OPEN ACCESS

CENTRO DE ESTUDOS DE PRAGMATISMO
FILOSOFIA - PUC-SP

COGNITIO
Revista de Filosofia da PUC-SP
Centro de Estudos de Pragmatismo

São Paulo, v. 22, n. 1, p. 1-13, jan.-dez. 2021
e-ISSN: 2316-5278 | ISSN: 1518-7187

http://dx.doi.org/10.23925/2316-5278.2021v22i1:e53430

Semantic fitness and C. S. Peirce's approach to natural kind terms*

Aptidão semântica e a abordagem de C. S. Peirce aos termos de tipos naturais

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Recebido em: 02/04/2021.
Aprovado em: 03/07/2021.
Publicado em: 30/12/2021.

Abstract: The purpose of this paper is to argue for a pluralist interpretation of Peirce's theory of meaning when applied to *general terms* which refer to natural kinds – or as recently established within contemporary debate, *natural kind terms* (NKTs). Upon conducting an analysis of Peirce's writings, we can find a reliable and promising theory regarding this wide category of terms. Guided by privileged readers of Peirce's philosophy, two main positions are identified and compared employing the pragmatic method. From the conclusions of this comparison, we find strong reasons to adopt a moderate pluralist stance, emphasizing the teleology of cognitive agents instead of the final causes of the things properly considered. This interpretation is not only strongly naturalized, but also works as an instrumentalist approach to the philosophy of language aiming to shed light on some of the main claims of this strategic author when confronted with the contemporary discussion around NKTs. The Peircean account of *general terms* is enriched by new empirical research in cognitive sciences and biosemiotics. The entire work has a special debt to recent cognitive computing studies that introduced the concept of *semantic fitness* to model an optimum level of abstraction to produce more meaningful representations in a given ontological domain, classifying particular objects dynamically and progressively. I will import this concept to a thoroughgoing evolutionary interpretation of Peirce's theory of generals and try to expose the advantages of this new framework.

Keywords: Meaning. Natural kinds. Naturalism. Reference. Semiotics.

Resumo: *Neste artigo defendo uma interpretação pluralista para a teoria do significado de Peirce quando aplicada a termos gerais que fazem referência a tipos naturais ou, como recentemente estabelecido no debate contemporâneo,* termos de tipos naturais *(TTNs). Conduzido por uma análise dos escritos de Peirce, podemos encontrar uma teoria confiável e promissora para esta ampla categoria de termos. Orientando-se por leitores privilegiados da filosofia de Peirce, duas posições principais são identificadas e comparadas por via do método pragmático. A partir das conclusões desta comparação, encontramos fortes razões para selecionar a posição pluralista moderada, enfatizando a teleologia dos agentes cognitivos em detrimento de causas finais. Esta leitura de Peirce não é apenas fortemente naturalizada, mas também se apresenta como uma abordagem instrumentalista à filosofia da linguagem. A leitura pretende lançar luz sobre algumas das principais reivindicações deste que é um autor estratégico, em especial, quando confrontado com a discussão contemporânea em torno dos TTNs. O tratamento de Peirce aos* termos gerais *é enriquecido por novas pesquisas empíricas em ciências cognitivas e biossemiótica. Todo o trabalho tem uma dívida especial com estudos recentes em computação cognitiva que introduziram o conceito de aptidão semântica para modelar um nível ótimo de abstração para produzir representações mais significativas em um determinado domínio ontológico, classificando objetos particulares de forma dinâmica e progressiva. Esta noção é introduzida para uma interpretação efetivamente evolucionária da teoria dos termos genéricos de Peirce e na exposição das vantagens desta estrutura conceitual.*

Palavras-chave: *Naturalismo. Referência. Semiótica. Significado. Tipos naturais.*

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* This research was supported by the CAPES foundation (CAPES/PDSE N. 2867-13-3).

1 Introduction

An important topic, often engaged in the debate about meaning and reference, is what is known as *natural kind terms*. Consensually, we consider that empirical sciences cluster the particular entities that are their objects of study in types (e.g., horse, water). Ian Hacking (1991; 2007) has already alerted about the complications that arise while trying to establish clear boundaries in defining what is and what is not a natural class. However, Peircean pragmatism, or Pragmaticism, can provide an open path for advancing inquiry about three different relations regarding these kinds of terms: their *adoption*, their *use*, and the proper *baptism* of these classes.

