathematics, logic and philosophy, continue to impress generations of his successors. Despite the massive advancements he made and the incredible volume of his works, he is not among the best known or the most popular philosophers. We aim to present the key aspects of his semiotics with special regards to his delimitation and classification of science. The reason for this is twofold. Firstly, we believe and intend to show that this delimitation and classification is the result of consideration of certain parts of Peirce's semiotics, namely of the findings of speculative grammar and critical logic. Secondly, we consider it important to discuss the role practice plays in Peirce's view of science and of the universe at large.

But our motivation is also personal. Ever since our beginnings in the human sciences our main interest was in the characteristic properties of certain groups of text. At first, we were only interested in literary fiction – what makes up a genre[1], or rather what are the properties of texts in one genre that no other texts have? A natural follow-up to such an inquiry is to broaden the scope from differences between genres of fiction to all genres of texts. Obviously, the intristic properties that can be found are not always inside of the texts themselves. That is why semiotics, and especially Peircean semiotics, is the perfect framework for this type of analysis. Texts are systems of signs

1 Such as “modernistic novel”, “authorial myth” etc.

which are connected to various other systems of signs and sign production. This paper shows Peirce's view of the issue with emphasis on its general relevance for other fields of inquiry.

We present the topics of this paper in six chapters. Chapter II explains the three basic phenomenological categories as well as Peirce's classification of signs. This classification is based on a particular analysis of the nature of signs and of semiosis. We focus especially on the class of argument and explicate the features which differentiate it from the other classes.

Chapter III discusses the nature and various forms of argumentation, the different ways of fixation of belief, and the role argumentation plays in this regard. Argumentation is inference, and a certain arrangement of particularly operational inferences constitute the scientific method.

Science is much more than just the application of this method of inferring. Chapter IV elaborates on Peirce's classification of science and on what distinguishes it from practice. We pay special attention to the dependence of the classes on each other and on practice.

Chapter V discusses Peirce's view of God, arts, and practice in order to complete our picture of his take on how a mind operates in the universe. Chapter VI illustrates this picture, which we try to finally present very concisely in our conclusion in chapter VII.

II The Notion of Argument in Peirce's Speculative Grammar

II.I. Introduction

This chapter aims to outline how the notion of argument appears and operates in Peirce's speculative grammar[2] and to show its application on an example of practical human communication. Because of the extremely broad scope of Peirce's research, we find it important to approach this topic from the very outside so as to properly set up Peirce's notion of argument in this part of his theory. This chapter focuses on the later form of Peirce's semiotic theory but we are using some of Peirce's earlier works where we find it enlightening for understanding the later ones.

2 This means this chapter deals only with the general theory of the nature and meaning of arguments rather than with an examination of their logical validity or potential to reach truth. More on that in chapter III and IV.

II.I Phaneroscopy

Charles Sanders Peirce was born in the year 1839 and died in the year 1914. In his 75 years of life he worked in many fields of scientific research and is today known as one of the greatest American thinkers of all time (Weiss: 1934), the founder of both pragmaticism and semiotics. Entering the work of such a giant is never an easy task and we will only focus here on topics central to our problem.

That being said, we still have to start with the broadest scope to show why we consider Peirce's approach worth investigating. We might generally call his efforts a pragmatically, logically oriented phenomenology and, while a somewhat fitting description, this demands a lot of further elaboration. Phenomenology in Hegelian sense is somewhat at odds with the idea of formal logic and, indeed, Peirce himself decided to call his effort “phaneroscopy” (CP 8.213), among other reasons to distinguish it from Hegelian phenomenology. Rather than metaphysical, ideal or historical, Peirce's approach is logical and at the same time semiotic because it considers anything present to a mind to be a sign suspended in an interplay of basic categories. This logic is therefore inevitably dependent on the discovery of these founding categories – that is on phaneroscopy itself – and consists mostly of a categorization based on the key conceptions identified in the phaneron: Firstness, Secondness and Thirdness. Peirce himself puts it like this: "I essay an analysis of what appears in the world. It is not metaphysics that

we are dealing with: only logic. Therefore, we do not ask what really is, but only what appears to everyone of us in every minute of our lives. I analyze experience, which is the cognitive resultant of our past lives, and find in it three elements. I call them Categories" (CP 2.84).

Pragmaticism plays an important role in Peirce's philosophy as it anchors the notion of examining the logic of sign interaction mediating the phaneron to the mind by taking into consideration the effects of a given sign and the real context in which it is produced and interpreted (Nicole: 2011). This is why we think that it is worthwhile to experiment with applications of his highly analytical and in many places theoretical endeavor.

II.II The Ceno-Pythagorean Categories

As mentioned above, in the core of Peirce's logical/semiotic system lay the categories of Firstness, Secondness, and Thirdness. Peirce called these "Ceno-Pythagorean" as they are truly universal and are related to and named after numbers, same way the mathematic-centered philosophy of Pythagoreanism constructed their theories, although, according to Peirce, there is no approach amongs the Pythagoreans resembling these categories at all (CP 2.87). Peirce states, in the relation to other philosophical systems as well as his own, that „a category is an element of phenomena of the first rank of generality" (CP 5.43). The immense importance these categories have in Peirce's system is clearly reflected in the huge amount of reformulations and notes he makes on this topic and in the number of cases where he identifies then in the various objects of his inquiries. They first appear in "On a New List of Categories" from the year 1867 but he frequently kept returning to them in the following 40 years. This on one hand provides us with valuable resources to understand his conceptions through comparation, on the other one it, however, creates a massive terminological confusion. We find it quite enlightening to look here at the different terms he chose for these categories as this points out their respective characters in an apparent way. We also briefly introduce our understanding of these categories and indicate how they relate to Peirce's view of arguments.

In his 1867 paper, Peirce laid out the three categories in

between 2 major conceptions: “being” and “substance”. Substance is the manifold inapplicable to a predicate, being is the unity equally inapplicable to a subject (CP 1.548). Thus, there is a need for a search for conceptions allowing the passage from the manifold to the unity. According to Peirce, “the conception of being arises upon the formation of a proposition“ (CP 1.551). A proposition necessarilly entails not only a term to express substance but also another one to express the quality of that substance. The function of the conception of being then is to unite the quality with the substance. Therefore, quality in its broadest sense is the first conception on the way from being to substance (ibid.). Apparent possibility of an agreement upon the nature of some quality in some respect leads Peirce to establish the term „ground“, „a pure abstraction, reference to which constitutes a quality or general attribute“(ibid.).

Peirce further states that, according to the knowledge of contemporary empirical psychology, we can only know a quality „by means of its contrast or similarity to another“. This inevitably requires a reference to a correlate which is also necessarily introduced with the introduction of a reference to the ground. A reference to a correlate is the second conception, third is a reference to an interpretant, to „a mediating representation which represents the relate to be a representation of the same correlate which this mediating representation itself represents“. Reference to an interpretant is the final step on the way from being to substace and, as to be seen below, an essential component of Peirce's theory of argument.

Here we finally arrive at Peirce's early list of categories. These are:

Being

Quality (Reference to a ground)

Relation (Reference to a correlate)

Representation (Reference to an Interpretant)

Substance (ibid.)

The three intermediate conceptions are termed accidents in this paper, although the terminology will be subject of many changes during the course of Peirce's research. These five categories afford five supposable objects:

What is.

Quale – that which refers to a ground

Relate – that which refers to ground and correlate

Representamen – that which refers to ground, correlate, and interpretant

It. (CP 1.557)

This is the basis of the speculative grammar Peirce worked on and kept on changing and improving for the majority of his life. Quality was later called Firstness, mostly because it is a term free of previous meaning and also for the aforementioned reference to Pythagoreans (this also holds true for Secondness and Thirdness). Relation is also called reaction or Secondness, the middle term effectively pointing out the effects of this category. Representation is also refered to as mediation or Thirdness, for similar reasons. The notions of being and

substance were always in the background of Peirce's theory, although he later rarely mentions them directly.

Before moving onto Peirce's ten genuine classes of signs, we consider it interesting to attempt to characterize the three categories in an associative way.

Firstness is probably most famously illustrated with this Peirce's example: “If you ask a mineralogist what hardness is, he will say that it is what one predicates of a body that one cannot scratch with a knife. But a simple person will think of hardness as a simple positive possibility the *realization* of which causes a body to be like a flint. That idea of hardness is an idea of Firstness.” (CP 8.329)

While Firstness is a concept that seems very abstract, inaccessible and is therefore often considered hard to understand, it is actually structurally simplest of the three categories because of its inability to degenerate (more on that in ch. II.IV). Based on what is said above it seems clear that Secondness always entails Firstness. According to Peirce, the general Firstness of all true Secondness is existence or actuality, it is „just when and where it takes place, and has no other being.“ (CP 1.532)

A genuine Thirdness is the category of mediation, generalization, intelligibility and influence. Peirce wrote that: „The first is agent, the second patient, the third is the action by which the former influences the latter. Between the beginning as

first, and the end as last, comes the process which leads from first to last“ (CP 1.361).

Let us now try to explicate these categories on an example we will work with in this chapter and will later return to in chapter VI:

Two people come home on a rainy day, soaking wet. They knock off their shoes and one of them proceeds towards the kitchen. The other one notices this and says: „It's easy to catch a cold in wet clothes.” Then they both go to the dressing room to change.

To briefly discuss the categories of Firstness, Secondness, and Thirdness we can easily consider only on the first sentence of the example, limit our investigation to our own viewpoint as readers of this short text, and also disregard its narrative implications and only focus on the mechanisms of emergence of its interpretants. Even with all these limitations the matter is still an obfuscated one. There are three subjects in play: the set of black markings on the page (or screen), the blank space surrounding them, and our mind. The lower level of analysis here is the interaction of the markings and the blank space. They both have their respective characteristic Firstness and their Secondness consists of their specific mutual spatial configuration. A third, as mentioned previously, is that which joins a first and a second. In this case it is the sum of grammatical, syntactic, stylistic, and semantic rules of English.

Thirdness is what guarantees the sentence's intelligibility.

The higher level of analysis concerns us as the recipients of the text. Again both we and the text have our respective, specific Firstness. There is Secondness in the here and now of our mind in the relation to the text. And there is Thirdness in the laws of interpretation that mediate between our mind and the markings through allowing the flow of the semeiosis to transfer the meaning between signs in the form of the black markings and in the form of our mental concepts.

Before we work with this example any further we must first discuss Peirce's ten genuine classes of signs.

II.III The Genuine Classes of Signs

Let us now skip some 30 years in the chronology of Peirce's work and discuss how he arrives at his notion of argument. He obviously starts at his three accidents (or, rather, categories, as he calls them most of the time, starting even in the 'New List') and proceeds to combine these with three threefold correlations: a/ according to the mode of apprehension of the sign, b/ according to the relation of the sign to its dynamic object and c/ according to the relation of the sign to the normal interpretant. This would add up to 27 categories had Peirce not used the logical rule „nota notae est nota rei ipsus“ or “a sign of a sign of a thing is a sign of the thing itself”. That way he arrives at the ten classes he considered “genuine”, that is basic and nondegenerate[3]. We find it important to show and briefly discuss these here as the Peircean notion of argument stem directly from them.

