



PROBABILITY, RISK, AND PRAGMATISM: AN OUTLOOK ON PEIRCE'S INSURANCE FIRM MODEL¹

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Abstract: C. S. Peirce used to discuss the validity of synthetic inferences by comparison with the way that insurance companies predict the extent of their risks collectively, even though they cannot to predict particular losses. This topic appears in at least three essays from different periods of Peirce's works, indicating that it involves an important issue during the development of pragmatism. By the way, it is important to note that Peirce's view on this matter was gradually improved over the course of those works: initially, it is practically only mentioned, later it takes the form of a full argument, and finally it was presented as a mathematical model whose discussion is quite complex. I begin with Peirce's puzzling assertion that "each of us is an insurance company", trying to explain how his frequentist conception of probability implies the famous statement that logic is rooted on the social principle. Next, I intend to show how such an issue sheds light on the reformulation of the maxim of pragmatism, which was initially based on psychological considerations, but which became grounded on the field of logic. This shift may be better understood as one considers the relation between the validity of synthetic inferences and securitization procedures. I conclude that some obscurities of the first Harvard lecture of 1903 derived from Peirce's expertise on a subject matter whose discussion was still incipient at his time.

Keywords: Insurance, Pragmatism, Probability, Risk, Uncertainty.

PROBABILIDADE, RISCO E PRAGMATISMO: UMA PERSPECTIVA SOBRE O MODELO DE EMPRESA DE SEGURO DE PEIRCE

Resumo: C. S. Peirce costumava discutir a validade das inferências sintéticas em comparação com a forma como as seguradoras predizem a extensão de seus riscos coletivamente, mesmo que não possam prever perdas específicas. Este tópico aparece em pelo menos três ensaios de diferentes períodos das obras de Peirce, indicando envolver uma questão importante durante o desenvolvimento do pragmatismo. A propósito, é importante notar que a visão de Peirce sobre este assunto foi gradualmente melhorada no decorrer dessas obras: inicialmente, é praticamente apenas mencionada, depois toma a forma de um argumento completo e, finalmente, foi apresentada como um modelo matemático cuja discussão é bastante complexa. Começo com a assombrosa afirmação de Peirce de que "cada um de nós é uma companhia de seguros", tentando explicar como sua concepção frequentista de probabilidade implica a famosa afirmação de que a lógica está enraizada no princípio social. A seguir, pretendo mostrar como tal questão lança luz sobre a reformulação da máxima do pragmatismo, inicialmente baseada em considerações psicológicas, mas que se fundamentou no

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campo da lógica. Essa mudança pode ser melhor compreendida quando se considera a relação entre a validade das inferências sintéticas e os procedimentos de securitização. Concluo que algumas obscuridades da primeira palestra de Harvard em 1903 derivaram da perícia de Peirce em um assunto cuja discussão ainda era incipiente em sua época.

Palavras-chave: Seguro, Pragmatismo, Probabilidade, Risco, Incerteza.

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Introduction

In a very influential book, Ulrich Beck (1992) defended that contemporary society is a risk society. For the German sociologist, the remarkable economic benefits from science and technology have been accompanied by a cost, namely, the increasing probability of accidents with harmful consequences. Such a claim has induced a substantial debate in social studies and has made its own way in philosophy too (e.g. HACKING, 1990; HANSSON, 2013; ROESER *et al.*, 2012; SHRADER-FRECHETTE, 1991).

Nowadays risk is a polysemic word usually associated with potential damages to human health and the environment. Nevertheless, its etymology is related to nautical activities: risk was the word used by ancient sailors to refer to the perils of maritime voyages (cf. KNUTSEN ET AL, 2012). With the raising of merchant capitalism and the increasing demand for maritime insurance, the word was incorporated into the economic and legal jargon (cf. FRANKLIN, 2015; FRESSOZ, 2012). From the 19th onwards, a fabulous insurance industry has emerged in Western countries intending to offer financial coverage on other economic goods. In fact, the concept of risk was scientifically defined only around the 1920s by J. M. Keynes (1921) and F. Knight (1921). Such authors independently converged on the notion that risks are insurable potential damages evaluable in terms of objective probabilities. But if a potential damage cannot be anticipated by means of objective probabilities, then it is not a risk but an uncertainty and it cannot be insured.