As observed by Quine (1951), the pragmatic approach opens a new perspective towards these issues, presenting new elements to construct a less rigid conceptual schema and sustaining criteria no longer bound to a notion of correspondence that aspires to produce a "mirror" of reality. The traditional notion of meaning as something stable and fixed loses strength in the face of a dynamic conception that embraces the continuous cognitive processes for interpretation of meaning (QUEIROZ; MERRELL, 2006). Peircean philosophy proposes a radical transformation of the idea of meaning as being something like a list of properties, changing the perspective to an organic sense of semantics – layers of iconic descriptions of habits. In this view, the meaning of a concept is the result of causal processes, in a continuous interpretation of the perceived effects, which are mediated by the teleology of the cognitive agent.

Houser (1998, p. 155) reminds us that the problem of natural classes was in Peirce's scope from the beginning of his career when he starts to avoid some aspects of J. S. Mill's philosophy. Peirce himself never used that terminology, preferring to adopt the definition of *general terms* instead. His preference and attention on the topic were especially strong because it is closely related to his *sui generis* realism. According to Houser (2011, p. 45), after the 80's, Peirce's realism begins to become more robust. His skepticism of semantic indeterminacy, although theoretical and not practical, does not develop in full by coercion of his realist metaphysics, a clear commitment to the methods of scientific. Peirce concedes more attention to the subject in "On Science and Natural Classes" (1902)[1] [henceforth *SNC*], emphasizing the idea of Science as a living entity.

2 The Peircean legacy

Peirce alerts us in *SNC* that many problems around classification arise from the definitions which were popular at his time. Peirce thinks that the first question that should be considered is what we understand to be a true and natural class. A controversial feature of the Peircean approach is his definition of a true or natural class as "a class of which all the members owe their existence as members of the class to a common final cause" (CP 1.204, 1902). Frederik Stjernfelt (2014, p. 257) points out Peirce's surprising movement, *i.e.*, to extend the treatment of artificial classes (e.g., tables, chairs) to natural classes.

> A class, of course, is the total of whatever objects there may be in the universe which are of a certain description. What if we try taking the term "natural," or "real, class" to mean a class of which all the members owe their existence as members of the class to a common final cause? (CP 1.204, 1902).

Pragmaticism refuses the idea of meaning as a list of essential properties and argues for an organic model of semantics. The meaning of a natural kind term grows, evolves, and becomes richer. Science is a living

1 In addition to the *CNS*, there are three more significant sources about classification in the later Peircean *corpus*: the first is the Lowell's Fourth Conference (1903); the second, the entry in the Baldwin Dictionary, "Kind" (1901); and finally, the application to the Carnegie Institute (MS L75, c. 1902). Naturally, I understand that each of these sources should be interpreted based on their circumstances and goals. However, from none of these sources can we extract a complete theory of the natural classes and their representations, although I believe it can be reconstructed based on the main argumentative lines in these and other fragments.

thing, and its purpose becomes explicit in the convergence of its propositions to the truth. Indeed, Peirce confirms that the classes "have to be defined, naturally if possible, but if not, then at least conveniently for the purposes of science" (CP 1.228, 1902). This statement sounds like an effort to understand what kind of practical effects on scientific activity the acceptance of a given natural kind might bring about.

One may think that it would not make sense to clarify something that is very puzzling, as the question of natural kinds is, with a conception that might be yet more puzzling as is final causation. Indeed, Peirce recognizes that "in regard to natural objects, however, it may be said, in general, that we do not know precisely what their final causes are" (CP 1.204, 1902). However, as we can verify in the next section, Peirce suggests a method for delineating those natural classes whose final causes are not accessible to us.

As James well defined, Pragmatism is a new name for some old ways of thinking. In his strategy, Peirce makes use of an old scholastic distinction, from the philosophy of Duns Scotus, between reality and existence to argue that generals are real, *i.e.*, natural classes are real (MAYORGA, 2007, p. 309; COLAPIETRO, 2006, p. 27). Although redundant, it is necessary to remember that Peirce proposed that general classes are not only *real*, but also *physically efficient* (DEWEY, 1916, p. 711), not just from a metaphysical point of view, but from the standpoint of common sense, which understands that human purposes are also physically efficient (CP 5.431, *What Pragmatism is*, 1905). However, we must understand that this expansion is due to the ontological fact that into his theory of signs Peirce incorporates the whole spectrum of possible semiosis (possible meaning processes). It is well known that Peirce also emphasizes the intentional, teleological, or even dispositional facts in the building of classes. For Peirce, desire is always general, always looking for some kind of thing or event (CP 1.205, 1902). Nevertheless, neither Peirce nor Aristotle attributed to rocks a desire or wish to fall. Instead, we experience this habit when someone releases it to the ground. Indeed, *animism* still remains a serious epistemological menace to the majority of philosophers and scientists.

