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Man the Abstract Animal

Diagrams, Abstraction, and the Semiotic Missing Link

"... the brutes use signs. But they perhaps rarely think of them as signs."
(Peirce, 5.534 (1905))

von Uexküll's simple distinction between closed *Umwelten* in animals versus open *Umwelten* for man obviously does not hold. But if biological evolution is - among other properties - characterised by increasing semiotic sophistication, then it becomes an urgent question to ask which decisive semiotic change took place, if any, with the introduction of language during the Homo Habilis period in human prehistory: what is the semiotic missing link?

In this context, Terrence Deacon's much-discussed and groundbreaking book *The Symbolic Species* attempts a new solution. Based on a threefold background of arguments - philosophical, neurological, and anthropological, - Deacon proposes that the main event in the animal-man transition is the introduction of *symbols*. Now, as is well known, the concept of symbol is probably one of the most ambiguous notions in the history of thought, and Deacon takes great care to make precise the version of it he finds central. He picks the notion of symbol found in Peircean semiotics which stands apart from many other symbol concepts by assuming the symbol as a complex derivative notion related to simpler sign types included in its composition. The symbol, of course, presupposes the existence of the simpler sign types icon and index, respectively, so that it makes sense to say that genuine symbols presuppose icons and indices. Icons are signs defined by similarity to the object they refer to; indices are signs defined by actual

connection to the object, and symbols, finally, as signs referring to their - general - object by means of habit. These three classes are not mutually exclusive partitions of the field of signs; rather, higher sign types presuppose and include more simple types. Thus, icons form the most fundamental sign type (with respect to object reference), and all higher types presuppose icons. Thus, indices are only possible in so far as they possess iconic qualities: the footprint in the sand is a prototypical index, in so far as the sign refers to the object having caused it, but it also possesses iconic qualities, in so far as the footprint's shape to some extent resembles the foot's.

In order to interpret something as indexical, so Deacon, a higher-order relation must hold between two groups of icons (in the footprint case, there must be a relation between the group of possible footprints similar to the actual print on the one hand and the group of possible foot shapes responsible for it on the other). This corresponds to conditioned response in ethology, Deacon argues. Furthermore, in order to construct a symbol, a whole group of indices are related by means of indexical relations between their tokens¹. This relation, internal to the symbol, is now strengthened at the expense of the initial index's object reference. Thus, the symbol is, as a tendency, loosened from the closer object contact found in icons and indices. They are bracketed, allowing the symbol to function on its own in representation and reasoning, but in any specific interpretation of a symbol, its iconic and indexical basis must be reinvoked, including the possibility of new icono-indexical specifications of it.

This forms the base of a fertile criticism of rival accounts conceiving of symbols as atomic primitives, so for instance the physical symbol systems hypothesis, making symbols simple physical units corresponding in a rather direct way to other physical units. With reference to a range of neurological brain scanning experiments which we shall not go into here, Deacon argues that philosophical points of view related to simpler symbol conceptions lack empirical support. This criticism is aimed especially at Chomsky's transformation grammar and related positions claiming the existence of an innate grammar module in human beings, a module which allegedly is completely lacking in apes. Deacon's scanning experiments point to the fact that sufficiently complex linguistic tasks inevitably give rise to very widespread brain activity including several separated parts of the cortex in addition to the well-known Broca's and Wernicke's areas involved in the production and reception of speech. This finding forms a strong argument against the language module hypothesis, and to counter that idea Deacon

claims a symbol hypothesis. Symbol use is taken as the distinctive advantage of mankind in comparison to other higher animals. Symbol use - as a complex phenomenon - naturally involves the integration of a large amount of highly different, more primitive brain competences. Hence, such a hypothesis makes the semiotic animal-man transition more continuous so that symbol use merely would amount to the integration of a series of competences already to a large extent present in higher animals. The neural equivalent to symbol processing is neither a specific module of the brain nor the simple size difference of the cortex - but the *degree of integration* of the human brain which is even neurologically measurable in terms of much longer growth period and a larger degree of neuron interconnection between spatially distant parts (so as for instance the cortex and the cerebellum, very important for the automatization of phonetic aspects of speech).

Deacon proposes a both a general and a specific scenario for the evolution of speech. The specific one features a huge amount of anthropological hypothesesⁱⁱ and may be left aside in this context. The more general scenario revives the notion of “Baldwinian” evolution (after the American psychologist James Mark Baldwin from around 1900).ⁱⁱⁱ He proposed the idea that seemingly Lamarckian acquired hereditary properties could be explained within a Darwinian framework with a support hypothesis: that animals able to learn new behaviors may be able to direct evolution as a result of that behavior - because the behavior in question forces fellow species members to assume it or perish. In such cases, a huge selection pressure will favor individuals most able to learn that behavior: “... *those congenital or phylogenetic variations are kept in existence which lend themselves to intelligent, imitative, adaptive, or mechanical modification during the lifetime of the creatures which have them.*” (Baldwin 1902, p. 95). This Baldwinian evolution argument is evidently stronger, the more intelligent the organism in question is. Thus, Deacon’s idea is that the passage to symbol use is intimately connected to the fast evolution of the human brain during the recent millions of years. He imagines a scenario, in which embryonic symbol use in small humanoid groups kickstarts a process selecting for higher brains with symbol processing capabilities within those groups, thus speeding up evolution’s pace dramatically, with our sophisticated symbol abilities as a result. The evolution of the human brain thus does not precede language evolution – rather, the two form two aspects of the same evolutionary process, and in some sense the semiotic a priori structure of language, via peer group pressure among humanoids, acts as a further constraint on brain evolution.^{iv}

My aim here is to try and render the semiotic aspects of Deacon's hypothesis - with which I basically sympathize - somewhat more precise. The main problem in it is that even the Peircean definition of "symbol" is probably much too primitive - as well as too general - to explain the semiotic aspects of the animal-man transition. In addition, there are some terminological problems to be sorted out; Deacon claims he uses Peirce's terminology, but as a matter of fact, he undertakes his own reconstruction of it, changing the higher sign types - indices and symbols - in two ways. First, they are rendered compositional with respect to lower sign types, maybe for theoretical economy reasons; and, second, they are rendered more complex than is the case in Peirce's account, maybe in order to make them "fit" the ape/man boundary better. Thus, Deacon's explanation of the index seems to cover cases which in Peirce's account automatically would be counted as symbols. Pure indices - in Peirce only possible as a limit case - will be tied to the actual here and now, while it is the privilege of the symbol to possess a general *esse in futuro* and thus form a habit, regulating future behavior. But when Deacon claims that conditioned behavior is indexical only, it seems he already includes future regulating features in indices (which are nowhere apparent in the prototypical footprint index) . The problem is, of course, that if we accept the ordinary Peircean notion of symbol, then symbolic behaviour becomes widespread in higher animals^v, and the notion becomes unfit for the task of distinguishing between animal and human behavior. Thus, a simple Pavlovian conditioning making the ringing of a bell release the excretion of saliva in dogs is a full-fledged symbol in Peirce's terminology: it is a habit, a regulation of future behavior, and it connects a continuum of possible bell sounds with a continuum of possible eating situations, thus being a general sign with a general object - a symbol. Accordingly, Peirce's symbol concept includes a wide range of subtypes of very different complexity degrees, ranging from simple terms over propositions to arguments - each of these, in turn, including a whole fauna of further subtypes. Thus symbol use is neither as simple as Deacon presupposes (with respect to symbol subtypes) nor as complex as he presupposes (with respect to the simpler sign types).^{vi}