Here, I intend to show that the pragmatism of C. S. Peirce has an important relation with the notion of risk. This issue has already been addressed by James Wible (2014) in his work about Peirce's mathematical model of an insurance firm included in the first Harvard Lecture of 1903. My aim is to clarify some epistemic issues which are not confined to the economic domain already examined by Wible (2014). In fact, Peirce's interest in probability theory and related matters dates from his early works on inductive reasoning and pragmatism. For instance, issues involving risk and insurance procedures already appeared in at least two previous works, namely, in "Grounds of validity of the logic laws" (1869) and "The doctrine of chance" (1878). In the next sections, I will examine three phases of Peirce's insurance model, trying to show that such model explains the theoretical development of Peirce's pragmatism.

The validity of inductive reasoning: each of us is an insurance company

The essay "Grounds on the validity of the laws of logic" can be divided into two parts related to the validity of deductive and inductive reasoning respectively. In order

to fully understand Peirce's early mentions to risks, it is necessary to consider the importance attributed by him to the question of the validity of induction. In Peirce's words:

There can no doubt of the importance of this problem. According to Kant, the central question of philosophy is "How are synthetical judgments a priori possible?" But antecedently to this comes the question how synthetical judgments in general, and still more generally, how synthetical reasoning is possible at all? When the answer to the general problem has been obtained, the particular one will be comparatively simple. This is the lock upon the door of the philosophy (Peirce, 1992 [1869], p. 206).

The pragmatist tried to open this lock using the notion of statistical inference. For this task he adopted a frequentist approach to defend that, *in the long run*, "the validity of induction simply depends upon the fact that the parts make up and constitute the whole" (Peirce, 1869, p. 206). It is important to emphasize that the validity of induction demands frequencies in the long-run – indeed, frequencies tending to infinite – to avoiding statistical fluctuations that make impossible to ascertain any determinate value. The frequencies in the long run, however, tend to balance those fluctuations around some convergent limit according to the weak law of large numbers (cf. LEVI, 2004). In summary, this is the basis for the thesis of the self-correcting character of induction. Peirce explained this point by saying that:

From this it appears that we cannot say that the generality of inductions are true, but only that in the long run they approximate to the truth. This is the truth of the statement, that the universality of an inference from induction is only the analogue of true universality. Hence, also, it cannot be said that we know an inductive conclusion to be true, however loosely we state it; we only know that by accepting inductive conclusions, in the long run our errors balance one another. In fact, insurance companies proceed upon induction; -- they do not know what will happen to this or that policy-holder; they only know that they are secure in the long run (Peirce, 1869, p. 206, italics mine).

The above passage is the first mention to insurance companies as an example of practical application of inductive reasoning. According to a frequentist approach to probability, we are not able to justify induction case by case; even so, we can take advantage of statistical patterns in the same way that insurance companies do it because "by faithfully adhering to that mode of inference, we shall, on the whole, approximate to the truth. *Each of us is an insurance company*, in short" (PEIRCE, 1992 [1869], p. 207, italics mine). Then the pragmatist presents one of the consequences of his argument, namely, that reliable scientific inquiries demand a communal engagement. According to Peirce:

If a man has a transcendent personal interest infinitely outweighing all others, then, upon the theory of validity of inference just developed, he is devoid of all security, and can make no valid inference whatever. What follows? That logic rigidly requires, before all else, that no determinate fact, nothing which can happen to a man's self, should be of more consequence to him than

everything else. He who would not sacrifice his own soul to save the whole world, is illogical in all his inferences, collectively. *So the social principle is rooted intrinsically in logic* (Peirce, 1992 [1869], p. 207, italics mine).

