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Logic and Natural Selection

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Abstract. Is logic, feasibly, a product of natural selection? In this paper we treat this question as dependent upon the prior question of where logic is founded. After excluding other possibilities, we conclude that logic resides in our language, in the shape of inferential rules governing the logical vocabulary of the language. This means that knowledge of (the laws of) logic is inseparable from the possession of the logical constants they govern. In this sense, logic may be seen as a product of natural selection: the emergence of logic requires the development of creatures who can wield structured languages of a specific complexity, and who are capable of putting the languages to use within specific discursive practices.

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1. Where is Logic? Is it Inside of Something that Evolves?

Is it possible to see logic as a product of natural selection? The answer, of course, heavily depends on what logic is, and where we say it is to be found. If it is located

(a) in the real, inanimate world,

or

(b) in a Platonist realm of ideal entities,

then the answer is clearly NO. On the other hand, as human minds and human languages *can* be seen as shaped by evolution resp. natural selection, the answer may be YES provided logic resides

(c) in natural language,

or

(d) in the human mind.

There remains one more possibility, one which does not yield a clear answer, namely that logic is founded

(e) in some formal language.

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In the last case, the answer would depend on whether we consider formal languages to be principally expressive of some Platonist entities (in which case possibility (e) may collapse into (b)), or whether we consider them instead as constitutively regimentative of natural language (in which case (e) may merge with (c)).

But to be able to arbitrate between these five options, we must, of course, first be clear about what logic actually *is*. I do not intend to answer this in full generality in the present paper; nevertheless, I think that I may safely assume that logic crucially involves rules of inference such as *modus ponens*. Hence, let me reduce, for our present purposes, the question *where is logic*? to *where is modus ponens*?[1]

What is *modus ponens*?[2] It is the claim that the consequent of an implication follows (and hence is derivable) from the implication together with its antecedent. Symbolically, we can express it as follows

$$\frac{A \quad \ulcorner A \to B \urcorner}{B} \tag{MP}$$

where "$\ulcorner A \to B \urcorner$" denotes the implication with the antecedent A and the consequent B. But what kind of thing is the "implication"?; and indeed what kinds of things are A and B? Are we to construe the symbols "A" and "B" as mere *placeholders* to be *substituted for* by some symbols; or are they rather *names referring* to something? And what about "$\to$"?[3]

The most straightforward way of reading (MP) would take "A" and "B" for placeholders for formulas of a language that also contains "$\to$", so that "$A \to B$" becomes, through the substitution, a well-formed formula (and "$\ulcorner$" and "$\urcorner$" become superfluous). In this way (MP) would be a claim about a formal language, such as the language of classical propositional logic.

How do we know that (MP), construed in this way, is valid? Just trivially, for in this case (MP) would be either directly a part of the definition of the language, or it would be its trivial consequence (as when the meaning of "$\to$" is defined by the usual truth table). Hence in this case, (MP) would be utterly trivial and it would make no clear sense to see it as a pillar of a substantive theory, which logic is usually supposed to be. There are myriads of artificial languages with myriads of rules of this kind; hence to be one of them is no

[1] This is not saying that *modus ponens* is in any way 'logically minimal' in the sense that there would be no logic without it. For it is clear that at least within formal logic we can have systems without implication and hence without *modus ponens* (either in the sense that they do not possess implication as a primitive symbol, or perhaps even in the sense that they do not possess it at all). It would be more challenging to imagine a natural language without something like implication; however, it is not my present purpose to argue for its essentiality for logic.

[2] The considerations in this section draw on an earlier paper of mine, viz. [17].

[3] From this viewpoint, it would appear that it is the understanding of the kind of generality informing schemata like (MP) that may be the entering wedge to understanding the nature of logic. And indeed I think that once we are clear about what exactly such schemata can tell us, we get rid of many frequent misconceptions of what logic is about.

distinction. This indicates that the answer (e) would render (MP) a *trivial consequence of the definition of* "$\rightarrow$".