It is not hard to perceive at least two distinct interpretations of Peirce's theory of general terms. The first one, that I will call *dogmatic* (HULSWIT, 1997; PAPE, 1993), is adopted by those interpretations that seek the real meaning of the proper *final cause* of a *natural class.* The other I could give no other name than *pluralist* (ROSENTHAL, 1994; HOOKWAY, 1985; HAWKINS, 2007; KENT, 1987). To pluralists, classes resemble the interests and the desire of the interpreters. They understand that classification is imposed from without by those who interpret objects guided by their advantage. James (1878, p. 6), for instance, wisely observed the existence of generic things that cause aversion to the mind and should be avoided by it.

Susan Haack (1992) assumes a moderate stance and does not subscribe to the strong dogmatic position. She stresses the relevance of the convergence of opinions in her analyses of Peircean realism. And, if scholastic realism is true, then it is possible that real and true classes do indeed exist (HAACK, 1992, p. 42). She understands that in pragmaticist metaphysics there are real general classes, even so, this does not mean that all general classes are real (HAACK, 1992, p. 23).

Inside Hulswit's extracted image of Peircean natural classes, we find a distinction between the *permanently relevant empirical character* (PRE-character) and the later conceived (after 1902) *teleologically determined empirical characters* (TDE-characters). He understands that we should obey a final cause in itself, even if this final cause remains hidden or constitutes difficult access to scientists (Cf. HULSWIT, 1997, p. 765). Indeed, Hulswit's work aids in the understanding of Peirce's claims, but does not help us when we want to apply them.

Hookway believes that despite generality being real, to discriminate classes reflects our intentionality and choice among different conventions (HOOKWAY, 1985, p. 251). Then, Hulswit charges Hookway of promiscuity – taking any subjective desire as competent for determining natural classes (HULSWIT, 1997, p. 728). Maybe Hulswit had not perceived the legitimacy of Hookway's pluralist thesis. Nevertheless, pluralists do not claim that all generals are genuine, obviously, there are fictional generals (e.g., fairies, unicorns) and there are also imprecise or idiosyncratic definitions (*e.g.*, spermatozoa,

pachyderms). Some errors could have effects that wrongly reaffirm them in their Peircean *secondness* on some occasions. However, in order to identify a specimen we should know how to proceed with the analysis of data. In "A Syllabus of Certain Topics of Logic" [from here, *TOL*], Peirce provides us with an idea of his identification method through the famous passage dedicated to the Lithium example, describing the *know-how* techniques with *habits* as criteria of classification.

> If you look into a textbook of chemistry for a definition of lithium, you may be told that it is that element whose atomic weight is 7 very nearly. But if the author has a more logical mind he will tell you that if you search among minerals that are vitreous, translucent, grey or white, very hard, brittle, and insoluble, for one which imparts a crimson tinge to an unluminous flame, this mineral being triturated with lime or witherite rats-bane, and then fused, can be partly dissolved in muriatic acid; and if this solution be evaporated, and the residue be extracted with sulphuric acid, and duly purified, it can be converted by ordinary methods into a chloride, which being obtained in the solid state, fused, and electrolyzed with half a dozen powerful cells, will yield a globule of a pinkish silvery metal that will float on gasolene; and the material of that is a specimen of lithium (CP 2.330, 1903).

The pluralist position is strengthened by Hawkins's (2007, p. 527) diagnosis of Hulswit's insistence in associating the hidden micro-structure of objects in his approach to natural classes and its final causes (Cf. HULSWIT, 1997, p. 766). However, Peirce never makes clear these strict claims about natural classes. As Peirce observes, a purpose "is merely that form of final cause which is most familiar to our experience" (CP 1.211, 1902). The relevance of final causes is better understood when we consider the transmission of the full symbol which could produce rich immediate logical interpretants. According to Peirce, the mind works with final causes and a final cause is a logical cause (CP 1.250, 1902).