Deacon consequently adds some further requirements to Peirce's symbol concept in order to make it approximately fit the animal-man transition (to be sure, he maintains that a few higher animals, mostly apes, maybe parrots, may learn simple symbol systems^{vii}). What he adds is a Saussure-like systematicity of requiring the co-presence of several

interlinked symbols, both paradigmatically (implying the systematic difference between selected expressions) and syntagmatically (implying the syntactical organization of combined expressions). Only a system of this kind, he argues, permits ape and man to skip icon- and index-consciousness and their tight connection to the actual world and indulge in the semi-autonomous world of symbolicity, giving rise to the possibility of systematical counterfactual imagination. But as to systematicity, higher animals do possess taxonomies, both in perception (prey types) and communication (warning calls for different predators) so it seems systematicity is not the only key to the problem.

Thus, it is correct that Peirce's symbol definition is a necessary, yet not sufficient prerequisite to give rise to the construction of counterfactual, possible worlds. The symbol notion seems too weak to account for the specific advantage of human semiotics over animal semiotics. More specific distinction within the field of symbols must be sought as responsible for this decisive jump. Peirce himself only rarely considers the question of animal semiotic behavior, but he is, at least, quite sure that animals' abilities are far more elaborate than for instance simple conditioning. Take this late deliberation (c. 1911):

Some seventy years ago, my beloved and accomplished school-ma'am taught me that human kind, being formed in the image of our Maker, were endowed with the power of Reasoning, while "the animals", lacking that power (which might have made them dissatisfied), received, each kind, certain "instincts" to do what was generally necessary for their lives. At least, so I understood her. But when I subsequently came to observe the behaviours of several big dogs and little birds and two parrots, I gradually came to think quite otherwise. For, in the first place, I gradually amassed a body of experiences which convinced me that many animals, perhaps all the higher ones, do reason, if by Reasoning is meant any mental operation which from the putting together of two believed facts leads to a Belief different in substance from either of those two. Once, for example, while I was driving (...) along a country road that was very familiar to me, a setter-dog that I had never seen before raced past me at the top of his speed. In an instant a turn of the road hid him from my sight. "Poor fellow!" I thought, "he races after his master in fear of losing him forever." A moment later, reaching the turn myself, I saw the dog again, not far ahead of me, but at a point where the road branched, and now sitting

on his haunches. He was not panting nor showing the least sign of fatigue, but evidently puzzled which branch of the road [to take]. After a second or two, he started off at the same tremendous pace as before, on the more travelled of the two roads, though being the older and harder, it was not very obviously the more travelled of the two. These alternations, - a halt between two utmost speedings, with no slightest symptom of fatigue, - seemed to me to show plainly that the dog had stopped to consider which of the two branches of the road his master had probably taken; and his sudden choice of the more travelled showed that he concluded that his master would probably do as most people, which was a kind of argument: technically called a "probable deduction", - the commonest reasoning of a general in a campaign, when information is lacking, defective, or conflicting. (Manuscript, Robin-nr. 672, p. 2-5, my square brackets)

Peirce continues with another example of a parrott fooling a dog named Spitz. Every day, the dog's master would come home and call "Spitz, Spitz, Spitz!" in order to take the dog for a walk. If, by chance, somebody else came to the door, the parrott would repeat exactly the same yell, now provoking the dog to run to the door - only to be laughed at by the presumably practical-joking parrott. It is of course very difficult to ascertain the amount or character of reasoning taking place in animals from behaviour observation, but especially the first of Peirce's examples seems illustrative for a deliberate choice based on reasoning seemingly widespread in higher animals. If we take this observation as being correct, this implies that higher animals are not only at the command of symbols in general, but also of those most demanding and complex of symbols called arguments and reasonings, involving diagrams. Even if not making it explicit, the dog's reasoning must implement a Y-shaped diagram in some fashion or other, making it possible for the dog to reason about which branch of the Y to chose. We may note, moreover, that the dog's situation at the fork road Y also, at least in germ-like form, contains the construction of another possible, counterfactual world (like "what if my master had gone the other way" ...). If the more complex parrott example is to be accepted at face value, it even contains the deliberate construction of a possible world *for* another animal, implying a theory of other minds - a type of behavior which seems well-documented in apes wanting to fool fellow apes away from food, sexual partners, etc., but let us stick to the more easy-to-interpret first example. Of course, the systematic exploration of worlds of alternative possibilities requires a stable representation system probably in the form of interconnected symbols - but

the example here goes at least to show that there is probably no upper bound to the complexity of symbol types which higher animals have access to as single signs. Animals do reason, and one could probably find cases displaying both abductive, deductive, and inductive argument use, to take Peirce's argument typology. A full-blown process of reasoning involves all of the three of them, and if animals reason, they master all of them - even if not necessarily explicitly, of course. They may guess, infer, and generalize from experience, respectively; they are rational because they are forced to - a Popperian argument - just like us. So the problem must lie elsewhere. The problem simply does not seem to lie in the the complexity degree of single symbol types, at least when measured on the term-proposition-argument complexity scale of symbols. Deacon is probably on the right track when he looks for the coming into place of a systematic interconnection of symbols making it possible stably to construct, evolve, and research possible worlds differing from the actually perceived world. But what makes the jump from a sophisticated reasoning ability and to a system of symbols possible? Deacon does not go into this question, but I think the explanation might be found in the ability to make signs explicit and undertake explicitly controlled reasonings with them. To Peirce, explicit control is even paramount to reasoning proper - which is why animal reasoning despite many similarities to human reasoning only rarely may qualify as proper reasoning.^{viii} The way Deacon describes his redefinition of the symbol concept actually indicates that Deaconian symbols are in fact symbols subjected to such explicit control. And the issue of explicit control points to another part of Peirce's work, namely his *abstraction theories* focussing upon the possibility of making stably explicit the meaning of a term.