Hence, what if we see "A" and "B" as placeholders not for propositional symbols of an artificial language, but rather for sentences of a natural one, such as English? The trouble, then, would be that what "$\ulcorner A \rightarrow B \urcorner$" would yield us would not be an English sentence, but two English sentences connected by "$\rightarrow$". So, what about taking "$\rightarrow$" as a shortcut for an English connective, such as "if ... then ..."? This time (MP) would yield us an inferential rule for English sentences; but as English is an empirical entity, the validity of such a rule would be an empirical matter (and besides, this a matter that is basically uncertain[4]). Hence the result is that construed in this way, (MP) would be *not only an empirical, but also a dubious matter.*[5]

Can we amend (MP) construed in this way to neutralize the empirical factors? It is clear that to secure the validity of (MP) thus conceived we would need to exclude the cases where the compliance of "if ... then ..." with (MP) is dubious, hence we would need to presuppose—or stipulate—something about its meaning. We might perhaps stipulate directly that it obeys (MP), or that it respects the truth table for classical implication. But it is obvious that in this case we would be no better off than in the previous case of an artificial language—we would end up interpreting (MP) as a trivial claim, namely that this inferential rule is valid if "$\rightarrow$" regiments something that obeys it.

In view of this, we may think about relinquishing the view that (MP) is a schema into which we are to substitute sentences (for neither sentences of an artificial, nor those of a natural language are able to render it non-contingent and at the same time non-trivial), and assume instead that the signs "A", "B" and "$\ulcorner A \rightarrow B \urcorner$" are to be construed as referring to something. Perhaps propositions seen as inhabitants of some Platonist realm of ideal entities?

In order to make sense of this proposal, we need to assume, firstly, that we are able to recognize, among the inhabitants of our Platonic realm, propositions (let us grant this) and, secondly, that given we know the propositions referred to by "A" and "B", we can recognize the proposition referred to by "$\ulcorner A \rightarrow B \urcorner$". How would we recognize it? Perhaps we may assume that a proposition is something structured analogously to the sentence that refers to it; hence perhaps we could assume that the proposition we are looking for consists of the proposition A and the proposition B, with something in between them. But how do we recognize that the something in between them is an implication (and not, say, conjunction)? Can we assume that it somehow resembles the sign "$\rightarrow$"? Surely not; that we use this very sign for implication is a matter of our arbitrary decision. Hence it seems that the only way to recognize that the thing in between A and B is an implication is to find out how it behaves,

[4] Several objections to the claim that the English "if ... then ..." obeys (MP) have been raised. See, e.g., [13].

[5] Note that even were we to obtain results of some huge empirical research confirming that the usage of the English "if ... then ..." (by every or almost every native speaker) does obey (MP), due to the dynamic nature of natural languages there could well be a shift in usage between the moment the research was done and the moment we see its results.

in particular whether it obeys *modus ponens*. But at this point (MP) becomes trivial again.

Thus, maybe Platonist propositions are not the right choice for entities referred to by "A", "B" and "$\ulcorner A \to B \urcorner$". What about beliefs? Many authors favor this choice: they propose seeing (MP) as a "belief-forming mechanism" (see below). Is this the way out of our troubles? But we still face the same problem. Given A and B are two beliefs, which belief is $\ulcorner A \to B \urcorner$? How do we recognize the belief referred to by "$\ulcorner A \to B \urcorner$" or the component of belief referred to by "$\to$"? If we say that it is the belief that A implies B (where implication is something that obeys—perhaps along with other rules—(MP)), the triviality we earlier encountered looms again. That to believe B is reasonable given one believes A and $\ulcorner A \to B \urcorner$, *assuming that* $\to$ *is an implication* (*and hence obeys* (MP)) is beyond any doubt; but precisely because of this it does not seem to be telling us anything of interest.