The risk of *ontological promiscuity* is not a real threat for weak versions of pluralism. Indeed, Hawkins argues that many scholars suppose that Peirce authorizes scientists who classify to group objects in a wishful manner or without any obligation to rules. However, as he observes, there is no hope that the World can accomplish with these capricious ontologies in the long run. Quite the contrary, the *dynamical object,* with its regulatory character, works to support some classes and refuse others (HAWKINS, 2007, p. 531-532). Another precious contribution to the topic was Hawkins's (2007, p. 532) selectionist thesis or the claim that the environment contrives opinions to produce fitted generals to mediate cognition. Supported by these arguments he states that desire: (i) works as an organizational principle for one's experience of the world; (ii) introduces coherence into the series of actions one engages in; and (iii) enables observers to explain one's regular activity and character (HAWKINS, 2007, p. 533). Indeed, the natural classes suggested by different classification systems could be considered apt for describing Nature and not merely fictions. However, some might perceive the need for a distinction between a functional class (e.g., photosynthetic organisms) and a true natural class (*e.g*., algae, cyanobacteria). To solve this problem, it is wise to adopt also genetic criteria which bring us to class development history.

> All natural classification is then essentially, we may almost say, an attempt to find out the true genesis of the objects classified. But by genesis must be understood, not the efficient action which produces the whole by producing the parts, but the final action which produces the parts because they are needed to make the whole. Genesis is production from ideas (CP 1.227, 1902).

Discussing Agassiz's techniques of classification, Peirce gave us some clues about how his final causes should work in life sciences. In these cases, Peirce's final causes sound like tiny and explanatory evolutionary stories that tell us how some structures emerge under the pressure of the environment. As we may realize, Peirce worked on a system that aimed to handle a world in perpetual transformation.

Moved by these reasons, I will proceed from here adopting a genetic and selectionist understanding of Peirce's writings about general terms.

It sounds reasonable, as suggested before (HAWKINS, 2007; KENT, 1987; ROSENTHAL, 1994), that our desires that act in the construction of natural classes are in conformity, or at least, in harmony with the material causes of those objects. However, it is imperative to make clear that this conception of *general terms* does not force us to accept the existence of *universals* as static or completely determinate entities. To Hausman (1993, p. 14), for instance, the idea of the evolution of generals is among the most important dimensions of Peircean metaphysics.

As Beverley Kent (1987, p. 87) observes, the determining purpose in the perception of objects to be classified could provide us with the use of genuine natural classes. Kent's reading of Peirce helps us to exorcise extremely animist interpretations and open a path to a truly natural classification. Rosenthal (1982; 1994) also concedes more authority to fragments where Peirce stresses on the purposes of the agent as the criteria of classification. In her opinion, the final causes are already manifest in common habits of objects submitted to classification. According to her, the empirical dimension of habit is the source of concrete objectivity – providing us with much more than a collection of simple appearances (ROSENTHAL, 1982, p. 234). The image that I want to delineate is attentive to heuristic value in taking *habits* as the distinctive character of natural classes and their final causes (*e.g.*, woodpecker, quicksilver, etc.). Ingo Brigant (2017), developing his image to natural classes and its mediations, also takes the pluralist stance and emphasizes the teleology of scientific communities in classification.

> I have claimed that the epistemic goal pursued by a concept's use is a semantic property of a term – just like reference and inferential role (intension) are – on the grounds that it is needed for a semantic task, namely, accounting for the rationality of semantic change and variation. Some may wonder whether the epistemic goal is actually a semantic or rather a pragmatic aspect of term use. But drawing the semantic-pragmatic distinction in a certain way is less important than the need to include the epistemic goal in any study of scientific concepts (BRIGANDT, 2017, p. 184).

Considering Peircean *synechism*, it is natural to conceive a continuity between natural sciences and other practices used to organize experience. To Peirce, *appearance* and *reality* are continuous. If the Peircean theory of knowledge is bound to the cognizable aspects of Nature, how can be these causes remain hidden to us? Is their revelation solely a question of time? Susan Haack does not seem to be alone in considering that the final answer to this question maybe comes only at the "end of inquiry" (Cf. HAACK, 1992, p. 29). Indeed, according to Peirce himself, in the case of natural classes their true final causes remain hidden (CP 1.204, 1902). However, this solution brings no advantage and do not save appearance. I think that a philosopher and scientist like Peirce would not be satisfied with this opaque and skeptical image of natural kinds and their terminology.

3 The contemporary debate

The dispute around natural kinds (or general) terms is relevant for three main reasons: (i) the ontological status of classes is a true problem to many fields of natural sciences; (ii) the issue of natural kinds is inserted in one of the broadest debates in modern-day epistemology (and historically imbricated with the *Problem of Universals*), the dispute between individualists and anti-individualists (e.g., twin-earth experiments); and (iii) it also helps to model cognitive processes in animals from simple content inferences (*e.g.*, Peircean Dicisigns[2]).