Before examining the further development of Peirce's ideas on risks, let me call attention to the italicized clause above. The passage states that logic is the basis of the social principle. This strong logicist view will be eventually reframed a decade later, towards a more sociologically informed approach. Let us see how this change took place.

The doctrine of chances

The third essay from the "Illustrations of Logic of Science" (1878) addressed the meaning of the concept of probability. For Peirce, a probability is, at a first glance, a continuous quantity representing degrees of our knowledge about the events, which are distributed between two poles, namely, necessity and impossibility. On this initial conception, Peirce applied the pragmatist method asking for the practical effects of different probabilities; in particular, he intended to explain a well-known difficulty concerning the probability attributed to single events. According to the frequentist approach adopted by Peirce, "an individual inference must be either true or false, and can show no effect of probability; and, therefore, in reference to a single case considered in itself, probability can have no meaning" (Peirce, 1992 [1878], p. 147). So the concept of probability demands collective distributions of characters in the long run, which will converge to a stable ratio in accordance with the law of large numbers. Nevertheless, Peirce observes that:

Although probability will probably manifest its effect in, say, a thousand risks, by a certain proportion between the numbers of successes and failures, yet this, as we have seen, is only to say that it certainly will, at length, do so. Now the number of risks, the number of probable inferences, which a man draws in his whole life, is a finite one, and he cannot be absolutely certain that the mean result will accord with the probabilities at all. Taking all his risks collectively, then, it cannot be certain that they will not fail (...) The same thing is true of an insurance company. Let the directors take the utmost pains to be independent of great conflagrations and pestilences, their actuaries can tell them that, according to the doctrine of chances, the time must come, at last, when their losses will bring them to a stop (...) However, I must not be understood as saying that insurance is on this account unsound, more than other kinds of business. All human affairs rest upon probabilities, and the same thing is true everywhere (Peirce, 1992 [1878], p. 148-149).

In the above passage, Peirce resumed and extended his early argumentation on the nature of insurance companies – which was just briefly sketched on "Grounds on the validity of the laws of logic". Indeed, the whole fourth part of the article "The doctrine of chances" focuses on the huge practical implications of such a frequentist approach to probability that requires long-run frequencies. Such frequencies, however, are always finite due to human mortality, so we never can be safe from mistakes and errors. In Peirce's words, "at the same time, death makes the number of our risks, of our inferences, finite, and so makes their mean result uncertain"

(Peirce, 1992 [1878], p. 149). Then, the pragmatist realized that such unavoidable difficult leads to the outcome that “logicality inexorably requires that our interests shall not be limited. They must not stop at our own fate, but must embrace the whole community” (Peirce, 1878, p. 149). Moreover, this community should not be restricted to our actual historical age and society, but it must embrace every future community of inquirers “beyond all bounds” (Idem). For Peirce, logicality involves the intent of making inferences collectively because “*Logic is rooted in the social principle*” (Peirce, 1992 [1878], p. 149, italics mine).

By the way, there is a noticeable difference between the quotation above and that one discussed in the first section of the present work. Ten years early, Peirce had stated that “the social principle is rooted intrinsically in logic” – in short, there is an inversion of the roles attributed to the logic and the social principle. Indeed, it indicates some type of primacy of the social principle over logic, an important change that, in my view, represents a redirection in the course of the development of pragmatism towards an intersubjective approach.