First, what does Peirce mean by a sign, an object, and an interpretant. A sign is the central term of Peirce's phaneroscopy. Signs are mediators between their objects and their interpretants and only this triadic connection is capable of what allows the mind to operate the percepts and the universe to operate its parts[4]. Thirdness is therefore the mode of being of genuine signs (see ch. II.IV). An object is what a sign corresponds to. There are two kinds of objects of any sign. An „immediate object“ is an object as represented by a sign. A „dynamical object“ is an object

3 We discuss degenerate signs in chapter II.IV.
4 More on that in chapter V.

as the actual cause of a sign. An interpretant is “the proper significant outcome of a sign” (CP 5.473). Interpretants are divided by Peirce into three distinct types. An „immediate interpretant“ is an interpretant as represented by a sign. A „dynamical intepretant“ is an interpretant that is actually produced by a sign. A „final (or normal) interpretant“ is an interpretant that would be produced if a sign were properly and fully understood. Interpretants also trichotomize to emotional, energetic, and logical. An emotional interpretant is always the first proper significant effect of any sign, entirely in the realm of feelings (CP 5.475). An energetic interpretant expresses the effort awakened by the emotional effect of a sign (ibid.). Finally, a logical interpretant allows for general reference and is connected to conditionality and habit (CP 5.480-6).

Correlation a/ consists of “qualisigns”, “sinsigns” and “legisigns”, depending on the category they're in. Correlation b/ consists of „icons“, „indexes“ and „symbols“ and correlation c/ of „rhemas“, „dicisigns“ and „arguments“. A qualisign is the ground of perception, pure quality. A sinsign is a pure existent, something existing „hic et nunc“ (CP 1.458), a dyad – a reaction of one thing against another, insistance without reason (CP 1.456). A legisign is then a law, a rule, or a convention. An icon represents its object through a communion of qualities that produces a resemblance among them (Icon, 2009), an index through being materially connected and a symbol through convention. A rhema is „a merely qualitative interpretant, i.e. it selects from the relation Sign-Object only what it has of essential quality“ (Rhema, 2009). „A dicisign is a sign which is

understood to represent its object in respect to actual existence“ (EP 2:292). Finally, an argument is a sign that distinctly represents its interpretant, which it is intended to determine (CP 2.95).

Lets start with a look at the most „extreme“ genuine classes. On one hand there is the „qualisign“ in the narrower sense. This is the only class based on a qualisign in the first correlate and it must, therefore, be based on an icon and a rhema in the second and third correlate, respectively. This class is „the most fundamental of the phaneron, embodied in all the other classes of signs as the fundamental source of originality in semeiosis“ (Ten genuine classes, 2009). On the other one there is the „argument“ in the narrower sense, the only class based on an argument in the third correlate, which logically requires a legisign and a symbol in the first and second correlate, respectively. It is „ a habitual sign (that) represents its object by habit as to produce a logical dynamic communicative effect and a logical final communicative effect“ (ibid.). We will discuss this definition later in this chapter. For now it is important to note that these „outer“ classes represent the starting and final points of a journey leading from a mere possibility of an effect through different stages of reaction and interpretation into the realm of logic, rules, and reason.

The class of argument is closely connected to the class of proposition. They both consist of habitual signs (legisigns) representing their objects by habit (symbols) but the difference between them is that arguments have arguments in their third

correlate while propositions have dicisigns in the same place. In other words while arguments produce logical dynamic and final effects, propositions produce dynamic and final interpretants that are energetic. The difference here really is that propositions deal with actual existence and arguments dwell within the realm of habits and laws.

Let us now return to the example set in the previous chapter. Actual Peircean interpretation is always a complicated matter, mostly because of the „incremental“ nature of Peirce's theory of sign we mentioned earlier – if there is a sign of higher class there are signs of the lower classes as well. That being so, we could easily find a representative of all the ten genuine classes in any given example but, even if we for now limit ourselves just to the classes of proposition and argument, it still remains a pretty messy task. We will therefore limit our interpretation even further and only consider the situation from the viewpoint of its actors and also only regarding the response to being wet. With these limitations there remain two instances of the proposition/argument confusion.

The first person walking towards the kitchen is a proposition in the sense that it conventionally communicates to the other person that the first one is going to make something (probably a hot beverage) and it elicits an actual, energetic effect. It is an argument in the sense that it can be shown in the classical syllogistic structure: a person going to the kitchen right after getting home goes there to make something; a person is going to the kitchen right after getting home; that person goes to make

something. The other instance is very similar to this one, as a person saying „It's easy to catch a cold in wet clothes.” makes at the same time a proposition and an argument, produces both an actual and a logical effect.

As the example shows, the different classes of signs are inseparably interconnected. However, we need to discuss the degenerate classes of sign here before we examine this matter any further.

II.IV The Degenerate and Genuine Categories

We already mentioned Peirce's idea of degeneracy several times in this paper. Now it's time to discuss it in detail as this notion is the last piece necessary to draw rough contours of Pierce's notion of argument. Before we get to the degenerate classes of signs we need to first discuss the degeneration of the basic categories.

Peirce himself wrote in his treatise on different kinds of Secondness that: "It must be extremely difficult for those who are untrained to such analyses of conceptions to make any sense of all this" (CP 1.527). This shows that it indeed is a fairly complicated topic. Let us, as Peirce did, start with the notion of genuine and degenerate Secondness, as "among Firstnesses there is no distinction of the genuine and the degenerate" (CP 1.529).

Secondness always requires a first and a second, but it is not a compound of two facts, it is a single fact about two objects (CP 1.526). There is, however, a difference between the Secondness of the object called the first and the one called the second. If there is a reason to call one of the two the first and the other the second it must, according to Peirce, be "that the Secondness is more accidental to the former than the latter" (CP 1.527). This means that if there is a first and a second in a Secondness then this first might have its own genuine Firstness that is not modified by this Secondness (the Secondness is only accidental to it) while this Secondness at the same time

constitutes the very being of this second. Peirce shows this on a very abstract, yet also very illustrative, example of matter and quality. In his view, quality is not changed in any way by its relation to matter while matter cannot even exist without having some qualities. Matter is therefore a genuine second while quality is a degenerate one in this Secondness. As a whole this Secondness is then considered degenerate as well because one of its seconds is only a Firstness. A degenerate Secondness "really amounts to nothing but this, that a subject, in its being a second, has a Firstness, or quality"(CP 1.528).

Let us now briefly return to our example from the chapter II.II. We obviously identified a Secondness in both levels of our analysis. We might say that the former one should be considered degenerate as both of the seconds are degenerate as well - they only allow for each others qualities, nothing more. The latter Secondness is also a degenerate one because while one of the seconds is qenuine, as mind changes by interacting with a text, the other one is still degenerate.

The notion of degeneracy we just discussed doesn't involve a third but Peirce later came with an approach involving Thirdness as well, in a letter titled “Degenerate Thirdness”. Similarly, category the first is by its simplistic nature incapable of degeneracy (CP 5.68) and category the second can be either genuine or degenerate (CP 5.69), although here it can also be so only "approximately" (ibid.). A degenerate second is such "in which there is Secondness indeed, but a weak or secondary Secondness that is not in the pair in its own quality, but belongs to it only in a certain respect" (ibid.).

Returning to our example again, this approach yields different results. While we must still consider the former discussed seconds degenerate as their Secondness is in a way only potential, we can now consider the latter genuine because it is completely realized. This shows that the later approach might bring better results in our applications by outlining the differences between different utterances.

The matter is a bit more complicated with Thirdness as it is capable of two different ways of degeneracy. The "lesser" degree of degeneracy involves what Peirce calls "an irrational plurality" (CP 5.70). It is a formally plural representation of something that is in nature only a sort of complicated duality. Peirce provides an example of the conception of subdivision of categories for this form of degeneracy. The most degenerate Thirdness is "where we conceive a mere Quality of Feeling, or Firstness, to represent itself to itself as Representation" (CP 5.71). Pierce offers the notion of „pure self-consciousness" as an example and then tries to explicate it further in a beatifully Borgesian digression (ibid.).

The apparent difficulties with explaining the degenerate forms of Thirdness stem from the fact that they, unlike the forms of Secondness, do not operate as an easily identifiable, linked and stable conceptions. According to Peirce, any class of signs for which Thirdness is the key element results in a trichotomy, spawning three new genera. These then continue to divide in a like manner, only being harder and harder to discern with each succeeding division (CP 5.72). Peirce illustrates these on the example of the representamen , which leads us to the degenerate

classes of sign.

II.V The Degenerate Classes of Signs

Although Peirce himself found this subject rather interesting (CP 5. 76), he didn't spend too much space on discussing it further. That is why we base this part of our paper on the work of V. Romanini from the University of Sao Paulo, who essentially expands on Peirce's ideas we just discussed.

In doing so he combines the notion of degenerate categories and the logical rule Peirce used to arrive at his original ten genuine classes to develop and name whopping 66 classes of signs (Romanini: 2009b). This is very interesting for us because we believe this allows for a more precise and fruitful analysis.

Following the pattern of the chapter II.II, let us first look at the degeneration of the most fundamental of classes: the Qualisign. Obviously, none is possible as this is the only genuine class completely situated in the realm of Firstness and therefore incapable of degeneracy.

The class of Argument is, on the other hand, fully based on representation. An interesting decision Romanini made was to name the degenerate forms of argument the induction and abduction (ibid.) as this does in a way correspond to the meaning Peirce affirmed to these terms in his logical critic and methodeutic, however, it also invites a lot of possible criticism. For the purpose of this paper we shall stick to these terms.

Being the relatively genuine out of the rhema – dicisign – argument trichotomy, argument is well fit for another level of the analysis mentioned in the previous chapter. The lesser degree of degeneracy transfers an argument into an induction while losing its capability of producing a final logical interpretant, replacing it with an energetic one. The higher degree transfers it into an abduction which doesn't produce any final interpretant whatsoever.

Leaving "lower" new classes aside, two new degenerate classes directly connected to argument. Romanini calls them "Inductive symbols" and "Abductive symbols" (2009a). To properly finish the discussion of our example we must also consider the degenerate forms of proposition. The key feature of a proposition is that it entails a dicisign. Dicisign is already a reactionally degenerate symbol (CP 5.73) and as such can only degenerate one step further. Romanini calls this degenerate form syntax, the difference to dicisign being that it produces an emotional final effect instead of an energetic one. This of course gives rise to one degenerate class connected to proposition, called "Syntactic symbol" (Romanini: 2009a).