2 See STJERNFELT, 2014.

The contemporary debate is mainly motivated by the failure and inadequacy of the dominant descriptions of how a community is able to create and make use of natural kind terms. Much of the current controversy is focused on what is widely known as *Kripke-Putnam's theory of Natural Kinds* (KRIPKE, 1972; PUTNAM, 1975). This description is characterized by the use of *rigid designators*[3] and can sharply distinguish nominal from real essence. However, problems arise because *Kripke-Putnam's* approach makes use of the real essence to determine the extension of the term (DUPRÉ, 1981, p. 68).

According to Jessica Brown (1998), the Kripke-Putnam's approach fails to deal with two conditions: (α) typically, an object that instantiates a natural kind, also instantiates others, setting *the higher-level natural kinds problem*;[4] (β) natural kinds occur in impure samples, configuring *the composition problem*; and I can also suggest (γ) the problem of *semantic change*, *i.e.*, when the meaning and use of the same term changes over time (*e.g.*, planet, atom).

In my view, these are not just problems of ordinary or scientific language. By Brown's (1998) analysis, she concluded that naming and references to natural kinds involve what she calls *recognition capacities*. Despite the simplicity of this claim, this idea is extremely valuable to our problem. Nowadays, some philosophers still claim that these kind of recognition capacities are exclusively human. However, if this ability to recognize natural kinds is exclusively human, then how could one explain the fact that certain species succeeded with adaptive strategies such as mimicry (false coral snakes, predator fireflies, carnivorous plants, among others)? In an evolutionary approach, we begin from the assumption that the most remote ancestors of our species already possessed the ability to discriminate between different natural kinds even before developing an efficient ordinary language.

The ability to recognize natural kinds is a necessary skill for the survival of highly-developed animals (*Bilateria*). This thesis is clearly supported by Peircean synechism, or his doctrine of continuity if it is taken seriously. Since the capacity of recognition to differentiate natural kinds as a well-developed ability in many groups of animals is almost a consensus among scientists, one can safely proceed with a movement such as this one. Nevertheless, of course, these capacities are not immune to error. The logician of Milford's *fallibilism* also welcomes this imperfection of other animals' capacity for recognition without worries.

In this scenario of mimicry and natural decoys, it is not the senses that deceive us (as had been the concern of rationalists and idealists for centuries), but the objects themselves, by the appropriation of some specific features of our sign processing system, the ones that deal with the recognition of natural kinds. Maybe, one can imagine such natural farces as a crowd of tiny biological Cartesian demons, which "make their living" attempting to deceive humans and other animals. As Eco (1976, p. 1459) observes, the "self-sufficiency of the universe of content, provided by a given culture, explains why signs can be used to lie." However, using the case of mimetism, this masquerade is not an endeavor merely of a sole agent, but of every specimen of a kind. So, this kind of lie is not confined to a specific culture or population but includes a greater sphere of natural signification.

Biologists have strong reasons to believe that mimicry is the result of adaptations that delude the cognitive abilities of predators and prey, specific or varied, in many cases, imitating other species, others, simulating the substrate or trying to look like plant species. These deluded agents probably make wrong associations between "essential" properties and natural kinds, starting physiological responses that cause their actions. If organisms adapt themselves to something, this thing cannot be merely a fiction. And, if it is not a human fiction, then is not reasonable to suppose that there is a fiction in which other animals are also cooperative authors. By this movement alone, we can avoid nominalism and, at

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3 Roughly speaking, a term is said to be a *rigid designator* when it refers to the same thing in all "possible worlds" in which that thing exists and does not designate anything else in those "possible worlds" in which that thing does not exist.

4 For instance, a specimen of a poisonous snake can instantiate a tiger-rattlesnake, a sample of the *Crotalus* genera, a member of the family *Viperidae*, a reptile, or vaguely as an *Animal*.

the same time, confront the realist problem in the denotation of biological species diachronically, or in their evolutionary dimension. As Quine points out, "creatures inveterately wrong in their inductions have a pathetic but praiseworthy tendency to die before reproducing their kind" (QUINE, 1969, p. 126).

Apparently, ordinary language is just the tip of the iceberg. To semioticists, the majority of the cognitive processes are computed in a mental language, and therefore, remain submerged. In Peirce's approach, the submerged part is only disclosed by a semiotic analysis. Indeed, quite often, our languages fail to satisfactorily reproduce the state of affairs in the world. Under a semiotic perspective, symbols are not entitled to be perfect copies of reality. They should be treated – solely – as an effort to adapt the organism to its environment. Peirce's theory of signs offers a vision that embodies this ontological dimension of meaning, as in his apprehension of the dynamical object, "which is the Reality which by some means contrives to determine the Sign to its Representation" (CP 4.536, 1906).