Peirce's abstraction theories

Peirce developed no less than two abstraction theories in so far as he finds the colloquial use of the word "abstraction" at his time (and in ours probably as well) refers to at least two separate and autonomous problems. Both are relevant here. One is the mind's focussing ability, the other on its ability to make issues explicit - referred to as *distinction* and *hypostatic abstraction*, respectively^{ix}. As often in Peirce, the two notions stem from different traditions in Mediaeval semantics of Scholasticism.

Even if the abstraction problem recurs over and over in Peirce's work, he never consecrates a whole paper to unfold it, so an exposition must be based on a series of small notes spread in his published and unpublished

work. The abstraction problem surfaces as early as 1867, but Peirce's interest in it reaches a peak in the fertile years of his mature theory of signs in the first ten years of the 20. century. The first part of it, however, is stated as early as in "On a New List of Categories" (1867, EPI, 2; 1.549)^x where the trichotomy of *dissociation*, *prescission*, and *discrimination* is terminologically fixed. The idea is that there are three modes of separation which may be undertaken in the analysis of a phenomenon, going from the most coarse, being able to distinguish different qualities, e.g. red from blue (dissociation), over one able to distinguish what may be supposed to exist without the other, e.g. space from color (prescission) to the most subtle being able to distinguish what may only be thought of separately, e.g. color from space (discrimination). This terminology remains constant in Peirce, and in "Syllabus" (1903), the three modes are directly connected to the definition of his three categories:

In order to understand logic, it is necessary to get as clear notions as possible of these three categories and to gain the ability to recognize them in the different conceptions with which logic deals. Although all three of them are ubiquitous, yet certain kinds of separations may be effected upon them. They correspond to the three categories. Separation of Firstness, or Primal Separation, called *Dissociation*, consists in imagining one of the two separands without the other. It may be complete or incomplete. Separation of Secondness, or Secundal Separation, called *Prescission*, consists in supposing a state of things in which one element is present without the other, the one being logically possible without the other. Thus, we cannot imagine a sensuous quality without some degree of vividness. But we usually *suppose* that redness, as it is in red things, has no vividness; and it would certainly be impossible to demonstrate that everything red must have a degree of vividness. Separation of Thirdness, or Terial Separation, called *discrimination*, consists in representing one of the two separands without representing the other. If A can be prescinded from, i.e. supposed without, B, then B can, at least, be discriminated from A.
(EP II, 270).

Furthermore, these distinguishing abilities are what make the very separation of Peirce's basic categories possible. None of them may be dissociated, however, but:

It is possible to prescind Firstness from Secondness. We can suppose a being whose whole life consists in one unvarying feeling of redness. But it is impossible to prescind Secondness from Firstness. For to suppose two things is to suppose two units; and however colorless and indefinite an object may be, it is something and therein has Firstness, even if it has nothing recognizable as a quality. Everything must have some non-relative element; and this is its Firstness. So likewise it is possible to prescind Secondness from Thirdness. But Thirdness without Secondness would be absurd. (ibid.)^{xi}

This implies that the three categories are interrelated as follows (arrow here meaning possibility of distinction; broken arrow impossibility):

1. $\leftarrow\text{---}\text{---}\rightarrow$ 2. 2. $\leftarrow\text{---}\text{---}\rightarrow$ 3.

The categories may not be dissociated.

1. $\leftarrow\text{----}$ 2. 1. $\text{---}\text{---}\rightarrow$ 2.
 2. $\leftarrow\text{----}$ 3. 2. $\text{---}\text{---}\rightarrow$ 3.
 1. $\leftarrow\text{----}$ 3. 1. $\text{---}\text{---}\rightarrow$ 3.

A lower category may be prescinded from a higher, not vice versa.

1. $\leftarrow\text{----}$ 2. 1. $\text{----}\rightarrow$ 2.
 2. $\leftarrow\text{----}$ 3. 2. $\text{----}\rightarrow$ 3.
 1. $\leftarrow\text{----}$ 3. 1. $\text{----}\rightarrow$ 3.

All categories may be discriminated from the others.

This makes the definition of the categories depend on a calculus very close to the mereology of Husserl's 3rd *Untersuchung*^{xii}, discussed in ch. 7-8. The three separation modes may be rephrased as 1) the distinction between autonomous (genuine) parts, 2) the distinction separating a founding content from a founded content, and 3) the distinction separating any moment (founded content, or *unecther Teil*) from its foundational basis. Thus, like in Husserl, the separation modes are crucial to the explanation of the status of properties (as moments) and their foundation interrelationship (the fact that color properties are founded on spatial properties, not vice versa), and the

separation modes can be seen as the devices necessary for isolating general moments in the phenomenon. Precission and discrimination are the most significant types of distinction because they entail the possibility of isolating predicates by leaving other properties in an object indeterminate^{xiii} (corresponding exactly to Husserl's eidetic variation which inserts algebraic variables in an object for the properties not considered, cf. the Prolegomena in the *Logische Untersuchungen*). With regard to the semiotic man-animal problem, though, it must be admitted that many higher animals can perform corresponding acts, as is evident from the bonobo Kanzi's ability to understand predicate symbols as related in Deacon 1997. Peirce often calls precission "precissive abstraction" to distinguish it from abstraction proper, or as he calls it, "hypostatic" or "subjectal" abstraction.

While the separation types makes possible generalization - by the peeling away of still further properties - and thus are tied to the Aristotelian general/specific/particular triad, the other abstraction type is tied to the abstract/concrete dichotomy. While the first one is objective - in so far as it discerns objective aspects of the phenomenon - the other is subjective in so far as it is tied to epistemology and the anatomy of the process of reason (but also has objective implications, see below).

Hypostatic abstraction is linguistically defined as the process of making a noun out of an adjective; logically as making a subject out of a predicate. The distinction between "hard" and "hardness" serves as the prototypical example. The idea here is that in order to investigate a predicate - which other predicates it is connected to, which conditions it is subjected to, in short to test its possible consequences using Peirce's famous pragmatic maxim - it is necessary to posit it as a subject for investigation. This is evidently a completely different procedure than the separation types (even if the two very often occur interlinked in the research process) insofar as the output is not more general than the input. It makes an second-order object out of a predicate, an object which may now be taken as the object for a further investigation. It takes a thought as a thing, in short. Consequently, the operation is recursive, and we may produce an unlimited hierarchy of ever more abstract notions^{xiv}.