Now let us finally go back to the example from the chapter II.III and see how we can apply these new classes. In the first instance we discussed nothing changes about the nature of the proposition. What shifts is our classification of the argument: although it can be shown in the form of a syllogism we can hardly maintain the position that the act of going into the kitchen produced a logical final interpretant. The dynamic interpretant indeed really is logical, however, we believe it is correct to

support the notion that an interpretation of this act as a sign is in this situation carried out to the maximal extent in the realm of relation rather than mentality, it's rather an act than a habit. Instead of a proposition/argument confusion we are now dealing with a proposition/inductive symbol one.

In the second instance nothing changes about the proposition either. However, even the argument still belongs to the proper argument class because its final interpretant is without a doubt a logical one. This allows us to observe and name the difference between the two situations presented in our example.

II.VI Conclusion

The class of argument and its degenerate classes in a way stand on the very top of Peirce's speculative grammar. Being the most complex of all classes of signs, it entails the presence of all the others and are the "highest" of them all, closely tied to the notion of God[5]. This chapter shows that a proper consideration of subtle differences among their various manifestations can lead to a more precise understanding of the universe, of the place people have in it and of the ways they relate to it.

5 See chapter V.

III Function and Division of Arguments in Peirce's Critical Logic

III.I Introduction

In the previous chapter we discussed the notion of argument as a class of sign standing on the very top of Peirce's classification system, identified where and how it differentiates from the lesser classes and also found several “degenerate” types of argument. Here we try to elaborate on the inner workings of arguments based on Peirce's studies in logic of science in order to allow our research further precision.

This obviously demands a further specification as logic in the broad sense underlays all of Peirce's thinking. Lets take a look at a list of Peirce's topics of research (or, respectively, memoirs meant to cover these topics) to show what exactly we are going to focus on. This list was composed by J. Ransdell of Texas Tech University (The significance...: 1998) but it is based on the contents of Peirce's 1902 application for a grant from the Carnegie Institution (MS L75) and its older drafts. This method is necessary because of the combination of Peirce's perfectionism and his aversion to repetition as he made 5 versions of this application before finally submitting the sixth one, each developing different topics while ignoring or just mentioning others.

The list by Mr. Randell nicely shows how systematic and thorough Peirce's philosophical investigations were and also how logically are the different topics organized – based on their presuppositional relationships. This means that the latter concepts or categories are based on and rely on the former ones. Therefore, the list begins with the topics on mathematics, especially those that have to do with mathematical logic. The following memoirs deal with phenomenology, the normative sciences, and, finally, metaphysics. The normative sciences include esthetics, ethics and semiotic or logic. Semiotic and logic in its broad sense comprise of philosophical grammar, logic in the relatively narrow sense, and philosophical rhetorics[6].

Here we see the place of logic in the relatively narrow sense in the system of Peirce's investigations. This area of inquiry is also mentioned as “critical logic” by Peirce and it deals with theory of inference and as such it focuses on abductive, inductive and deductive logic. Let us now briefly introduce what Peirce had in mind with these different types of inferential relations.

6 More on that in chapter V.

III.II Deduction, Induction, Abduction

Sometime around the year 1865 Peirce begins to work on and broaden the then commonly accepted division of arguments between two subclasses, the class of deductive arguments (necessary inferences) and the class of inductive arguments (probable inferences) (Deduction...: 2001). He holds the view that there are in fact two distinct classes of probable inferences, which he decided to call inductive inferences and abductive inferences. A deductive inference is generally an argument from a rule through a case to a result – the fact that the case is known to conform to the rule is what makes the result necessary, generally speaking. An inductive one on the other hand is an argument from a result through a case to a rule. This means that an inductive argument is not necessary as a rule that is to be the conclusion of that argument is only claimed and not known – in other words, in contrast to a deductive argument, the premises of an inductive one do not guarantee the validity of the conclusion.

This is of course a problem that the philosophers were concerned with since the ancient times. Can inductive reasoning lead to a proper knowledge if its conclusion is only probable and not certain? There are two major problems, first that an induction often consist of a generalization about the properties of all members of a certain class based on the properties of only a few of the members, and second that an induction often relies on the notion that past events will occur in the future the same way they did previously.

These problems were in Peirce's focus as soon as in his well known series of papers called “Illustrations of the Logic of Science” from the 70's of the 19th century. Peirce regarded the question of validity of an inference solely as a matter of facts (Koehn: 1973, p. 157). Whether we are inclined to think that an argument is bad or otherwise is of no consequence, it only matters whether the facts asserted in the premises of that argument relate to the facts asserted by the conclusion in such a way that for the most part the conclusion *in fact* follows the premises (ibid, p. 159). If the validity of an argument rests solely on facts the problem of validating any sort of synthetic reasoning arises. The solution to this problem rests in the notion that in our asking about the validity of an inference we already presuppose a number of facts, such as “that there are such states of mind as doubt and belief – that a passage from one to the other is possible, the object of though remaining the same, and that this transition is subject to some rules which all the minds alike are bound by” (Peirce 1877: p. 4). It is this transition from doubt to belief that Peirce refers to as inquiry (ibid., p. 6) and explores the different species of it based on whether the valid-invalid distinction can be made for it or not.

The simplest kind of inquiry has reference only to the mind of an individual inquirer (Koehn: 1973, p. 159). Peirce calls this kind the method of “tenacity” and considers it impossible to make the valid-invalid distinction for it as different inquirers can consider the same rule of reasoning both great and poor. The second simplest kind of inquiry is called the method of “authority” and it has reference to a definite, limited community. Here the rules of passage from doubt to belief are the same for

all the members of a certain community – but it follows that as such it can never resolve differences between different communities. This leads us to the third kind of inquiry, called the "a priori" method, which has reference to an indefinite, unlimited group. Here the rules of passage are found within the mind itself. Although Peirce regards this method as much more intellectual and respectable than the previous two he also finds it most apparently insufficient as there is no way to tell if what one thinks to be clear and distinct in his thought really is so: "[This method] makes of inquiry something similar to the development of taste..." (Peirce 1877: p. 10)[7].

Knowing that Peirce spent a significant part of his career on natural sciences, it's hardly surprising that it is exactly the scientific method of inquiry that, he holds, can alone allow for the valid-invalid distinction in fact. The existence of "the rules which all the minds alike are bound by" rests on the reality hypothesis, that is on the supposition of an external permanency that, although affecting individual minds differently, will lead all alike minds to the same conclusion given they abide to the scientific method. The notion of validity is closely tied to the notion of truth as an argument is only valid if it is of the kind that generally leads an inquirer from true premises to a true conclusion. Here arises the topic of probability, which Peirce considers a problem of logic. In our trying to determine the numerical probability of a possible fact we are really trying to ascertain the numerical value of a mode of inference. If the inference is demonstrative, then it is such that if its premises are true the conclusion is always true. If it is probable, then the

7 More on this in chapter III.IV

inferential rule leads from true premises to the true conclusion only for the most part. The reality hypothesis forms the foundation of our ability to distinguish the worth of an inference both in general and numerically: “in the long run, there is a real fact that corresponds to the idea of probability, and it is that a given mode of inference sometimes proves successful and sometimes not, and that in a ratio ultimately fixed” (Peirce 1878: p. 606).

Peirce identifies another type of an argument as going from a rule through a result to a case. This type of inference can be considered a sort of „educated guess“ (Deduction...: 2001)[8], a probable argument of a kind. Peirce calls this type of inference „hypothesis“ in his earlier writings and „presumption”, „retroduction”, or, most commonly, “abduction” in his later writings and considered it fundamentally important for the logic of science: “[a]bduction is the process of forming explanatory hypotheses. It is the only logical operation which introduces any new idea” (CP 5.172), he noted and added that it encompasses “all the operations by which theories and conceptions are engendered” (CP 5.590). In Peirce's view, abduction is the first stage of theory assessment: deduction then allows for deriving of testable consequences from the explanatory hypotheses that abduction helped to conceive, and induction finally helps to reach a verdict on the hypotheses that is dependent on the number of testable consequences successfully verified (Peirce on Abduction: 2011).

8 There is a more familiar name for it than *abduction*; for it is neither more nor less than guessing. (HP 2.898-899)

Although this paper is not very much concerned with the temporal development of Peirce's thought we find it important to note here that his view of abduction (as well as many other topics he concerned himself with for a prolonged period of time) somewhat shifted over the course of his research as the different approaches shed some additional light onto the nature of his logic of science. According to A. W. Burks, Peirce at first thought of abduction, and inference generally, as of an evidencing process. The difference between abduction and induction then was the same as between the explanatory, theoretical part of science and its summarizing, descriptive part: abduction was considered an inference from a body of data to a hypothesis, while induction was considered an inference from a sample to a whole (Burks: 1946, p. 301). Sometime during the last decade of the 19th century Peirce widened the concept of inference to include methodological processes as well as evidencing ones: induction became the method of testing hypotheses, and abduction the method of discovering them.

Induction as a method of testing hypotheses can be of three different kinds. The first one, crude induction, "goes on the presumption that the future experience of a given phenomenon won't be completely at variance with all the past experience of it" (CP 2.756). It is the weakest kind of induction as its conclusions are easily demolished in any given moment by a single counter-instance. The next kind of induction is qualitative. It "is not based upon experience in one mass (as the crude induction), nor upon the experience of a definite collection of numerable instances of equal evidential values (as the

quantitative induction), but upon a “stream of experience” of different parts whose evidential value needs to be estimated by the investigator” (CP 2.759). This kind of induction provides conclusions that may be very valuable for initial testing of hypotheses but which rely on constant evaluation of the sense of the impressions that the instances being experiences make upon the inquirer. Quantitative induction is “the statistical inference according to which the value of a sample is approximately the value of the class, or the real probability in question” (CP 2.758). Peirce later calls qualitative and quantitative induction “gradual inductions” as they are of the kind "which makes a new estimate of the proportion of truth in the hypothesis with every new instance" (*CP* 6.473). Quantitative induction is more useful for the final testing of hypotheses as it operates through measurements, statistics, or counting and its conclusion are, therefore, capable of generating probable truths.

The view of abductive discovery as inference is enabled through Peirce's conception of logic as a study of habits of inquiry and even more so through his notion of logic as a normative science. Let us briefly elaborate on these two topics before we discuss Peirce's logic of science any further. The connection of the habits of inquiry and logic depends upon Peirce's pragmaticism[9], specifically on his notion that “what we think is to be interpreted in terms of what we are prepared to do” (CP 5.35), meaning that a belief is considered a conscious habit of action. Along these lines, genuine doubt only arises when an actually functioning habit is interrupted. Such interruptions are

9 The importance of Peirce's pragmatism to the other areas of his thought relevant to this paper is discussed in chapters IV and V.

necessary subjects of inquiry. Once one arises the aim is to arrive to a new belief-habit that will prove to be stable, one that would "lead to the avoidance of all surprise and to the establishment of a habit of positive expectation that shall not be disappointed" (CP 6.469). For Peirce, logical inquiry is exactly this activity that resolves a genuine doubt and arrives at a stable belief-habit (Burks:1946, p. 303).