4 Thoroughgoing evolutionism

If we consider the symbol as a living thing (CP 1.222, 1901), and get a clear idea of its growth and development, then we can also conceive of its evolution. The evolution of representations in the semiotic processes can provide us with new symbols that enhance our reasoning. That perspective contains the very idea of fitness, but in a broader sense, embodying pragmatic and semantic aspects. I assume that, even among the most qualified users of scientific vocabulary, there are some risks when one tries to identify or give names to new classes. Users are always willing to get a better outcome in their reasoning and communication.

Tomasello (2014), for instance, argues for the recognition of the effects of group collective teleology on superior animals in his *shared intentionality hypothesis*. This hypothesis *assumes* that communities' teleological aspects operate also in the evolution of language among other collective enterprises. However, Tomasello (2014) believes that our semantics can only develop by the action of *language games* (stressing just on the use of signs). Games have place and time, evolution happens through time but especially in decisive moments. Kalevi Kull reminds us of the role of real and decisive choice in semiotic activity.

> Semiosis is the process in which the sign (and meaning) emerges. In other terms, semiosis is interpretation, the formation of interpretant – according to Peirce. Yet it is important to emphasize that interpretation always includes choice (KULL, 2018, p. 455).

Here, we find the coercive effect of the dynamic object over the selection of terms. Then, the pluralist thesis sounds more reasonable because it also accommodates better the Peircean distinction between immediate objects and the dynamic object. This continuous coercive action of Peircean *secondness* opens possibilities to the community refinement of general terms in *thirdness*.

In short, the meaning of a concept should be taken as the result of causal processes, in a continuous interpretation of the perceived effects, which are mediated by the teleology of the cognitive agent. These processes, in turn, can be refined through the interaction with other individuals in their communities, on a linguistic level. Therefore, if this is the case, the pragmatic standpoint does not accept that the meaning of natural kind terms may be established through the free play of linguistic signs.

The Vervet Monkey (*Chlorocebus pygerythrus*) is a specie which developed vocalized symbols to make reference to general types of animals dangerous to them (QUEIROZ, 2003, p. 3). These monkeys can make acoustic alarm calls when facing a "super-kind" of predator, provoking measures to each specific kind of threat. They can make use of at least three different super-kinds, as follows: (a) constrictor snakes, (b) birds of prey, and (c) non-human carnivore primates (Cf. SEYFARTH et al., 1980, p. 801).

The discovery of this example of animal use of language group conventions is a strong reason to produce a theory of natural class terms that is broadly general and all-embracing. Thomas Short (1996, p. 513-514) made important considerations about what kinds of interpretants are involved in the interpretation of danger signals to an animal. This consideration focuses around the question if mammals possess in their mind logical dynamic interpretants or only energetic and emotional ones.

> As long as there is a goal, there is a distinction between success and failure, or between better and worse, and, hence, between a dynamic interpretant and the final interpretant? in the case of energetic interpretants, between what was done in fact (a dynamic energetic interpretant) and what would have been done in an ideal state of information (the final energetic interpretant) (SHORT, 1996, p. 514).

I hope that it becomes clear that the adoption of the weak pluralist thesis does not imply *ontological promiscuity,* because it considers the action of two decisive factors: reality coercion and community selection. Communities oriented by consolidated experience can objectively identify in the long run the classes that are not real. Indeed, we can see in action the "objectual principle of interpretational variety" as already suggested by Helmut Pape (1993, p. 595).

> At the same time, a general agreement concerning the use of terms and of notations – not too rigid, yet prevailing, with most of the co-workers in regard to most of the symbols, to such a degree that there shall be some small number of different systems of expression that have to be mastered – is indispensable. Consequently, since this is not to be brought about by arbitrary dictation, it must be brought about by the power of rational principles over the conduct of men (CP 2.220, 1903).

Taking this path, driven by the intent of exorcis*ing animism* from our use of final causes, we can adopt *desire* as an instrument to cut off natural classes from the continua and *habit* as a common denominator of these same classes. However, is important to remember that the one who classifies needs to make choices.

> Science is continually gaining new conceptions; and every new scientific conception should receive a new word, or better, a new family of cognate words. The duty of supplying this word naturally falls upon the person who introduces the new conception; but it is a duty not to be undertaken without a thorough knowledge of the principles and a large acquaintance with the details and history of the special terminology in which it is to take a place, nor without a sufficient comprehension of the principles of word-formation of the national language, nor without a proper study of the laws of symbols in general (CP 2.222, 1903).