In the beginning of the century, Peirce over and over again illustrates abstraction with reference to the well-known Molière joke about the "Virtus Dormitiva", the dormitive powers, of opium^{xv}. The joke is a parody of sterile abstractions of Scholastic medicine, of course, and in Peirce's positivist time, it apparently functioned as a general warning against abstractions *tout court*. But Peirce turns the table on this interpretation. He

admits, of course, that it serves as an extreme example of an idle and useless abstraction, but still there remains, if we put it under a microscope, as he says, an ever so small step forward in the reasoning process, even in this foolish example. By going from the statement that “opium puts people to sleep” and to the statement that “opium possesses a *virtus dormitiva*”, a hypostatic abstraction has been performed. *Something* in opium is taken to have this well-known effect. We know nothing more positively about the workings of opium in the brain, but the hypostatic abstraction now permits us to ask further: in what, more precisely, does this *virtus dormitiva* consist? It might be that opium just put some people to sleep by coincidence, but the hypostatic abstraction - by substantivizing this ability - asks the question of possible further reasons and structures behind this mere fact. Thus, hypostatic abstraction is a crucial motor in the process of research by positing new *somethings*, new *x*'s, as issues to be investigated.^{xvi} It consists in “asserting that a given sign is applicable instead of merely applying it”, as he says already in 1898^{xvii}, it goes from saying that something is red to the fact that redness may be applied to something, and in doing so, it creates an *ens rationis*, a second-intention, whose truth resides in the fact that something holds for other, really existing things: “For what is an abstraction but an object whose being consists in facts about other things?” (“Logic of History” (1904), NEM IV: 11) The point of the Molière joke, consequently, is not that hypostatic abstraction is futile, but rather that the idea of such an abstraction being *sufficient* as an explanation is foolish.

In a 1905 manuscript “Basis of Pragmatism” (Robin nr. 284), Peirce attempts to give hypostatic abstractions a systematic place in his semiotic architecture. In a chapter on the “Division of Signs”, he gives a new trichotomy pertaining to the sign’s relation to its immediate object (distinct from the well-known icon-index-symbol pertaining to its relation to its dynamic object). Here, he distinguishes *vague, or indefinite* signs, *singular* signs, and *general* signs, respectively. The singular sign refers to one particular object, while the vague signs refers to objects which are in need of more precise description in order for their object to be determined, and the general signs refer to a possible continuity of objects, among which the interpreter is free to chose any he likes. Among the singular signs, now, a further subtrichotomy is posited as follows: *hypostatically abstract* signs, *concrete* signs, and *collective* signs, respectively. The latter two refer to singular existing entities and entities built from parts or elements^{xviii}, respectively, while the former are characterized thus: “The Immediate

Object, though Singular in form, is represented as having the logically material character of the Priman, which is the absence of the matter of existence.” (67) Existence is abstracted away to highlight the “Priman”, that is the Firstness, the quality which is then represented as an object. As soon as an abstraction is performed linguistically, it becomes a symbol, so we should place hypostatic abstractions as a specific subtype of symbols. Of course it is possible to refer to abstractions by other means than language - diagrams will be a typical way of referring to them, cf. below - but in these cases a symbolic, general indication of their object will be a part of the sign. Collections, the third subtype, are of course already itself abstractions, and an interesting fact is that also the single existing object for Peirce is an abstraction^{XIX} - it is only possible as a limit case for investigation; to that extent, it is no wonder that hypostatic abstractions are seen as the most simple singular signs.

Hypostatic abstraction is supposed to play a crucial role in the reasoning process for several reasons. The first is that by making a thing out of a thought, it facilitates the possibility for thought to reflect critically upon the distinctions with which it operates, to control them, reshape them, combine them.^{XX} Thought becomes emancipated from the prison of the given, in which abstract properties exist only as Husserlian moments, and even if precission may isolate those moments and induction may propose regularities between them (and we have any reason to believe higher animals may perform these two logical operations), the road for thought to the possible establishment of abstract objects and the relations between them seems barred. The object created by a hypostatic abstraction is a thing, but it is of course no actually existing thing, rather it is a scholastic *ens rationis*, it is a figment of thought. It is a *second intention* thought about a thought - but this does not, in Peirce's realism, imply that it is necessarily fictitious. In many cases it may indeed be - as when we make the abstraction of unicornity - but in other cases we may hit upon an abstraction having real existence:

Putting aside precise abstraction altogether, it is necessary to consider a little what is meant by saying that the product of subjectal abstraction is a creation of thought. (...) That the abstract subject is an *ens rationis*, or creation of thought does not mean that it is a fiction. The popular ridicule of it is one of the manifestations of that stoical (and Epicurean, but more marked in stoicism) doctrine that existence

is the only mode of being which came in shortly before Descartes, in consequence of the disgust and resentment which progressive minds felt for the Dunces, or Scotists. If one thinks of it, a *possibility* is a far more important fact than any *actuality* can be. (...) An abstraction is a creation of thought; but the real fact which is important in this connection is not that actual thinking has caused the predicate to be converted into a subject, but that this is *possible*. The abstraction, in any important sense, is not an actual thought but a general type to which thought may conform.

(letter to E.H. Moore, Jan. 2. 1904; 2 918).

The seemingly scepticist pragmatic maxim never ceases to surprise: if we take all possible effects we can conceive an object to have, then our conception of those effects is identical with our conception of that object, the maxim claims - but if we can conceive of abstract properties of the objects to have effects, then they are part of our conception of it, and hence they must possess reality as well (cf. the 1903 *Lectures on Pragmatism*, Peirce 1997, 134). An abstraction is a possible way for an object to behave - and if certain objects do conform to this behavior, then that abstraction is real; it is a “real possibility” or a general object. If not, it may still retain its character of possibility (just like Husserl in the *Prolegomena* to the *LU* states that the law of gravity would not cease to hold even if the last heavy object in the universe vanished). Peirce’s definitions of hypostatic abstractions now and then confuse this point. When he claims that “An abstraction is a substance whose being consists in the truth of some proposition concerning a more primary substance.” (Peirce 1997, 135), then the abstraction’s existence depends on the truth of some claim concerning a less abstract substance. But if the less abstract substance in question does not exist, and the claim in question consequently will be meaningless or false, then the abstraction will - following that definition - cease to exist. But “unicornicity” does not cease being an abstraction just because no unicorns exist? The problem is only that Peirce does not sufficiently clearly distinguish between the really existing substances which abstractive expressions may refer to, on the one hand, and those expressions themselves, on the other. It is the same confusion which may make one able Peirce scholar claim that hypostatic abstraction is a deduction and another - no less able - claim it is an abduction^{xxi}. The first case corresponds to there actually existing a thing with the quality abstracted, and where we consequently may expect the existence of a rational explanation for the quality, and, correlatively, the existence of an

abstract substance corresponding to the supposed *ens rationis* - the second case corresponds to the case - or the phase - where no such rational explanation and corresponding abstract substance has yet been verified. It is of course always possible to make an abstraction symbol, given any predicate - whether that abstraction corresponds to any real possibility is an issue for further investigation to estimate. And Peirce's scientific realism makes him demand that the connections to actual reality of any abstraction should always be estimated: "... every kind of proposition is either meaningless or has a Real Secondness as its object. This is a fact that every reader of philosophy should carefully bear in mind, translating every abstractly expressed proposition into its precise meaning in reference to an individual experience." ("Syllabus", 1903, EPII, 279; 2.315). This warning is directed, of course, towards empirical abstractions which require the support of particular instances to be pragmatically relevant but could hardly hold for mathematical abstraction. But in any case the step of hypostatic abstraction is necessary for the ongoing investigation, be it in pure or empirical cases.