Peirce's notion of logic as a normative science is of even bigger importance here. In his view, reasoning is that kind of thinking that conforms to and operates by norms or ideals and logic is the science tasked with creating a theory of this thinking (Burks:1943, p. 190). It follows from this approach that such a theory must be capable of generating truly moral judgment of thinking, and that this thinking must necessarily be deliberate and self-controlled or the moral judgment would be "(no) less ridiculous than it would be to pronounce the growth of your hair to be morally good or bad" (CP 5.109). The purpose of reasoning is to arrive at a truth and a good reasoning is therefore that which succeeds in resolving a doubt and results in genuine knowledge (Burks: 1943, p. 190). The problem here is that although reasoning aims at truth it can't be held accountable for arriving at it as truth and falsity lie outside of the realm of a man's control. What is left for logic to examine, criticize and develop are the methods used to pursue truth. This is what makes logic a normative science as these methods are the *norms* that guide our reasoning. This really means that they guide the way a man's cognition determines another cognition and for this way to be reasonable it must be an inference, that is "the conscious and controlled adoption of a belief as a consequence of other

knowledge” (CP 2.442). Considering this theory of reasoning, it becomes apparent that a discovery of hypothesis can be considered an inference as it can be seen as a deliberate determination of one cognition (the hypothesis) from another cognition (the facts of the problem) (Burks:1946, p. 304).

We already noted the connection of pragmaticism and abductive reasoning but this relation goes much deeper as Peirce referred to his pragmatism as the logic of abduction. In this view, pragmaticism is a logical doctrine to be used in determining the admissibility of hypotheses (ibid, p. 307). Pragmaticism acts as a maxim of analysis here as it ties the admissibility of hypotheses to their practical or empirical consequences and therefore "[abduction's] conclusion should be such that definite consequences can be plentifully deduced from it of a kind which can be checked by observation"(CP 2.786). Acting as this maxim is the full extent of pragmaticism in Peirce's logic (CP 5.196).

III.III The Aim of Critical Logic

We have discussed the different kinds of inferential reasoning that Peirce considered instrumental according to his logic. But what is the ultimate aim of such reasoning? First thing to note here is that Peirce's logic is not psychological: “[l]ogic is not the science of how we do think; but, in such sense as it can be said to deal with thinking at all, it only determines how we ought to think; nor how we ought to think in conformity with usage, but how we ought to think in order to think what is true. That a premiss should be pertinent to such a conclusion, it is requisite that it should relate, not to how we think, but to the necessary connections of different sorts of fact” (CP 2.52). How the people think is not the question Peirce is asking, he rather seeks the conditions of a logically valid reasoning. He rejects the criteria of “self-evidence” and rationality as they either make the logical validity of a reasoning rest on an individual mind or on a non-testable, non-cognitive social faculty (Buchler:1939, p. 202). For him the validity of a reasoning rests on its correspondence with facts.

This of course does not mean that Peirce would completely ignore the psychological aspects of reasoning. On the contrary, he even shows that his criterion of validity is the one implicitly assumed when people infer. He holds that there isn't an instinct of rationality that would guide one's reasoning and that our reasoning rather relies on habits tested by experience. We form these habits through continual representation to ourselves of what would ensue if we make a certain supposition, that is,

what in fact would have to be (probably) true if certain premisses were true. Our habits of reasoning are formed by our diagramming of facts in our imagination. "The habits formed by this continuous representation of experimental situations connected in certain ways are the factor that determine the validity of all reasoning." (ibid., p. 203). The habits are (logically) either good or bad, and to decide that is not the matter of psychology but of correspondence with facts. Peirce considers the habits that we form on the whole good because we continually improve them[10]. The habits that enable us to draw correct conclusions constitute our *logica utens,* the acritical and implicit logic of a common man. When the habits get linguistically expressed as rules of inference, or conscious leading principles, they become *logica docens*, the formulated, scientific and critical logic (Buchler:1939, p. 204).

Peirce's "realistic" approach to judging the value of reasoning certainly sheds sufficient light on how a probable inference works. But there is a problem with necessary inferences because they are more than just an extreme kind of probable ones and to say so clearly misses an important part of their constitution. Different classes of inferences are defined by their respective leading principles. These principles are inferential rules making inferences possible and they usually consist of linguistics formulations of the habits employed in ordinary reasoning (CP 3.164). Inference can be considered necessary only if these rules themselves are logically necessary. In case of deduction this rule is the well-known nota notae est

10 Note the similarity with Peirce's view of inductional inferences as eventually capable of reaching the truth.

nota rei ipsus or in the modern notation: (x) (Fx ⊃ Gx): Fa: ⊃ Ga. Here we approach Peirce's notion that not every necessary inference is also universal. It follows that there are two categories of deduction, a universal, necessary deduction („necessary deductions) and a deduction that is necessary but not universal („probable deduction“).

The key difference here is that necessary deduction involves a universal proposition while probable one involves a statistical or particular proposition. In other words, necessary deduction recognizes only the inclusion or non-inclusion of one class under another, whereas probable deduction takes account of the proportion of the class subsumed under another. This means that necessary deduction doesn't require an inquiry into the nature of cases mentioned in the premises in order to evaluate whether the quantifier „all“ supplies to them, while such an inquiry must be made in the case of probable deduction, in order to see whether a term „a proportion of“ applies to the cases mentioned in the premises. Therefore, necessary deduction applies to both discrete and continuous objects and probable deduction only to discrete objects. But the difference between these two types of inference most poignant to our topic is the one explained in this quote:

„A cardinal distinction between the two kinds of inference is, that in demonstrative reasoning the conclusion follows from the existence of the objective facts laid down in the premises; while in probable reasoning these facts themselves do not even render the conclusion probable, but account has to be taken of various subjective circumstances, - of the manner in

which the premises have been obtained, of there being no countervailing considerations, etc.; in short, good faith and honesty are essential to good logic in probable reasoning" (W 4:410).

„However, even if the subjective circumstances allowing for probability are present, it is still the case that in probable deduction, the conclusion is only probable" (W 4:411).

Peirce identifies two kinds of demonstrative reasoning, corollariar and theorematic. This distinction comes from Euclid but Peirce obviously shifted the meaning of the terms in order for them to fit into his semiotics. Corollariar deduction is such an argument where conclusions stem from propositions which are already implicitly present in premisses. Theorematical deduction is the more demanding type of argument. It necessitates an experimental diagrammatical establishment of certain elements not present among the original premisses in order to successfully conclude.

To sum up, Peirce considers reasoning valid if it follows a proven habit of inquiry and in doing so infers from a fact or a set of facts onto a certain corresponding belief; such a belief may likely hold true either necessarily or just statistically but as long as it was reached in such a way that it connects the arrangement of facts in the phaneron to their arrangement in our imagination it can on the whole be considered good, albeit always a subject to further inquiry. Let us now discuss Peirce's evaluation of some of these habits.

III.IV On the Fixation of Belief

To understand Peirce's evaluation of different belief-habits we must firstly briefly return to the discussion of different methods of fixation of belief. As we noted previously, Peirce engaged himself in the natural sciences for a major part of his life. Therefore, it is hardly surprising, that he considers the scientific method to be the best for fixation of a reasonable belief. But he identifies three other modes of fixation as well. These modes or methods are very common in everyday thought but can rather simply lead to a false belief. According to Peirce, the most common method amongst humans is based on authority. That means that a certain belief is adopted from a certain trusted source. The aspect of trust is of utmost importance here, as there is no other reason to accept such belief besides experience acquired about the source either directly or indirectly. The human susceptibility to and preference for this form of fixation is likely hardwired in our brains as it is an important aspect of our ability to create and maintain self-organizing and self-regulating societies. Unfortunately, the human history offers much too plentiful examples of beliefs based on authority, which led to some of the greatest tragedies ever suffered.

An another rather common method of fixation of belief is the method of tenacity. Here a belief is fixated through elimination of or disregard for the facts that could possibly destabilize it. This is supposed to be happening on both the individual and the collective level and it is probably important to point out that it never failed so often for us both as individuals

and as a society as it does in this day and age. The “information age” we live in now makes it especially difficult to protect beliefs against doubt. Peirce considers this a good thing but it is an unfortunate fact seen many times in our history that when our beliefs are shattered and we are overcome with doubt it is rather the voice of authority that calms us down than the voice of reason and science.

The third method is called the “a priori method”, the idea here being that a human mind has a direct access to a body of knowledge prior to experience. This naturally causes a couple of problematic points to arise. Firstly, there are only very few a priori truths that philosophers would be able to agree about. Secondly, the contents of our consciousness are an inseparable interconnection of culturally-based truths that are often based on authority. Even though these points definitely somewhat eliminate the a priori method as a proper means to reach a true belief Peirce gave it some merit in the sense that humans have a rather strange ability to “guess” answers in face of extremely complicated issues and that the hypotheses they formulate often originate as mere feelings - but only the scientific method can tell whether these hypotheses lead to true beliefs.

So the scientific method is, according to Peirce, the by far best one to use to fixate our beliefs in such a way that they approximate truth. The method of inquiry embodied by the scientific method is naturally temporal and subject to permanent improvement and thus doesn't aim to pretend to arrive at some absolute, perfect truth. Instead, the truth it reaches can always be found wrong in the light of new facts that undermine it.

IV Peirce on the Classification of Sciences

IV.I Introduction

We surveyd Peirce's view of the human desire to truly understand the world from the most fundamental aspects of it reaching our consciousness to the most profound methods of the fixation of beliefs we hold about it. The real beauty of this view is that it encompasses all aspects of how a consciousness[11] apprehends the world being presented to it without creating unnatural and needless thresholds or divisions. Let us now take advantage of this great feature of Peirce's theory and try to explore the different ways a mind can process the world around it with the intent to reach truth as they are classified by Peirce and see how they interconnect and differ.

11 Not necessarily a human or even a self-aware consciousness.

IV.II The Scientific Discourse

Let us start with the field of inquiry that's effectively trying to embody the proper method of the fixation of belief. We talk about the scientific discourse here in the sense that we discuss the way of thinking and expressing the thoughts considered proper to the different fields by C.S. Peirce.

Science is in the lives of men who work together with a certain degree of cooperation and communication. These men form the smallest group among the three distinct, discrete ones Peirce identifies in the paper we just cited. He suggests that the by far largest group are people who devote themselves to seeking enjoyment, both for themselves and for the other. He considers this group necessary. The other group sees as the aim of life to accomplish results: „[t]hey build up great concerns, they goy into politics, not as the heeler[12] does, for a living, but in order to wield the forces of state, they undertake reforms of one and another kind.“ (ibid.). This is the group that makes civilization. Finally, the third group seeks to truly understand the physio-psychical universe[13]. These are the men of science. It is worth noting here that the incremental triadic conception once again resonates in this classification, as enjoyment stems from a certain quality, results require action and understanding is impossible without representation.