I assume that, even among the accredited users of specialized vocabulary, the user always ventures out when using or developing new terms, aspiring for higher gain in his or her communication. I do not doubt that humans are sufficiently *semantically adapted* to survive, as we can perceive under the Darwinian criteria of success as a specie. This is a premise that finds a correlate in Peirce's *innatism*. However, it is necessary to explain how this kind of an approach of thoroughgoing evolutionism can be fruitful when applied to the studies of cognition (both learning and discovery) and scientific activities.

Nowadays, many studies are trying to make use of Peirce's theoretical framework in order to handle a variety of different problems inside cognitive sciences and information theory. Nevertheless, the opposite way may also be promising – Peirce's doctrines can be enriched by some contemporary methods. In the next sections, I will point out some of Peirce's doctrines that may help us to overcome the three problems already mentioned in the contemporary debate, guiding us to a broader theory of natural kinds representation. However, is important to perceive that his understanding of natural classes – within his

doctrine of general terms – is deeply connected with his theory of truth and its convergent projections. This premise makes it possible to associate methodological pluralism with an *evolutionary realism,* a version of realism already identified in Peirce's philosophy by Carl Hausman (1991; 1993; 2002).

5 Semantic fitness

The enriched evolutionary notion of *semantic fitness* associated with Peircean doctrines of s*ynechism* and *fallibilism* may support an earnest account of semantic phenomena in nature, leading us far away from the rigid and inflexible orthodox views of semantic correspondence. If a sign is something alive; then, maybe it could reproduce and adapt itself through mutation and selection.

A seminal work in this approach – *Semantic annotation and inference for medical knowledge discovery* (SAHAY et al., 2007) – is the result of a research project that brings many virtues from practice in the empirical sciences. Indeed, working with microbiological life – with a very fast mutation rate – suggested a new strategy to work on our old metaphysical problem. Saurav Sahay and his colleagues developed the notion of *semantic fitness* to model an optimum level of abstraction in order to produce more meaningful representations within a given ontological domain, classifying objects in a dynamic and progressive way. Their project aims to use massive data to generate evidence-based, machine-processable knowledge that can be incorporated into expert systems for the diagnosis and prognosis of diseases. I will incorporate this key-notion into a contemporary interpretation of Peirce's approach to natural classes, trying to increase its explanatory power. My goal here is to stay close to a pragmatic and thoroughgoing evolutionary conception of meaning.

By the extremely complex and dynamic picture of the world which natural sciences has presented to us in the last centuries, it looks as if there is no rest or purity. This is a serious reference problem for contemporary theories of meaning when applied to general terms. However, the evolutionary concept of fitness associated with pragmatist strategies subsidizes a new interpretation of semantic phenomena in nature, distant from rigid, constrained and orthodox views of semantic correspondence.

> A symbol is a representamen whose special significance or *fitness to represent* just what it does represent lies in nothing but the very fact of there being a habit, disposition, or other effective general rule that it will be so interpreted (CP 4.447, 1903, *my emphasis*).

Peirce's method to the recognition of samples is, roughly speaking, an application of his theoretic notion of habits. This notion makes explicit the *general* character of a class; they are not *universal* characters. Instead of lists of properties' descriptions in clusters (as a descriptivist) or a search for essences (as an essentialist), the pragmatist philosophy of language attempts to describe practical effects in constructing a class and to use a *token* to describe it. Thus, as the Kripke-Putnam's approach, pragmaticism also is committed with causal processes.

Quite often, Peirce speaks of a term, word, or signs as "apt" to some tasks and "inapt" to others. Therefore, it will not sound precipitated to suggest that there was already in Peirce's writings a growing idea of *semantic fitness*. Where each word or sign, is used in accordance with a goal, a purpose, and to achieve a goal.

> When we express a proposition in words, we leave most of its singular subjects unexpressed; for the circumstances of the enunciation sufficiently show what subject is intended and words, owing to their usual generality, are not well *adapted* to designating singulars (CP 5.153, 1903, *my emphasis*).