The pure case corresponds to the second reason for abstraction's central role in reasoning: the role of hypostatic abstraction as the most central operation in mathematics. It is the possibility of making an operation into the object of a new operation, so as to investigate the rules holding for the first operation (e.g. its transitivity, symmetry, etc.). As everywhere, this abstraction procedure is recursive and may form a hierarchy of concepts. Generalization undertaken by *prescission* is, of course, equally important in mathematics. Mathematics is linked to hypothetical deduction and diagrams in a very tight fashion in Peirce: mathematics is the science that draws necessary conclusions, and diagrams are the vehicles for all deductive reasoning. Deductive reasoning featuring empirical matter must thus imply a diagrammatic, mathematical structure, and diagrammatic reasoning forms the center of Peirce's epistemology: the iconicity of the diagram ensures its structural similarity with its object, the symbol governing it determines the possibility of manipulating it with regard to gaining new information, as discussed in ch. 4. Both abstraction types play a crucial role in diagrammatical reasoning:

All necessary reasoning without exception is diagrammatic. That is, we construct an icon of our hypothetical state of things and proceed to observe it. This observation leads us to suspect that something is true, which we may or may not be able to formulate with precision, and we proceed to inquire whether it is true or not. For this purpose it is

necessary to form a plan of investigation and this is the most difficult part of the whole operation. We not only have to select the features of the diagram which it will be pertinent to pay attention to, but it is also of great importance to return again and again to certain features. Otherwise, although our conclusions may be correct, they will not be the particular conclusions at which we are aiming. But the greatest point of art consists in the introduction of suitable *abstractions*. By this I mean such a transformation of our diagrams that characters of one diagram may appear in another as things. A familiar example is where in analysis we treat operations as themselves the subject of operations.
(Peirce 1997, p. 226)

Thus, the two abstraction types are seminal for diagram formation. Precission permits to construct a general diagram, bracketing all contingent features of the particular diagram drawing in favor of the features of it to be read as referring to a general property. Only the required predicates is preserved by this precission procedure. Abstraction allows diagrams to be recursive and to investigate the properties of other diagrams, taken as objects. By these two operations, diagrammatic reasoning performed by rule-bound experimentation on the diagrams is made possible. But it is important to notice in our context that we have no reason to suppose that animals may not make simple diagrams (the road fork's Y), nor experiment upon them (the dog's probable inference taking the more travelled of the roads is such an experiment). But we have no reason to believe that the abstractive making a diagram explicit is a part of higher animals' reasoning abilities.

Seen from a logic point of view, abstraction's character of representing predicate classes makes it pertain to our days' concept of second order predicate logic (which is, of course, unlimited in contradistinction to first order predicate logic, not allowing quantification over predicates, quantifiers etc. but only over individual variables). T.L. Short remarks (Short 1997, p. 295) that hypostatic abstraction is identical with "the transition from first- to second order predicate logic", and he adds: "It does not follow that every fact about an *ens rationis* is inferable from facts about other things. Second-order predicate logic is not reducible to first-order predicate logic; mathematics could not be done without referring to classes or to other abstract entities." (p. 296) This makes explicit the purpose of abstractions: they are not only shorthands for information already available at the concrete levels. They may add genuinely new information -

corresponding to Peirce's idea that by theorematic reasoning with diagrams (as opposed to merely corollarial reasoning), new information may appear that was not explicit in the construction of the diagrams in question.

A more detailed investigation of hypostatic abstraction must try to analyse its basic subtypes. Obviously, there are a lot of different dimensions along which it is possible to perform hypostatic abstractions. In language, they may give rise to a linguistic variety of semantically different abstract noun types and, more broadly, nominal constructions. I know of no Peirce scholar trying to go this way, but in the Husserlian tradition of pure a priori grammar from the 4th LU, a scholar like Jean-Louis Gardiès presents some ideas on linguistic hypostatic abstraction types. There are, for instance, at least three types of possible quotation-marks (in a wide acceptance of the term), each of them nominalizing the expression in question: 1) The operator "the fact that ..." which forms the name of a state of affairs; 2) the nominalization of a predicate ("redness", "humanity"); 3) ordinary quotation marks referring to the name of a proposition (or any other element of discourse expression ("or" is pronounced parallel to "door"), structure ("or" is a conjunction), or content ("or" may mean XOR or it may mean V)). We may add - following Peirce's ideas above - 4) the collection operator forming a set of objects ("my books", "mankind"), 5) the individual object operator: "that object as it exists fully determined now and here" (or with any other spatiotemporal or other specification), cf. Peirce's contention that the unique object with all properties completely determined is also an abstract idea. From linguistic tradition, a whole series of 6) verbal substantives permits to abstract a verbal predicate in other ways than ordinary nominalization: a) present perfect ("operating") forming the abstract idea of an ongoing process; b) past perfect ("operated") forming the abstract idea of a process having taken place; c) infinitive ("operate") forming the abstract idea of the process content apart from realization; d) nominalization ("operation") forming the abstraction of the process as a whole; e) nominalization of the agent ("operator") forming the abstract idea of a specific ergative subject for a process; f) adjectivisation ("operational") forming the idea of some other x having to do with the process. From predicate relations with more than one relative, several different roles may be abstracted (from "give": "the giver", "the gift", "the gifted", "the given"). Other languages may add still further types (gerundive "the one that ought to be given something" etc.).

But hypostatic abstraction needs not be expressed in nor refer to linguistic entities (even if they support it by abstraction suffixes like "-ness", "-ity", "-ation" and many more, and highly enhance the possibilities for

using it). A recurring example in Peirce is the idea of seeing the geometrical line as an abstraction from the trajectory of a particle. Thus, the nominalization act of hypostatic abstraction may also include the spatial “stiffening” of temporal processes or aspects thereof into objects of an abstract space. All abstraction types probably refer - explicitly or implicitly - to such spaces in which diagrams may take other diagrams as their objects. The description of hypostatic abstraction in terms of linguistic or logical vocabulary should not keep us from seeking the phenomenological basis for it, and the possibility for diagrams of taking other diagrams as their objects (thoughts taken as things) precisely presupposes abstract spaces embedded in other abstract spaces. The list of how this may be achieved and represented is possibly open-ended, given the fact that an abstraction of a given predicate may be attempted with reference to many other already constructed abstract ideas; this open-endedness corresponds to abstraction’s homology with second-order logic.