The men seeking understanding further segregate

12 A „hack politician“.
13 Peirce operates with a conception of God in this paper. Refer to section 5 for a detailed discussion of this topic.

themselves in another three groups, according to their conceptions of the purpose of science. The men in the first group („prattospudists“) consider themselves tutors and superiors to those who aim to accomplish results. Science is there to determine the world's work and they therefore cultivate applied sciences. The development of applied sciences would be impossible without a sort of a digest of science, a systematized account for all human knowledge. The second group concerns itself precisely with producing such digests. These men (taxospudists) regard science as being, organized knowledge (ibid.) and they practice the sciences of review. The third group consists of men engaged in the endeavour to discover („heurospudists“). It is true that all men of science aim to discover. The prattospudists endeavor to discover for the ultimate purpose of doing and the taxospudists for the purpose of applying knowledge in any way, be it in action or in cognition (ibid.). But the heurospudists look at discovery as the very purpose of why the human race exists. Advancing the minds' understanding of the original psycho-physical universe to its farthest possible point is to them the ultimate, self-contained goal of the heurospude. It is a purpose so significant that even the existence of the human race pales in importance compared to it: “Remember that the human race is but an ephemeral thing. In a little while it will be altogether done with and cast aside. Even now it is merely dominant on one small planet of one insignificant star, while all that our sight embraces on a starry night is to the universe far less than a single cell of brains is to the whole man” (ibid.).

These observations lead to a classification of science that

we stick to in our explanation of Peirce's views. The first division he bases his classification on is into branches, that is according to the fundamental purpose of the given sciences. This constitutes two branches: theoretical, whose purpose is to reach the truth about the universe, and practical, for the uses of life. Theoretical sciences split into two subbranches. We focus first on the science of discovery and discuss the science of review in chapter IV.VII. The second division is based on the way certain sciences make their observations. This constitutes the classes of mathematics, coenoscopy and idioscopy (the latter 2 terms originate in the work of Jeremy Bentham and designate a science concerned with the phenomena known to all mankind and with discovery of new phenomena, respectively).

Peirce is also especially adamant in highlighting the social and the temporal aspect of science: „But what I mean by a "science", both for the purpose of this classification and in general, is the life devoted to the pursuit of truth according to the best known methods on the part of a group of men who understand one another's ideas and works as no outsider can. It is not what they have already found out which makes their business a science; it is that they are pursuing a branch of truth according, I will not say, to the best methods that are known at the time. I do not call the solitary studies of a single man a science. It is only when a group of men, more or less in intercommunication, are aiding and stimulating one another by their understanding of a particular group of studies as outsiders cannot understand them. that I call their life a science. It is not necessary that they should all be at work upon the same problem, or that all should be fully acquainted with all that it is needful for another of them to know;

but their studies must be so closely allied that any one of them could take up the problem of any other after some months of special preparation and that each should understand pretty minutely what it is that each one's of the others work consists in; so that any two of them meeting together shall be thoroughly conversant with each other's ideas and the language he talks and should feel each other to be brethren. In particular, one thing which unites them is their common skill, not possessed by outsiders, in the use of certain instruments, and their common skill in performing certain kinds of work. The men of that group have dealings with the men of another group whose studies are more abstract, to whom they go for information about principles that the men of the second group understand better, but which the men of the first group need to apply. At the same time the men of this first group will probably have far more skill in their special applications of these principles than have the members of the second group who understand better the principles themselves. Thus the astronomer resorts to the student of optics, who understands the principles of optics better that he does. But he understands the applications of those principles to astronomical instruments and to work with them far better than the pure optical student does“ (MS 1334).

IV.III Mathematics and the Formal Sciences

Among the formal sciences belong such disciplines as mathematics, logic and statistics. These disciplines are concerned with the study of formal systems and as such are characterized by a high degree of formality and internal consistency. They are very important and interesting from the Peircean point of view as the systems they study are completely enclosed sign systems. This means that any doubt that is to destabilize the understanding of these systems must arise from within themselves rather than from some new external fact entering them. In other words, there is no boundary between the system being examined and the system operating the examination. Axioms specify the basic rules of operation of certain objects (such as sets, elements, or values) and lead to some definitions for those objects. Some basic facts about the objects in question can be proven and these proofs, called propositions, lead to more complex proofs, called theorems. Axioms, definitions, propositions and theorems constitute a formal theory.

Speaking specifically of mathematics, we shall make a detour here and come back to Peirce's division of sciences already discussed in the previous chapter. Peirce divides mathematics into three orders (CP 1.283). In today's terms, these could be roughly correspondent to discreet mathematics, mathematics of the infinite and mathematical or formal logic. He regards mathematics as the provider of basic guidelines for other sciences, particularly for philosophy. Given our previous explanations, it should be fairly clear why. There are no

existential concerns about the beliefs mathematics arrives at because mathematics creates imaginary objects according to abstract rules – there is no reason for a new surprising destabilizing fact to arise in a closed system like that; therefore, there is no reason not to trust in the beliefs properly drawn on its basis. "As for what the truth of existence may be the mathematician does not (qua mathematician) care a straw" (CP 1:53). These beliefs, in the form of "necessary conclusions" about mathematical constructs, provide general laws or principles for acquiring other true beliefs, imaginary or actual. The key principles through which mathematics arrives at its conclusions are abstraction and generalization, which are a in an important sense a certain form of peculiar observation. They are also necessary for what Peirce considers the scientific method proper (Burks:1978).

Peirce, whose father and brother were both university math teachers, advanced mathematics and mathematical logic in various ways and identified its importance for a proper scientific interpretation of the world. The ideas of Firstness, Secondness and Thirdness, for example, are best thought of as mathematical possibilities – it is the possibility of certain objects, of their interactions and of the laws that govern them. „Mathematics studies what is and what is not logically possible, without making itself responsible for its actual existence" (CP 2.184).

The attributes of formal sciences we identified above apply to the more specialized of them as well. For example, the operations research, a field of study developed in the beginning of the World War II, deals with problems such as task scheduling

and bin packing. Task scheduling looks for the optimal way to sequence a number of factory tasks, which are subject to certain conditions and requirements. Bin packing deals with how to fit a heap of articles of given sizes into a number of bins of given capacities. (The Formal Sciences...:1994, p. 19). Although these are both apparently practical problems, the search for solution is imaginary and abstract. The tasks or items and the machines running them or bins meant to contain them are defined in the beginning of the search and there is no way for new ones to enter the system, otherwise it would be an entirely new problem to solve. The methods used to find the optimal solution apply mathematical procedures to rule out the ineffective ones.

IV.IV Philosophy

Philosophy is the class of sciences that deals with positive truth yet contents itself with observations such as come within the range of every man's normal experience, and for the most part in every waking hour of his life (CP 1:241). This is entirely true for the first subclass of coenoscopy, which Peirce calls necessary philosophy (or epistemy, as this subclass alone represents the Platonic, and generally Hellenic, conception of epistémé). The other subclass, called theorics, is based on universal observations but might make use of some special observations as well. This subclass contains families of chronotheory and topotheory, which are concerned with the general questions about the nature of time and space, respectively.

Epistemy divides in three orders. The first order is called phenomenology, or the doctrine of categories, and its task is to make the ultimate analysis of all experience, to "unravel the tangled skein [of] all that in any sense appears and wind it into distinct forms" (CP 1:280). Peirce considers this the most difficult order of coenoscopy to practice and notes that even a mere appreciation of advances already made in it is beyond reach of many who even wrote books about it. We have tried to show the basics of Peirce phenomenological research in the chapter 1.

The second order of epistemy consists of the so called normative sciences. "A normative science is one which studies what ought to be" (CP 1:281). Not ought to be in a practical

sense, although it is clear that they are connected with the practical sciences, but ought to be in a purely theoretical sense. This means that the normative sciences are in fact the most theoretical order of coenoscopy. The normative sciences form a department of coenoscopy that consists of three intertwined subbranches. Logic is the theory of deliberate thinking, practics is concerned with the theory of the conformity of action to an ideal and esthetics is the theory of deliberate formation of habits of feeling. Note that ethics doesn't appear here because it involves the theory of the ideal itself and, in so far as it studies conformity of conduct to an ideal, it is limited to a particular ideal, which is in fact nothing more than "a sort of composite photograph of the conscience of the members of the community" (CP 1:573). Also note that, for Peirce, esthetics is not limited to "taste" but relates to all the feelings, even the deepest and earnest ones: "the theory is the same, whether it be a question of forming a taste in bonnets or of a preference between electrocution and decapitation, or between supporting one's family by agriculture or by highway robbery" (CP 1:574). While demarcation of lines discretely separating the three subbranches is certainly unnecessary to carry out, it seems apparent that esthetics relates to feelings, practics to action and logic to thought, once again alluding to the basic phenomenological categories of Firstness, Secondness and Thirdness, respectively.

Metaphysics, the third order of epistemy, is the science of reality (EP 2:459). It seeks to explain the origin and constitution of the physio-psychical universe (MS 1339:12) and as such in places connects with idioscopy. It is distinguished from it mainly by its containing itself to such parts of physics and of psychics

that can be established without special means of observation. These parts have some very peculiar properties as opposed to those studied by idioscopic sciences. Peirce also set forth further division of metaphysics into three families in his 1903 lecture at the Lowell Institute. While at odds with some of the divisions presented above and only marginal in the whole of Peirce's system, we shall mention this division as it concerns topics we discuss later in this paper. These are general metaphysics (or ontology); psychical (or religious) metaphysics, concerned with the questions of god, freedom and immortality; and physical metaphysics, which discusses the nature of time, space, laws of nature, matter etc.

IV.V The Natural Sciences

According to the aforementioned classification of sciences, the natural (or, in Peirce's terms, physical) sciences together with the psychical (or human) sciences form the class called idioscopy. This class is occupied with accumulation of new facts and depends upon special observations carried out by individuals or groups with access to a special training or specialized tools. The physical sciences further divide into three orders. „Nomological physics discovers the ubiquitous phenomena of the physical universe, formulates their laws, and measures their constants. It draws upon metaphysics and upon mathematics for principles. Classificatory physics describes and classifies physical forms and seeks to explain them by the laws discovered by nomological physics with which it ultimately tends to coalesce. Classificatory physic splits into two suborders. The first one consists of studies of kinds of matter, the second of the kinds of forms the matter may take. (CP 1:262). Descriptive physics describes individual objects — the earth and the heavens — endeavors to explain their phenomena by the principles of nomological and classificatory physics, and tends ultimately itself to become classificatory" (CP 2.188). The subclass of the physical sciences aim to set forth the working of efficient causation, that is the active relations of parts in the physical world and their origin.