Curiously, since Scholasticism, the definition of universal has already contained the notion of aptitude as mentioned by Peirce himself, in the occasion of transcribing the definition of a general term as *aptus natus prædicari de pluribus*, as he read in Peter of Spain (CP 2.367, 1903); followed by Albertus Magnus' definition: *Universale est quod cum sit in uno aptum natum est esse in pluribus* (CP 2.367, 1903). And, from Burgersdijk's translation of Aristotle, Peirce also transcribes: *Universale appello, quod de pluribus suapte natura praedicari aptum est* (Idem). So, it looks like this idea was in a latent sleep for a long time, resting calmly in the realm of logical acceptance of our tradition. However, the epistemic gain is possible through the semantic change of this theory-laden term over the last centuries. Indeed, Peirce went far in the path signaled by Aristotle, already conceding the status of *fitted* to other orders of classification.

> The five terms of second intention, or more accurately the five classes of predicates, genus, species, difference, property, accident, were in the middle ages (as they still are) called "the predicables." But since predicable also means *fit to be a predicate*, in which sense it is almost an exact synonym of universal in the first sense, the five predicables came to be often referred to as "the universals" (CP 2.368, 1903, *my emphasis*).

According to this framework, some inferences about natural kinds, because the terms reference problems cited before, sometimes are neither true nor false, but could be considered as *aptly* or as *inaptly* formed by the use of a specific term. Nevertheless, intermediary states are not excluded and one given term (*t*) can be more apt than the other. Indetermination never was a novelty to pragmaticism. Peirce denies that the principles of non-contradiction and excluded middle term do apply to reality independently of the organizing agent (ROSENTHAL, p. 52, 2003). At the same time, a true proposition should always to be considered as apt and false propositions should be always considered as inapt ones.[5]

6 Final considerations

Under the strength of these arguments, the following definition of semantic fitness seems sustainable for my goal here. The higher the efficiency of a given term (*t*), or sign, in priority to others available for a given task, the more likely this term (*t*) or sign will be to accomplish that task. Its purpose could be either the communication between cognitive agents or the construction of simple inferences (*e.g.*, this animal is a mouse) for decision-making processes. To measure the outcomes or the semantic fitness of *t* for the construction of an inference, in a crude manner, we may make use of a few outcome factors (or our criteria of evaluation), as follows: (1) precision to describe nature (or how it *saves the appearances*); (2) commensurability with other vocabularies; and (3) parsimony. However, if our goal is to communicate inferences to other epistemic agents, we must to consider also (4) the reception of this *term* within a community, a factor that varies in accordance with the diffusion of this term among its individuals; and (5) ethical and aesthetical values of other agents and linguistic communities[6]. And, for both cases, to make inferences and for communication, it is possible one could find under special circumstances (n) other relevant factors as well.[7]

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5 The last example could be developed in two different circumstances where the fitness of a term matters. In the first one, we are in a Zoo and the hosting personnel says that the animal that we see is a specimen of *tiger-rattlesnake*, using with no doubt the more fitted term to introduce a new specie. In the second case, we rescue a person who was attacked by the same animal and in the hospital, he searches for a snake antivenom. Supposing that the nurse (or the physician) is not an enthusiast of reptiles, the use of the term *Crotalus* is much more apt because it helps to find the correct medicine more quickly, i.e., the anticrotalic serum.

6 In the last decades, people have experienced the change of values in the reception of many general terms (not only natural) in specific or larger audiences. Values change and relations between different people should become more harmonious in these processes. It is not difficult to see that the weak pluralist stance is more democratic and politically correct without a significant loss of efficiency or falsification criteria to suspicious generals.

7 Here we can also accommodate Peirce's decision for ugliness as an incorporated value to discourage raptors when he chose the name "pragmaticism".

Therefore, we can perceive that the adoption of the enriched Peircean approach by the notion of fitness may dissolve the (α) *problem of higher order*, since we can choose the denomination level that best serves our purposes at a given circumstance, independently of whether it is or not the more accurate term, adopting a selectionist instrumentalism. In addition, the (β) *problem of the composition* is not a real problem in this approach, since the recognition of uncertainty, impurity, and indeterminacy has been previously incorporated into such a fallibilist conception of meaning. In Pragmaticism, correspondence is a concept to be applied under some restraints. Moreover, regarding the (γ) *problem of semantic change*; oriented by such an evolutionary and semiotic perspective, its reception is understood as something trivial, because transformation of mediations is found exactly in its field of inquiry.

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List of Abbreviations[8]

The works of Charles S. Peirce are cited as follows:

Collected Papers of Charles Sanders Peirce: volume (v) and paragraph (p) (CP v.p).
The Charles S. Peirce Papers: roll (r), and page (p) (MS r:p).

8 Editor's Note: This list of abbreviations follows the rules described at: https://en.wikipedia.org/wiki/Charles_Sanders_Peirce_bibliography. Accessed on: 01 Dec. 2021.