In spite of the fragmentary treatment of these two abstraction types, they play, as is evident, a central role in Peirce’s architectonic. In his Carnegie application from 1902, e.g., one of the few occasions when he proposes a systematic exposition of his mature thought, hypostatic abstraction appears already in lecture 4 (out of 36, and long before the introduction of categories, signs, etc.). This is of course because of hypostatic abstraction’s central role in mathematics - the possibility of an operation to be taken as an object for another operation, investigating the first operation’s properties. And precursive abstraction is logically prerequisite to hypostatic abstraction: before hypostatic abstraction of a predicate to a subject, a predicate must already be precursive. This interplay between the abstraction types are rarely treated explicitly in Peirce, but on one significant occasion, he links the two with the animal-man transition problem, worth quoting at length (in the letter to E.H. Moore, Jan. 2. 1904):

There are two entirely different things that are often confused from no cause that I can see except that the words *abstract* and *abstraction* are applied to both. One is ἀφαίρεσις, leaving something out of account in order to attend to something else. That is *precursive abstraction*. The other consists in making a subject out of a predicate. Instead of saying, Opium puts people to sleep, you say it has a dormitive virtue. This is an all important proceeding in mathematics. For example take all “symbolic” methods, in which operations are operated upon. That

may be called *subjectal abstraction*. This use of the word abstract goes back to the beginning of the XIIIth Century while the other use is earlier still. So both are of unquestionable respectability. But they have nothing in common. What I say in treating such subjects I am apt to mean. They have nothing in common. No doubt subjectal abstraction presupposes a certain considerable precise abstraction in each case; but that was not introduced in making the subjectal abstraction, it was there before. Experience is first forced upon us in the form of a flow of images. Thereupon thought makes certain assertions. It professes to pick the image into pieces and to detect in it certain characters. This is not literally true. The image has no parts, least of all predicates. Thus predication involves precise abstraction. Precise abstraction creates predicates. Subjectal abstraction creates subjects. Both predicates and subjects are creations of thought. But this is hardly more than a phrase; for *creation* and *thought* have different meanings as applied to the two. Without precise abstraction man would not be man; but I can well believe, - indeed, I do think it probable, - that a large fraction of the races of mankind, by no means necessarily very low in the arts, are entirely devoid of the power of subjectal abstraction. (...) (NEM III/2, 917-18).

Lots of interesting ideas are implied in this. Here we find the idea that precise abstraction precedes hypostatic abstraction, that the former creates predicates and the latter, in turn, creates subjects. In so far as even simple collections are abstract entities, it follows that this creation process goes on in human thought all of the time and not only in its purified form in the sciences. Everyday reflection is impossible without it; T. L. Short even argues that the self - and correlatively self-consciousness - is an entity inferred by means of hypostatic abstraction from faults in single actions (as the source of those errors)^{xxii}. In relation to the semiotic animal-man transition question we find in the passing a reflection upon abstractions' relation to biology: the idea that without precise abstraction man would not be man, while many human beings, maybe even cultures^{xxiii}, may be in lack of sufficient ability to perform hypostatic abstractions. This is not, it must be admitted, very precise, and we have already assumed precision to be widespread in higher animals, evident in their ability to associate via qualities (Peirce: "The most ordinary fact of perception, such as "it is light", involves precise abstraction, or precision" ("Minute Logic", 1902, 4.235)). In any case, if many higher animals may prescind and man not be

man without it, hypostatic abstraction seems restricted to mankind, even if maybe unevenly distributed among us (which might in fact be an indication that selection pressure for it is still at work, or has been until recently).

As is evident from the above, this conforms with our general idea: it is the ability to form not symbols in general, but the special symbol type called hypostatic abstractions, that distinguishes (most) men from (most) animals. It is, of course, a very difficult problem to ascertain which mental procedures higher animals are capable of. But it seems reasonable to assume that they master symbols, including arguments, action according to diagrams, and even symbol systems in some rudimentary form, involving huge amounts of generality made possible by precission - but with no means to extract that generality from sensory experience and to isolate it, control it or experiment upon it. Here, Peirce's 1905 reflection briefly quoted at the beginning of this paper adds the explicit control dimension as an important role for the abstractions to play:

Pragmaticist. To my thinking that faculty [of language] is itself a phenomenon of self-control. For thinking is a kind of conduct, and is itself controllable, as everybody knows. Now the intellectual control of thinking takes place by thinking about thoughts [cf. the description of hypostatic abstraction in such second intention terms]. All thinking is by signs; and the brutes use signs. But they perhaps rarely think of them as signs. To do so is manifestly a second step in the use of language. Brutes use language, and seem to exercise some little control over it. But they certainly do not carry this control to anything like the same grade that we do. They do not criticize their thought logically.

("Pragmaticism, Prag. [4]" c. 1905, 5.534, my brackets)

Man as well as animals are consequently rational beings, probably even necessarily so. Both are involved in a constant series of arguments in a reasoning process involving a whole range of simpler sign types. But what enables man to build up his symbol systems and its resulting more acute and accelerated rationality is precission and abstraction working together, making it possible to isolate and to make explicit single phases in the ongoing chain of arguments in order to control them, scrutinize them, experiment upon them, combine them, recombine them, and improve them. Animals may possess the same abilities in germ, precission probably especially so, but the continuum going from animal to man is to be grasped

in terms of gradually higher mastering of abstraction. It must also be admitted, though, that this ability greatly enhances man's ability to commit errors, to be fooled, to lie. Of course, higher animals possess all these abilities, but abstraction adds the possibility for the construction of the enormous subdomains of discourse involving counterfactual universes: myth, religion, literature, science whose vast capacity for general truths mirrors an equally large capacity for general fallacies.

This would also conform well with Deacon's Baldwinian assumption: that the behavior-selection feedback in symbol using Homo Habilis communities acquired an extreme pace measured against evolution's normal velocity. For the active controlling and explicit experimenting on signs makes it possible to develop them significantly within one single biological generation, while the spontaneous historical aspects of language evolution (change in phonetic patterns, etymology etc.) is a much slower phenomenon, even if still quick as compared to biological evolution. Given this scenario, it seems reasonable to assume that a very strong selection pressure has prevailed against the increased possibility of fallacies, especially against the formal logical fallacies without any empirical content, but also against violations of basic linguistic constants like the subject-predicate structure^{xxiv}. All in all, these abstraction operations permit us to construct an indefinite amount of abstract objects, more or less apart from the actually surrounding world of here and now - and it permits us, by the same token, to construct explicit diagrams to bring these abstracta to the test, yielding the amazing increasing insight in empirical regularities as well as in formal and synthetic a priori laws of fallibilistic apriorism.^{xxv}

If this idea is correct, human beings are indeed a symbolic species, even if not the only one. Man is rather the abstract animal.