IV.VI The Human Sciences

The psychical sciences (or psychognosy, Peirce's tendency to vary his terminology in different papers and lectures assure that his commentators are never in the lack of synonyms) aim to set forth the workings of final causation, that is the active relations of the world and the mind and inside the mind as well. Similarly to the physical sciences, psychognosy further divides into three orders, the nomological, the classificatory and the descriptive. The nomological psychognosy (or psychonomy) aims "to formulate with exactitude the laws governing the final causation and show how its workings are to be traced out" (CP 1:269). Peirce also identifies a second suborder of psychonomy, which concerns itself with other laws subordinate to the universal law of final causation. The classificatory psychognosy (psychotaxy) studies the kinds of mental manifestation. Its first suborder embraces studies of mental performances and products (e.g. linguistics, ethnology), the second one of incarnations, or ensoulments of mind (e.g. sexology, developmental psychology) (CP 1:270). Descriptive psychognosy likewise splits in two suborders. The first one constitutes of descriptions of man-made systems or examinations of individual productions of man, while the other of narrations of events and their succesion (CP 1:271).

Just like the observations of mathematics and philosophy qualitatively differ from each other and from the observations of idioscopy, those of psychognosy differs from those of physiognosy (the physical sciences), although to a lesser degree. Physiognosy observes physical facts, while psychognosy

observes virtual conventions – even though these can be often represented in physical form. An example of this is a philologist studying certain regional variants of pronunciation – the various cases of variance do not constitute a specific language phenomenon, the social, psychical conventions underlying them do that (CP 1:250).

Physiognosy depends in some of its endeavors on mathematics and philosophy, especially metaphysics. Psychognosy depends on these superordinate classes too but in this case it is logic that is the most important because the final causation is logical causation. An example of this would be "the intimate bearings logic has on grammatical syntax" (ibid.). More importantly, everything in psychognosy is inferential. An emotion is recognized as a particular one only inferentially. Any object is referred to the mind only inferentially. These properties of the psychical mean that even though it is not what these aim to study, they must base their inquiries on the physical, on the facts (CP 1:154). This is not to say that psychognosy depends on physiognosy, although there are some cases such as the assistance linguistics gets from acoustics and from the human biology. Physiognosy assists psychognosy more so than the other way around but its influence is still miniscule compared to the one of mathematics on philosophy or of both on idioscopy.

The social aspects of science identified in the previous chapter apply to psychognosy just as much as to physiognosy and the inner division set forth by Peirce is very much parallel for both the classes.

IV.VII The Sciences of Review and the Practical Sciences

The sciences of review, also called the systematic, tactic or tagmatic sciences, or the taxospude, form the second subbranch of the theoretical sciences. It is the activity and the results of that activity of the taxospudists. This activity aims not to add to the human knowledge but to render what has already been discovered comprehensible, that is, "to put it into such shape that the mind can grasp and handle it with facility" (MS 601:26). This requires sorting out the results of the heurospude, subjecting them to comprehensive criticism and deducing their best conclusions. These conclusions are are to be digested in handbooks and the classification of the sciences and the characterization of their different classes is to be made. This allows for the creation of broad surveys such as Comte's "Philosophie Positive" or Spencer's "Synthetic Philosophy" (ibid.).

The practical sciences, or theory of arts, or prattospude, is the branch of science which is selected, arranged and further investigated in details as a guide to the practice of an art (NEM 4:191). It consists of "building up edifices of knowledge as is motivated by a desire of ministering to a human want" and makes for by far the greater part of all scientific labor (MS 601:27). We will discuss Peirce's view of the arts in chapter V.

IV.VIII Conclusion

Such is Peirce's view and classification of science. Let us reiterate the most important aspects. Firstly, science is not just some body of knowledge. It is a mode of life characterized by a certain purpose and by certain requirements necessary for a successful fulfillment of that purpose. This is true for mathematical logic and stylistics alike. Secondly, there are various characteristics that can be used to identify various classes of science. The ones chosen by Peirce show the interconnectedness and the gradual emergence of the sciences but also their fundamental differences, which make the classification into a hierarchy. This hierarchy is not based on certain classes being deemed inherently better, after all, the question of (logical) goodness and badness is central to all the sciences. Instead, it stems from identifying in certain classes a need for methods developed in the classes being “above” them. Thirdly, accumulation and interpretation of new facts, while absolutely crucial for the scientific method, is not really what constitutes science.

V Peirce on God, Arts and the Ordinary Life

V.I Introduction

We have surveyed Peirce's view and classification of science in order to ascertain what he considers important about it and how exactly he delimits it. This section discusses what lies, so to speak, above and below the realm of science.

V.II Peirce on God

As noted in the chapter IV.V, Peirce quite often works with the conception of God in his later writings and lectures. He even wrote two papers concerning specifically this topic: "Answers to Questions Concerning My Belief in God" from the year 1903 (CP 6.494-521) and "The Neglected Argument for the Reality of God" from the year 1908 (CP 6.452-91). We believe Peirce's view of God, as presented in these papers and elsewhere, is a wonderful illustration of the scope, influence and validity of his semiotics, regarding everything from the conception of the categories of experience to the classification of science and to pragmaticism. It is also a prime example of Peirce as a poet[14].

Firstly, it must be stated that Peirce's belief in God is not that of the Christians - or of any organized religion, for that matter. Instead, God is the immanent, universal thought which constitutes the order of the universe. It is a construction of something which science aims to discern but which is unattainable and therefore must only act as an object of adoration for the scientists. This of course doesn't mean that Peirce's God is not real. Reality of God is in Peirce's antinominalistic view of the same kind as that of the law of gravity or of the feeling of pain. It is the reality of a sign which creates other signs by virtue of its interpretants. This process is not dependent on the human mind and thought, it pertains to the whole universe.

God cannot be found using the scientific method as all

14 More on that in chapter V.II.

kinds of inferences are insufficient for this task. For induction to work, God would either have to be expressible as a probability ratio, as an affair of frequency or his parts would have to be evaluated. Both options are equally absurd. An explanatory hypothesis would only work if God was a contingent being, only so necessary as the facts to be explained. Deduction would require God to be purely formal in nature (Hartshorne:1941, p. 517). The idea of God then must have another origin - which is in musement[15]: "No, as to God, open your eyes – and your heart, which is also a perceptive organ – and you see Him" (CP 6.493, 497).

Peirce doesn't deny that the notion of God is anthropomorphic on the basis of his criticism of the idea of things-in-themselves, which, being completely different from our nature and experiece, are consequentially unknowable and strictly unthinkable. Anthropomorphism as a doctrine of analogical relations between ourselves and other is a more reasonable alternative (Hartshorne:1941, p. 518). The analogy of God, which is by definition of a uniquely remote kind from us,

15 "There is a certain agreeable occupation of mind which, from its having no distinctive name, I infer is not as commonly practiced as it deserves to be; for indulged in moderately – say through some five to six per cent of one's waking time, perhaps during a stroll – it is refreshing enough more than to repay the expenditure. Because it involves no purpose save that of casting aside all serious purpose, I have sometimes been half-inclined to call it reverie with some qualification; but for a frame of mind so antipodal to vacancy and dreaminess such a designation would be too excruciating a misfit. In fact, it is Pure Play. Now, Play, we all know, is a lively exercise of one's powers. Pure Play has no rules, except this very law of liberty. It bloweth where it listeth. It has no purpose, unless recreation. The particular occupation I mean – a *petite bouchée* with the Universes – may take either the form of aesthetic contemplation, or that of distant castle-building (whether in Spain or within one's own moral training), or that of considering some wonder in one of the Universes, or some connection between two of the three, with speculation concerning its cause. It is this last kind – I will call it "Musement" on the whole – that I particularly recommend, because it will in time flower into the Neglected Argument" (CP 6.458).

naturally leads to a rather vague idea of Him.

Peirce's conception of God and his scarce discussions of the theological problems connected to it are not without inconsistencies and logical stumbles (ibid., pp. 520-523) but this is of little consequence to us. What matters is that we can see the supreme conception in Peirce's depiction of the universe and the role it plays in the layout of the universe and for the minds occupied with studying how the universe operates.

V.II Peirce on Art

We already noted some of Peirce's views of art in the previous chapters. Art is among the products of the largest group of people, those who seek enjoyment in their lifes. It is also an area of applied science where the prattospudists so inclined process the knowledge of idioscopic sciences in order to facilite creation of such products. Furthermore, art is one of the subjects of esthetics, even though it surely isn't the only one. Finally, art is similar to phenomenology in its mode of observation, although it obviously isn't science precisely for the reason that its purpose is to embody certain qualities of feeling. An artists employs a peculiar mode of observation in his search for these qualities and this mode is very similar in nature to the one employed by a phenomenologist in his endeavor to discern the most basic elements of phaneron. The difference is that the training of a phenomenologist has him never satisfy himself with identification of a particular quality of a percept until he finds them all while, according to Peirce, it is in the nature of an artist to focus on reproducing the qualities he identified (CP 5.112). One can easily imagine a classification of art based on this idea that would kind of stand between imagology and thematology but, unfortunately, that has little to do with the topic of this paper so we shall just leave it here as an idea and move on.

There is a famous formulation in Peirce's explanation of the nature of perceptual judgments which bridges the topics of this chapter and the previous one: “Therefore, if you ask me

what part Qualities can play in the economy of the universe, I shall reply that the universe is a vast representamen, a great symbol of God's purpose, working out its conclusions in living realities. Now every symbol must have, organically attached to it, its Indices of Reactions and its Icons of Qualities; and such part as these reactions and these qualities play in an argument that, they of course, play in the universe — that Universe being precisely an argument. (…). The Universe as an argument is necessarily a great work of art, a great poem — for every fine argument is a poem and a symphony — just as every true poem is a sound argument. But let us compare it rather with a painting — with an impressionist seashore piece — then every Quality in a Premiss is one of the elementary colored particles of the Painting; they are all meant to go together to make up the intended Quality that belongs to the whole as whole. That total effect is beyond our ken; but we can appreciate in some measure the resultant Quality of parts of the whole — which Qualities result from the combinations of elementary Qualities that belong to the premisses" (CP 1.119).

There is a bunch of statements in this excerpt relevant to our topic:

- The universe is a symbol of God's purpose.
- The universe is an argument.
- Every true poem is a sound argument.
- Every fine argument is a poem and a symphony.
- The universe as an argument is necessarily a great work of art, a great poem.

Going back to the previous expositions, the meaning of these statements seems pretty clear. The first one basically summarized the points we made in the previous chapter – the universe can be understood as a symbol based on the interpretant of God Himself. A symbol produces energetic interpretants – God is a real entity behind the actions and manifestations of the universe. The universe is an argument in the sense shown in both chapter II and III. On the one hand, it is of the class of signs which produce logical effects, that is habits and laws. On the other hand, it most certainly is a process of thought reasonably tending to produce a definite belief (CP 6.456).

Now, what is the relation of an argument to a work of art[16]? If it is the aim of art to reproduce how certain percepts connect to certain qualities[17], then this is perfectly clear. Consider the painting from the excerpt above. An impressionist painter aims to replicate how certain alternations of appearance of a familiar object connect to emergence of certain qualities of feelings because the peculiar nature of this emergence, which he noticed through his artistic observation of the phaneron, brings him to a state of doubt. He is making a good, valid argument that certain premisses (various compositional and thematic aspects of the paintings) lead to a certain conclusion (qualities of feeling) which satisfy his doubt. We can even return to the discussion of the three types of argument from chapter IV here and show that all of them are in play in this case in the same way the scientific method employs them. First, such an artist makes the hypothesis

16 Considering Peirce mentions literary, visual and auditory arts, it seems safe to assume the differences among various art forms are inconsequential regarding this topic.