The maxim of pragmatism

The full significance of probability and insurance practices for Peirce's pragmatism can be evaluated in his first Harvard Lecture of 1903. Extending almost the same line of argument employed 25 years early, he discussed three examples related to such issues, which can be roughly divided into, first, the “argument of the infinitely rich men against the infinitely rich bank”; second, the “argument of the insurance firm”; and, third, the “argument of the indefinite coin-tossing game”. For our purposes, the second argument is the most important. According to Peirce:

The theory of probability is full of paradoxes and puzzles. Let us, then, apply the maxim of pragmatism to the solution of them. In order to do this, we must ask, What is meant by saying that the probability of an event has a certain value, p ? According to the maxim of pragmatism, then, we must ask what practical difference it can make whether the value is p or something else. Then we must ask how are probabilities applied to practical affairs. The answer is that the great business of insurance depends upon it. Probability is used in insurance to determine how much must be paid on a certain risk to make it safe to pay a certain sum if the event insured against should occur. Then, we must ask how can it be safe to engage to pay a large sum if an uncertain event occurs. The answer is that the insurance company does a very large business and is able to ascertain pretty closely out of a thousand risks of a given description how many in any one year will be losses (Peirce, 1998 [1903], p. 136).

In order to illustrate this point, Peirce presented a detailed mathematical model for the optimization of the price of insurance policies: a model that, according to the historical accounts, was mind-breaker because the audience was formed by James' students with no acquaintance with such a subject matter. By the way, J. R. Wible (2014) discussed the content and the reception of Peirce's profit-maximizing insurance firm model but, within my limited knowledge, not much further research has been made on this issue. This present work is an attempt to call attention to such

issue already discussed by Wible, but with an additional focus on the general development of pragmatism. According to Wible:

The insurance company is truly a practical example for Peirce since insurance was an emerging activity in the business world in the late 19th century. His point is that the insurance company will have to estimate a probability accurately. It must estimate how many losses of a certain class would occur in a certain population or market -- or it would suffer large losses and perhaps go out of business if its estimate is very mistaken. To paraphrase the pragmatic maxim as Peirce applied it to situations involving probability: for the insurance firm, there is a real sensible difference between one probability and another regarding the success or failure of the firm (Wible, 2014, p. 552-553).

As said above, the reception of Peirce's high specialized mathematical insurance model was disappointing, and, perhaps, it has not been fully evaluated yet, even by Peircean scholars. Without possessing the econometric tools available only 30 years later, Peirce developed an idiosyncratic analytical demonstration of insurance companies profit optimization function. Importantly, this mathematical approach makes pragmatism akin to modern economics and decision theory rather than to psychology. Indeed, it suggests that pragmatism looks like a type of risk management of reasoning, and by considering it we can better understand why James got frustrated "at having an 'old friend' as a guest lecturer tell his class and colleagues that mathematical economics along with games of chance were more closely in line with pragmatism than psychology" (Wible, 2014, p. 571). In fact, Wible has provided a remarkable analysis about both the role performed by Peirce's insurance firm model and the poor reception of such model among pragmatist more aligned with Jamesian ideas. Nevertheless, I intended to highlight that this theoretical conflict already was incipient in Peirce's early works examined in the previous sections of this work.

Conclusion

We must resist to the temptation of claiming that Peirce anticipated issues on risk analysis which are central for economics and decision theory nowadays. The history of risk analysis and decision theory is well-documented, including prominent figures of statistics and economics who surpassed Peirce by far in terms of influence on the scientific community of their time (cf. MARTINS, 2012, chapter 5). At those days, a formidable new industry of insurance had been emerged in the western countries and, in fact, the current state of global economy resulted from such material context. One of the lessons to be learned seems that in a risk society citizens became *part* of an insurance company – at least those included in the global economy, but not for billions of human beings excluded from the system.

Conversely, the significance of risk analysis for the development of Peirce's intellectual trajectory may be underrated yet today. Peirce has not anticipated such issues, however he exhibited acquaintance and expertise with a domain of inquiry which was emerging at late 19th century. From this point of view, there was a historical context that explains why pragmatism resembles the way of thinking nowadays adopted by risk analysts and decision theorists. They ask themselves: what are the consequences of choosing either action X or action Y? Can we estimate

the chances of success of our inferences? Indeed, now the sentence “each of us is an insurance company” gains a new epistemological significance. This is the way I have been looking at Peirce’s pragmatism: as a philosophical method for risk decision.

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