ⁱ It should be noted that this recursive definition of symbols does not correspond to Peirce's original account. In Deacon, indices are made out of icons plus icons holding between icons, and symbols, in turn, out of indices plus indices holding between indices. In Peirce, however, the three are irreducible, and the icon-index structure rather forms the internal anatomy of the symbol without being sufficient for its compositional definition.

ⁱⁱ So as for instance that the increase in brain size necessitating more protein made early man turn to a more carnivorous behaviour. While the *Männerbund* went hunting, the mothers nursing the children were waiting for protein to be brought home. The hunting man's gene pool was threatened, however, by his woman's possible unfaithfulness during hunt, and she and her child was correlatively threatened by protein undernourishment if he did not return. This situation calls for stabilization by marriage which in turn requires stable institutions guaranteed by language - in turn calling for (further) development of symbol use. This hypothesis is interesting indeed, but it includes many specific issues and premisses which is not our concern in this context.

ⁱⁱⁱ Baldwin was primarily known as one of the pioneers of child psychology. Incidentally, he was also one of Peirce's acquaintances and invited Peirce to contribute his many entries to Baldwin's influential *Dictionary of Philosophy and Psychology* (1901). Sometimes, Peirce expressed ideas not far from Baldwinian evolution: "For we must remember that the organism has not made the mind, but is only adapted to it. It has become adapted to it by an evolutionary process so that it is not far from correct to say that it is the mind that has made the organism." ("Abstract of 8 lectures", undated, NEM IV, 141)

^{iv} After *The Symbolic Species*, Deacon has refined the Baldwinian hypothesis assuming two phases often interchanging in complex evolution, involving the "masking" and "unmasking" of selection pressure on a specific gene (Deacon 2003). A gene may be masked by a learned behaviour which makes the effect of that gene superfluous. Deacon's example is early primates being introduced to fruit in the diet with the result that the gene governing Vitamin C synthesis in early primates (as in most other mammals) was masked against selection with the result that the gene degenerated. Now, primates were forced to stick to a Vitamin C rich diet in order to survive, a fact which unmasked a completely different gene, namely in the set of genes governing the anatomy of the retina. Now, colour vision all of a sudden became an advantage in order to get Vitamin C from red, yellow, and blue fruit on the green foliage background, and via two duplications of a retinal gene, primates became able to see colours. Genetic degeneration facilitated by masking is thus an important factor in evolution because it loosens genetic control over certain phenotypical features and allows self-organizing possibilities in the organism to experiment with new properties. Thus, Deacon conjectures that early symbol use in hominids masked genetically constrained stereotypical communication and thus allowed for the brain to self-organize in new ways giving rise to the growth of interconnectedness of the human brain – in turn making more complicated symbol use possible and thus unmasking other cerebral genes and exposing them to Baldwinian selection pressure from linguistically skilled group members.

^v It may even cover lower animals as well, cf. *E. coli*'s ability to swim upstream in a saccharine gradient which in Peirce's terms must be classified as symbolic with respect to

its *esse in futuro* – see ch. 9. See Harnad 1987 for a long range of investigations of categorical perception tied to behaviour - hence forming symbols - in many different species. The issue of the natural extension of Peirce's symbol concept is complex – as already discussed in ch. 2. There is no agreement upon it, and Peirce's own idea on the point seem to find symbols even in anorganic nature – an idea nowadays supported by John Deely. Thomas Sebeok tended to make semiotics co-extensive with biology, hence only finding symbols in biological nature. Deacon, in turn, heightens the distinctive limit to make symbols a human prerequisite. On this point, we support Sebeok's middle way.

^{vi} A further problem is that Deacon's reconstruction of the icon-index-symbol triad as referred above makes it compositional, so that higher sign types are presumed reducible to combinations of the lower. But if pure icons - so Peirce - are mere possibilities, taken by themselves, then the actuality dimension of indices can not be created by the composition of ever so many icons; correlatively, the general, future dimension of symbols can not be the result of a composition of ever so many actual, indexical moments. Peirce's description face the opposite direction: symbols are wholes, and icons and indices are moments of the symbol's anatomy.

^{vii} Deacon refers at length to the famous *Kanzi* case where a young bonobo on its mother's back learned the symbolic language which scientists were trying to teach its mother. There is little doubt that *Kanzi* is a symbol user, both in Deacon's and (less surprising) in Peirce's sense of the word.

^{viii} See, e.g. "Minute Logic" (1902):

"Reasoning, properly speaking, cannot be unconsciously performed. A mental operation may be precisely like reasoning in every other respect except that it is performed unconsciously. But that one circumstance will deprive it of the title of reasoning. For reasoning is deliberate, voluntary, critical, controlled, all of which it can only be if it is done consciously. An unconscious act is involuntary: an involuntary act is not subject to control; an uncontrollable act is not deliberate nor subject to criticism in the sense of approval or blame. A performance which cannot be called good or bad differs most essentially from reasoning." (2.182)

^{ix} Both must, furthermore, be distinguished from *induction* dealing with a series of related, empirical phenomena and proposing a probable law uniting them. Induction is often by empiricists confused with abstraction, but like Husserl (2nd LU), Peirce keeps these problems apart, and neither of the abstraction types have anything to do with extracting regularities from a set of examples.

^x The central quote is the following:

"The terms "precision" and "abstraction," which were formerly applied to every kind of separation, are now limited, not merely to mental separation, but to that which arises from *attention* to one element and *neglect* of the other. Exclusive attention consists in a definite conception or *supposition* of one part of an object, without any supposition of the other. *Abstraction* or precision ought to be carefully distinguished from two other modes of mental separation, which may be termed *discrimination* and *dissociation*.

Discrimination has to do merely with the senses of the terms, and only draws a distinction in meaning. Dissociation is that separation which, in the absence of a constant association, is permitted by the law of association of images. It is the consciousness of one thing, without the necessary simultaneous consciousness of the other. Abstraction or

precision, therefore, supposes a greater separation than discrimination, but a less separation than dissociation. Thus I can discriminate red from blue, space from color, and color from space, but not red from color. I can prescind red from blue, and space from color (as is manifest from the fact that I actually believe there is an uncolored space between my face and the wall); but I cannot prescind color from space, nor red from color. I can dissociate red from blue, but not space from color, color from space, nor red from color.

Precision is not a reciprocal process. It is frequently the case, that, while A cannot be prescinded from B, B can be prescinded from A. (...)"

^x_i We may note that in this argumentation, the three separation modes are tied to three different modes of presentation: imagining, supposing, and representating, respectively.

^x_{ii} Peirce's definition of the distinction abstraction types connects them intimately to a part-whole dependency calculus. This idea is exactly parallel to the connection between Husserl's 2nd and 3rd LU with the anti-empiricist abstraction theory of the 2nd (abstraction is not inductive generalization, abstraction is a special idealizing focussing act related to an object's properties) and the mereology of the 3rd (the properties thus grasped should be seen as different parts and moments of the object, and a calculus is possible to map these parts' internal relationships). This connection between abstraction and mereology is a highly original idea crucial for the possibility of a realist understanding of the cognition of abstract objects.