17 E.g.: "Poetry is one sort of generalization of sentiment, and in so far is the regenerative metamorphosis of sentiment" (CP 5.676).

that these particular percepts lead to the observed conclusion. He then deduces their nature and interaction and uses the tools of his art to replicate the objects of those percepts. Finally, he inductively tests his hypothesis by observing the effect of his painting on others as well as himself.

Notice that what distinguishes an impressionist painter from an experimental psychologist specializing in visuality is really nothing internal to the argument/painting itself. A psychologist might design an experiment where he would be interested in the qualities of feeling instigated by certain visual impulses and would let people watch a painting in order to see the reactions. What guarantees that his endeavor is indeed scientific are the numerous external aspects mentioned in the previous chapters, such as use of specialized tools and language, preference for quantitative induction, repeatability of experiments, peer reviewing, etc.

A true work of art is an argument. A fine argument is a work of art because, again, it truly allows to replicate how certain percepts connect to certain qualities. Take the classical argument for Socrates' mortality. It is a work of art because it shows something generally applicable to how a (human) mind experiences the universe. This interpretation makes the last statement on our list obvious.

V.III Peirce on Practice

The description we give in chapters II, III and IV already picture Peirce's view on the relation between science and practice. We show how a force being exerted onto a mind represents to that mind some generality or law via its being as a sign. This universe of signs acts on the basis of habits. A deliberate habit of a mind is a belief. An emergence of a state of doubt concerning a certain belief necessitates an inference from another belief(s) to (a) new belief(s). Practice aims to to eliminate doubt and to satisfy need. Reasoning is an inference which regards the new found belief(s) as a result of previous belief(s). There are certain kinds of reasoning and a certain method of combining them which best allow to discern truth. No truth is infallible besides the truth of the universe itself – God. To understand Him is the aim of science.

There are some interesting notes on this topic from Peirce himself which we shall discuss here. We can find the following example in a lecture regarding his criticism of the nominalist denial of the reality of Thirdness: “Speaking strictly, belief is out of place in pure theoretical science, which has nothing nearer to it than the establishment of doctrines, and only the provisional establishment of them, at that. Compared with living belief it is nothing but a ghost. If the captain of a vessel on a lee shore in a terrific storm finds himself in a critical position in which he must instantly either put his wheel to port acting on one hypothesis, or put his wheel to starboard acting on the contrary hypothesis, and his vessel will infallibly be dashed to pieces if he decides the

question wrongly, Ockham's razor is not worth the stout belief of any common seaman. For stout belief may happen to save the ship, while Entia non sunt multiplicanda praeter necessitatem would be only a stupid way of spelling Shipwreck" (CP 5.60). This example illustrates Peirce's assertion that scientific belief is of a weaker kind than belief which is necessitated by situations where one lacks the opportunities to apply various logical approaches and examine the results. These "living beliefs" are based on instinct and devoid of theoretical considerations, they are "stout" because they are unhindered, while the beliefs of an advanced science are frail and bleak amidst the various inferences and experiments, they are "but a ghost of beliefs" (ibid.).

Peirce makes a similar point in his discussion of "vitally important topics" (CP 5.623-629). He argues that we should distinguish everyday affairs from great crises in our lives and that, besides theories, reason is only sufficient to deal with the less important problems. We believe in a proposition if we are willing to act on it. Full belief is willingness to act on it in vital crises and willingness to act upon it in relatively insignificant cases is opinion. There is nothing vital in science except for the logic's highest impulse to never stop generalizing - and even this single point is insufficient, for such generalizations "should come about, not merely in man's cognitions, which are but the superficial film of his being, but objectively in the deepest emotional springs of his life" (CP 1.673).

It seems to us that the similarities between science and practice are just as important as the differences. These are both

certain ways a mind interacts with the universe. The major differences lie in the purpose of this interaction and in the specific circumstances which surround it. These circumstances include a group of agents acting together in an organized effort, using specialized tools and given ample time. The purpose of science, as seen in chapter IV, is to lead to an understanding of the universe for the sake of this understanding itself. The purpose of practice is to either feel or act. But it is clear from our discussions that there is no understanding without quality and action, no action without quality, and quality by itself is but a potential. Therefore, there shall be plenty of practice in science and plenty of science in practice. A proper Peircean analysis of instances of one with regard to the other adds to the discussion of art genres, fields of activity and scientific disciplines on the theoretical level and to the tools of criticism on the practical level. We present a number of illustrations of this approach in chapter VI.

VI Illustrations

VI.I Formal Reasoning

Let us assume we have a chocolate bar consisting of a number of squares arranged in a rectangular pattern. The task is to split the bar into small squares (always breaking along the lines between the squares) with a minimum number of breaks. How many will it take?

This sort of inquiry radically differs from all the others in that its subject is clearly defined and imaginary and therefore free from any potential changes while also being accessible to a certain kind of "observation". To solve a formal problem is to set it up as an argument and the beauty of this argument is that it is forever valid. Somebody or something might one day set up a more beautiful, cleaner argument but the conclusion to which it leads will inevitably be the same. The solution to the given problem requires diagramming of facts. Specifically, we might consider a bar consisting of a single square. Obviously, we only need 0 breaks then to solve the task. In modern notation $P(1)=0$, where P is the number of breaks needed and the number in bracers is the total number of squares in a bar. Using induction we can assume that P(k) holds true for $2\leq k\leq n$, where n is the number of squares in a bar, therefore $P(n+1)=n$. To prove this assumption, we need to again diagram the facts. This time we imagine breaking the bar into two section n_1 and n_2, where $n_1+n_2=n+1$. Using our assumption, we note that $P(n_1)= n_1-1$ and P(

n_2)= n_2-1. The total number of breaks is then 1+(n_1-1)+(n_2-1)=n. It follows that P(n+1)=n which proves the assumption.

The reasoning of formal sciences leads to conclusions that are unreasonable to doubt and which apply to many other areas of thought. They are strictly not concerned with existence but rather with proofs of theorems. That is why the above example holds the same validity for the question of how many cuts must a lumberjack make to divide a log into certain number pieces or how many single-elimination matches must a certain number of players play in a tournament until there is a winner (BOGOMOLNY:2015). These differences have no bearing on formal reasoning just as the fact that a chocolate bar will inevitably crumble, a lumberjack will lose his count and a bunch of players will drop out of the tournament to catch a bus home.

VI.II The Universe

"A decapitated frog almost reasons. The habit that is in his cerebellum serves as a major premiss. The excitation of a drop of acid is his minor premiss. And his conclusion is the act of wiping it away" (CP 6.286).

A frog almost reasons because reasoning is deliberate. What the frog does is infer and this is a process inherent in the whole physio-psychical universe. Consider we lift a stone in our hand and hold it some height above ground. It is the habit of any stone (or any object with mass) to rest without motion unless a force is exerted upon it. It is also its habit to be mutually attracted to other objects which have mass proportionally to the ratio of their masses. If we let go of our grip the universe works out an argument: There is the law of gravity and the laws of motion. There is an object which has mass and is presently free to move. The conclusion is that the stone gets pulled by the earth and vica versa until they stop upon each other. Then another argument starts, this time concerning the smallest discernable parts of the objects in question.

Same holds true even for all the involuntary actions living creatures make. You have a ant in your room. Being a gentle soul you leave him be. What can one ant do? Well if it finds something worth taking which he cannot haul himself he will go back to his colony, leaving a pheromone trace behind him. This activates an inference in the mind of many, many more ant workers. This instinctual inference has the nature of an

argument. Their invading your room and the subsequent long war is the consequence of that argument's conclusion.

You got bitten by a mosquito in your right calve. Now you sit on a sofa watching TV. Suddenly your arm moves to scratch the bite. You stop midways because you know you don't want to make the bite infected but, still, the argument has already concluded. An unconscious habit was overrun by a conscious belief based on medicine. Some instinctual habits cannot be overrun by beliefs. What if we don't let the stone just go of our hand and let it fall instead throw it in your face. No matter what you believe, unless you suffer of some sort of congenital analgesia, your nerve endings will work with your brain to the conclusion that it really, really hurts. The working out of this argument is a fortunate habit of mind, in no way dissimilar to how, for example, the earth responds to the ration which it receives from the surrounding universe.

VI.III Coenoscopic and Idioscopic Sciences

Peirce made his vast contributions to science in the age when it just started the rapid acceleration that had such a huge impact on how we live our lives today and how the events of the 20th century unfolded. As seen in chapter IV, the main difference between the idioscopic and the coenoscopic sciences lie in their methods of observation. Consider the electron microscope, a device invented about a decade after Peirce's death. It has about 5000 times better magnification and about 2000 times higher resolution compared to the previous iteration of the device developed for the same purpose, the light microscope. The development of a device is obviously a matter of practical science but the knowledge allowing for such development is based on discovery, interpretation and understanding of certain facts, in this case regarding properties of particles moving along given electrostatic or magnetostatic fields, subsumed under the framework of electron optics. The measurements made using the electron microscope again need to be interpreted and understood so as to allow for further theoretical progress into the nature of the universe. In the meantime, the practical knowledge acquired in the process of construction of electron microscopes comes in handy when the advancements of electron optics allow for the construction of particle accelerators, the strongest implements science has these day to use in order to peer into the darkest depths of the micro-world theoretical physics can so far consider.

Similar development can be shown in the case of psychical sciences. Consider the understanding of the child's

mind. Developmental psychology is a relatively new discipline which was founded in the beginning of the 20th century. Previous attempts to characterize the development of a child's mind were, according to Peirce's classification, either artistic[18] or philosophical[19]. The first scientific advancements in this field of inquiry were made at the end of the 19th century under the influence of the theories of Charles Darwin and Ernst Haeckel (Developmental Psychology:2008). The facts concerning the development of one's psyche are obviously not directly observable. This creates need for an indirect method of observation. Developmental psychology involves experiments and long term close observations and their statistical representations in order to prove its conclusions. Advancements made in this method lead to rejection of older, more rigid theories whose conclusions do not correspond with the body of facts examined. The central question of the role of experience versus the role of innate properties in the development of a child's mind today seems to have no direct answer. Various experiments and observations show that both of these aspects are permanently in play. To push the understanding even further requires either even more extensive use of the methods of observation already employed or an adoption of new methods

18 All the world's a stage,
And all the men and women merely players;
They have their exits and their entrances,
And one man in his time plays many parts,
His acts being seven ages. At first the infant,
Mewling and puking in the nurse's arms;
And then the whining schoolboy, with his satchel
And shining morning face, creeping like snail
Unwillingly to school. And then the lover,
Sighing like furnace, with a woeful ballad
Made to his mistress' eyebrow (All the world's a stage:2015).

19 Such as Locke's idea of a child's mind as "tabula rasa" or Rousseau's three stage development presented in his novel "Emile" (Developmental Psychology:2008).

from the natural sciences - one could for example imagine that one day will the biology of human brain advance far enough that it will be able to perfectly describe how the physical activity of neurons connects with human thought. That would certainly allow for more precise conclusions about the development of human mind.

There is a lot of idioscopic pseudoscience nowadays. Fortunately it is fairly easy to spot if one keeps in mind what the scientific method entails, both generally speaking and especially in Peirce's view. But what about coenoscopic science and its peculiar mode of observation? Can anybody be a philosopher? Given that the observations of philosophy are of a nature which makes them hard to evaluate, the criteria of a valid philosophical endeavor are the use of logic and the social aspect. Logic is clearly the very necessity for any meaningful philosophical inquiry but so is a proper way its author connects with the tradition and how is his contribution accepted by others. Consider Peirce himself. There are many, many aspects of his thinking about the universe which can be criticized, many observations which offer themselves to doubt – after all, he wasn't understood very well in his time and although people recognized his genius it didn't help him to live a more comfortable life. The important thing is that today no one can doubt Peirce's place in philosophy both for his original contributions and for the continuity of his thought to that of his predecessors, especially the scholastics. A logically sound philosophy can only by judged by time.

VI.III Art

Let us consider two areas of art production, visual and literary. “The Hay Harvest”, a painting by Pieter Bruegel, and “Abstract Painting” by Ad Reinhardt will represent the visual art here[20] and “The History of One Tough Motherfucker” by Charles Bukowski and “Sonnet 29” by William Shakespeare will represent the literary art. We have discussed that art is characterized by its peculiar mode of observation, much in the same way philosophy is, but it is not bound by the rules of logical inferring and doesn't aim to approach truth but rather replicate the source of that peculiar observation in order to fulfill some human needs. Bruegel's painting is figurative, Reinhardt's is abstract. The former shows the relation of people to nature, the latter shows the nature of our understanding of the visual. Bukowski's poem is free verse, Shakespeare's is very much structured. The former shows that to endure life is a virtue by itself, the latter that love elevates man from the lowest depths of despair to the supreme heights of elation.

Even though our examples are formally and historically extremely disparate, they are all instances of works of art. Although it may seem distasteful to some, we argue that even applied arts are proper art in Peircean sense of the word. Take the image of a woman using a razor to shave her leg. The impeccable whiteness of the foam contrasts with the absolute smoothness of the patch of skin being revealed. There is a sort of

20 These paintings are kept in the collections of the Lobkowicz Palace in Prague and the Guggenheim Museum in New York, respectively.

perfection to be attained – all you need to do to experience it directly is to buy our new razor and foam for only $13.99. Or take the incredible play of the colors of the sea and the skies, delimited in the perfect golden ration by an island consisting entirely of the blindingly white sands and deep green trees and flowers. There is a proper harmony of nature, one you can become part of – once again, if you buy our ticket to “Island Paradise” for only $1499.99.

Peirce's take on art in our opinion leaves space for a sort of criticism. Art must have a certain vision and it must replicate the source of this vision in some way. That means we can focus our criticism on whether a work of art succeeds in, so to speak, letting us observe together with the author. Consider a side shot of a beautiful young lady lying on a table bare naked. She has her legs slightly bent and we see a hand pouring some sort of hot sauce on a leaf of lettuce she has in her lap. It should probably make us connect the usage of said sauce with the pleasure generally associated with this sort of image but, depending on our gender, it is much more likely to simply make us either angry or horny and thus fails as art – unless the sauce was just a pretext for showing how we appreciate an image of a woman body, in which case we doubt that the CEO of the company selling said sauce is very satisfied with the orientation of his marketing department.

VI.IV Practice

Lets go back to our example from chapter II here and discuss it again with all the knowledge presented in this paper.

Two people come home on a rainy day, soaking wet. They knock off their shoes and one of them proceeds towards the kitchen. The other one notices this and says: „It's easy to catch a cold in wet clothes.” Then they both go to the dressing room to change.

The fact that we can read and understand this story is, as discussed previously, apparent evidence that Thirdness is in play here, just as it always is when a mind operates. The contrast of light wave lengths coming to our retinas from the various points on the paper (or screen) and the electric impulses they generate in our brains allow our minds to recognize certain patterns and, based on experience with such patterns, create further interpretants of these patterns, in this case words. These words lead to further interpretants until there is no purpose in continuing the process. When considering ourselves as the readers of that text our purpose is hardly practical. In fact, we would have to go pretty far to find an interpretant with a practical meaning for us – we could for example take the story as a reminder of a relationship we used to have and enjoy the bittersweet memories it allows us to recall. But this is a scientific paper, albeit in the field of science of review, and as such is concerned with truth. We want to see what is the relation of

thought and action in that story and to do that we have to consider it as an argument. Our hypotheses are that proceeding towards the kitchen is interpreted as communicating the intent to go wash oneself first before taking any other action and the sentence „it's easy to catch a cold in wet clothes" in fact means "when one's in wet clothes its best to change as soon as possible". Now if this was a real situation we were inquiring into and not just an example we would be able to deduce further conclusions from said hypotheses and then inductively test them. Since it isn't we have no way to experimentally test it and because the conclusion of the story conforms to the conclusion of our abduction we just have to be satisfied with that and call it a good day until some other scientist comes to let it rain on our parade.

The situation is different from the viewpoint of the actors in the story themselves. They are firmly in the realm of the practical but they need to infer nevertheless because they are both at a certain point of the story cast into the state of doubt. The person uttering the sentence is the first one in doubt. His belief that it is best to get out of wet clothes as soon as possible is disrupted by his inference that the other person plans to do something else based on his present actions, namely to go wash himself. He chooses to restate his position on the matter in other to reconcile his belief with the belief of the other person and in doing so to prove its worth above the already scientifically proven. This illustrates an important point about human social conduct, which is that the scientific proof of validity is often considered insufficient compared to the authority of others

around us. Whether a certain belief is objectively true matters nowhere as much as whether other people act upon it.

The person speaking chooses to formulate his sentence in a particular way because of the existing social conventions on the communication of ideas. If the person instead said “I firmly believe that it is best to change out of wet clothes as soon as possible”, it would be easier for the other person to understand the locus of the statement. But it could also lead to the other person thinking that the first one sort of has a stick up his or her rear. So the sentence is instead the way it is which leaves the other person in doubt about its intended meaning. Based on the experience with the English language the receiving person understands that the sentence is declarative. Yet the situation in which it is uttered suggests that it might be of imperative nature. So the receiving person makes a hypothesis that the sentence in fact means “we should both first go change before we do anything else”. From that he deduces that he should go change. The fact that the other person doesn't say anything else and goes to change with him proves that the argument is valid.

One thing to note is that if one of the people were a dog very little would change in a certain respect. Consider a person coming home with his dog. They are both soaking wet. Just as it is important to change oneself out of wet clothes as soon as possible, it is also important to dry the dog's fur before he soils the whole flat. But the dog has a habit of running right to the kitchen to have a drink when he arrives home. So no matter whether he's wet or not as soon as the person opens the door to

the flat the dog runs to the kitchen. But the person says “come” with a strong voice and goes to the bathroom. The dog turns around and follows him to get dried. The dog obviously doesn't have the ability to understand precisely what his master means by the word “come” but his experience taught him that if he recognizes this specific sound pattern coming from certain people he is supposed to follow them. The dog infers, although it doesn't reason.

Our final point regarding this example concerns Peirce's belief that the scientific reasoning has no place in the matters of vital importance. Imagine the two people come home, open the door and the flat is very hot and filled with smoke. It is safe to assume they would not think about the nature of the elements, the best way to communicate the fact that their flat is on fire or even about the reason why the fire started. They would rather act on instinct, yell “Fire!”, call the firemen and try to combat the fire themselves or evacuate the building. Scientific reasoning has its place in many affairs of the human life. Just not in those closest to our heart. Consider some great love in your life and try to construct a scientific argument that could make you abandon it. We believe such a task is impossible to accomplish and that it is incredibly stupid to strive for it – because we shouldn't doubt in science what we do not doubt in our hearts (Peirce:1868). And all the search for truth cannot ever disprove that the heart is more than the head, that it is our highest concern (MS 435).

VII Conclusion

We discussed Peirce's thinking on the basic nature of the universe in its being as a sign, on the various kinds of inferences a mind makes from this sign, and on the differences between the discernible areas of thought, action and quality that sustain and constitute such universe. Although science is not and should not be the ultimate guide for conduct, understanding Peirce's categories, classes and types allows to nuance what exactly is the nature of a certain inquiry or sign with respect to its purpose, its method of observation and its argumentation.

Let us now sum up our findings - for clarity and to the benefit of any potential lazy reader. There are three categories always in play when a mind interacts with the universe. These categories are Firstness, or quality, Secondness, or relation, and Thirdness, or representation. The universe gives itself to a mind as a sign. Every sign has an object and an interpretant and the particularities of their nature constitute the classes of signs.

Arguments form a class of signs which distinctly show what interpretant they are intended to determine (MS 491:9). Argumentation is the expression of reasoning (EP 2.11-12). Reasoning is conscious inferring. Inference is the process of setting up a new belief in the face of a doubt.

There are various forms of argumentation and various methods

of fixation of belief. The scientific method employs a certain sequence of argumentation and observation which validates its results. This validation is always only temporary and unfit for issues of vital importance. The fields of scientific study differ in their purpose and in their method of observation. The methods and findings of the more abstract disciplines serve an instrumental role in the development of the less abstract ones – the findings and methods of mathematical logic are instrumental to the idioscopic sciences, and those of the idioscopic sciences to the coenoscopic sciences. Furthermore, the findings of the sciences of discovery need to be organized by the sciences of review before they can be practically applied.

Practice, in fact, underlies and enables the scientific reasoning. On the one hand, the most basic inferences used in mathematics rely on imaginary diagramming of abstract facts in accordance with how they are actually. In other words, the most fundamental inferences of mathematics formally follow the practical inferences, which are either involuntarily learned or instinctual. On the other hand, the ultimate aim of science is to understand practice – of God Himself, that is to understand the universe as an argument.

Allow us to conclude with an image. Practice is a vast landscape with wild forests, rugged mountains, rushing rivers and deep lakes under an ever-changing, furious skies. Science is an ivory tower which protrudes from the middle of this land, perfectly chiseled and impeccably organized, floor after floor filled with knowledge of increasingly abstract nature. The tower differs

from its surroundings in form and intention, but not fundamentally. It is still of the land, but it wants to survey the land and understand it and at the same time to understand itself. However, no matter how tall it gets the land around is always too extensive to be seen in its entirety. Perhaps, when the height of the tower matches the height of the pillar on which God resides, it will finally be able to see all the land. That might never happen – but it is a worthy goal to aim for.

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