^x_{iii} "In general, precission is always accomplished by imagining ourselves in situations in which certain elements of fact cannot be ascertained." ("Supplement", 1893, 2.428) Precission thus is Peirce's version of Duns Scotus' famed "formal distinction"; it refers to a distinction made by the mind, but with a *fundamentum in re*.

^x_{iv} A simple example is the train of thought as follows: *a white particular thing* - (P) - *white things as such* - (A) - *whiteness*, with P for precission and A for abstraction. A more complicated example is hinted at in set theory and may be reconstructed as follows: *elements* - (P) - *belonging together* - (A) - *a set* - (P) - *bigger/smaller* - (A) - *multitude* - (P) - *relation to other multitudes* - (A) - *cardinal number* ... This example is reconstructed from "Consequences of Critical Common-Sensism" (1905), 5.534. The unlimited character of this abstraction process does not entail it is infinite.

^x_v So as for instance ("Consequences of Critical Common-Sensism" (1905), 5.534). The famous quote stems from the third interlude in Molière's last play, *Le malade imaginaire* which introduces a grotesque ceremony of doctors dancing and singing medical latin. Here, a medicine student answers a doctor's question as follows:

"BACHELIERUS/ Mihi a docto doctere/ Domandatur causam et rationem quare/ Opium facit dormire./ A quoi respondeo./ Quia est in eo/ Virtus dormitiva./ Cujus est natura/ Sensus assoupire. CHORUS/ Bene, bene, bene, bene respondere./ Dignus, dignus est entrare/ In nostro docto corpore." (Molière, p. 660); in my translation: "Bachelor/ Me the learned doctor/ asks about the cause and reason why/ Opium puts to sleep./ To this I answer/ That there is in it/ A sleep-inducing power/ Whose nature it is/ To weaken the senses./ CHORUS/ Good, good, good, good answer./ Honorable, honorable is it to enter/ into our learned society."

^{xvi} Peirce's theory of hypostatic abstraction thus forms a strong argument against the current fad in rhetorics where it is claimed that abstract noun use is just a showoff strategy trying to impress the reader with difficult wording (the opium argument of our time), while texts which express "the same" in more concrete terms are praised as more honest and easier to read. In a Danish context, the two writing styles are even hastily connected to males and females, respectively, rhetoricians taking the party of the latter. If this claim were true, it would do the feminist cause a questionable service, as abstractions are indeed necessary for thought to occur.

^{xvii} Roberts, p. 64.

^{xviii} Peirce has a primitive mereological intuition in so far he refuses to distinguish between parthood and elementhood (as in set theory) and sees those two as shadings of one and the same basic relation.

^{xix} Cf. e.g. "... I do not think that we need have any further scruple in admitting that abstractions may be real, - indeed, a good deal less open to suspicion of fiction than are the primary substances." ("Pragmatism Lectures" (1903), Peirce 1997, p. 136. This idea forms a very important phenomenological principle in Peirce: the objects to which we have direct access are neither completely abstract nor concrete; they are at different intermediate levels. Thus, both abstract objects and the concrete object are constructions reached by abstraction, and the ladder of levels is virtually bottomless; we have no guarantee that it terminates "downwards" in some elementary, atom-like entities. As collections are also abstractions, this consideration also goes for scalar properties. This idea is basically a mereological idea (whole-part relations are pertinent on all levels of observation or reflection) and fits nicely with Peirce's proto-mereological refusal of distinguishing element-of and part-of relations (like it was later formalized in Lesniewski).

^{xx} T.L.Short (1983) traces roots of this idea in Peirce's thought to the famous "How to Make our Ideas Clear" paper from 1878 where Short emphasises the crucial idea that "we *can* use ideas that are *less* clear to make other ideas *more* clear" (290). Thus, the fact that the higher, more abstract terms may be more clear than their concrete basis is a crucial insight in order to avoid infinite regresses and appreciate the role played by abstraction in Peirce.

^{xxi} Helmut Pape: "... the 'abstract in concrete form' brought about by a 'realistic hypostatization of relations' is a deductively valid form of reasoning which he at other places calls 'hypostatic abstraction' and which is now called class abstraction." (Pape 1997, p. 171) Pape explains in a note: "It is obviously deductively valid to conclude that, if there is a red rose, the class of red things has at least one member, namely, this rose." (182n). In the very same volume we read T.L.Short: "... neither is the inference to it logically necessary. Rather, that inference could be deductively valid only with the additional, logically contingent premiss that the regularity in question has an explanation (...) Absent that assumption, the inference is not deductive but an extreme case of what Peirce called 'abduction' ..." (297).

^{xxii} This should, of course, be taken to refer to reflective self-consciousness. Pre-reflective self-consciousness (cf. Zahavi 2000) as a moment of any conscious experience

is presupposed by reflective self-consciousness, and may probably, unlike the latter, be found in large parts of the animal kingdom and maybe even in lower organisms.

^{xxiii} The quote talks about “races”, but we should not take this as an indication that any idea of “racism” could be found in Peirce’s thought; he is merely using the word as coextensive with “culture” or “social or geographical group of people”, such as was a commonplace at the time.

^{xxiv} The Husserlian idea of a pure grammar - to some extent shared by Peirce - may make the Chomsky-Deacon conflict around grammatical innatism irrelevant. If there are indeed a priori rules for grammar, then we should expect evolution (biological as well as linguistic evolution) to conform to them in a gradual approximation, making the riddle of possible innate chunks of universal grammar easily understandable, because no empirical selection pressure will be needed for their articulation. This would correspond to the fact that we have learned elementary arithmetics and performs that easily without anybody wondering about the specific selection pressures giving rise to an “arithmetic module” in the brain. Terrence Deacon seems on the same track when toying with an “extraterrestrial” grammar valid for any speaking subjects whatever ...

^{xxv} The issue of the “semiotic missing link” is currently the object of intense investigation. A famous suggestion parallel to Deacon’s is Michael Tomasello’s idea that what separates man from other higher primates is the ability of *shared attention* during learning. Mother and child, for instance, may direct their attention to one and the same object, initiated by the child understanding the mother’s gaze direction or pointing gesture, while young apes would rather look at the pointing finger than at the object indicated. There is not, however, any common scientific language or set of criteria making us able to decide between such proposals – or even to decide whether they are mutually exclusive, reconcilable – or even maybe expressing related or identical ideas in different vocabularies. It would not be strange, for instance, if shared attention necessarily involved hypostatic abstraction – the explicit control necessary for the latter being provided by the common discursive field opened by the former. Here, further investigation, both empirical and conceptual, is necessary.