What if the claim is that (MP) is a valid belief forming method, *without the presupposition that what* "$\to$" *refers to is an implication*? Well, obviously we *do* need to assume *something* about "$\to$"—for if it were to refer to disjunction, then (MP) would *not* be a valid method. Hence *what* is it that we should assume, if we do not want to assume directly that it is an implication? Here somebody may take recourse to the claim that one simply knows that a component of one's belief is an implication, just like one knows that one's perception, say, is a perception of a circle, or that a feeling is a feeling of pain. But this yields the suggestion that implication has something like what in philosophy of mind is called a *quale* (a peculiar 'look and feel'), and this does not seem to make much sense.[6]

It is clear that the situation would be the same if we saw "A", "B" and "$\ulcorner A \to B \urcorner$" as referring to elements of a Fodorian "language of thought".[7] We would still have the problem of distinguishing implication of this language from other connectives. Again, being unable to assume that it would have a particular *look*, we would have to individuate it in terms of its *behavior*—and it is hard to imagine how this could be done without using either (MP) itself, or something that has (MP) as a trivial consequence. As a result, we would again have to read (MP) as the claim that if "$\to$" obeys (MP), then (MP) holds for it. Hence again, (d) does not seem to be a viable option.

Now consider the remaining option ((a) in the list above), namely that "A", "B" and "$\ulcorner A \to B \urcorner$" refer to some items within our physical reality. For the referents of "A", "B", we might think, together with Russell, about something like *facts*. But what about "$\ulcorner A \to B \urcorner$" and indeed "$\to$" itself? Suppose that the dependence between facts that we call *causality* resides (*pace* Kant and many others) in the world. Suppose (*pace* many more philosophers) that relationships can be pointed at, just like individuals can. Could we treat "$\to$"

[6] The usual *qualia* can be at least approximated; we can try to describe and categorize our impressions or feelings. Nothing of this kind seems to be possible w.r.t. implication.

[7] See [7].

as a name of this relation and construe (MP) as claiming that whenever there is a cause, then there is its effect?

There is a number of grave obstacles accompanying this idea. First, if we are to make this kind of sense of (MP), then we cannot make do with facts, we would have to admit that "A" and "B" could refer also to merely *potential* facts. (If the referents of "A" and "B" were restricted to facts, i.e. if we were allowed to apply (MP) merely to *true* sentences, then there would be no reason to apply it at all, because we would always know in advance of its application that its conclusion is true.) But then we are dangerously close to saying that they refer to propositions, which, as we have already seen, falls prey to the problems outlined above.

2. Logic as a Matter of Concepts; "Semantiogenic" View of Logical Laws

Summarizing the considerations of the previous section, it seems that we face a dilemma: either we can see (MP) as a trivial consequence of a definition (which does not seem to be an attractive option, for it threatens to render (MP), and, by way of generalization, the whole of logic, trivial); or we can see it as a contingent claim that may be refutable on an empirical basis (which again lacks attraction). However, our considerations have not revealed the possibility of any other option—so it seems that here we have a real *tertium non datur*. What we are facing is the *dilemma of triviality or contingency*.

Let us recapitulate these considerations on a more general level. Given (MP) as we formulated it above, we must specify what exactly it is that is to be substituted for "$\rightarrow$" or what this sign is to refer to (call such an item *implication*). Obviously, there are two possibilities: either we may take (MP) as taking part in this specification, which results into the triviality of (MP); or we assume that the specification is independent of (MP). Only in the latter case can (MP) then be taken as a nontrivial, substantial claim.

How can we specify implication without making use of (MP)? Perhaps there is something, within the world around us, that has already been called *implication* (and thus can be—literally or metaphorically—pointed at), and has been so-called not directly with the help of (MP). The only thing of this kind I can see is the English connective "if ... then ..." and its counterparts in other languages. In this case, the validity of (MP) is obviously a contingent matter, to be verified by empirical means.

But maybe we cannot *point at* an implication, but we are in possession of a criterion that enables us to single it out from among other things? Then there are, again, two possibilities: either the criterion is a matter of how it *looks* (its *form*), or it is a matter of something else (its *content*, what it *stands for*, how it *behaves*, or *how it is used*). Can implication, in general, have a specific *look*? Surely not, if it is to be seen as a linguistic item—we know all too well that any kind of look would do, and that candidates for an implication in actual formal and natural languages look very different. But also if we see it as a non-linguistic item (an ideal object of a Platonist realm or a mental content), the idea that it has a specific *look* seems to be far-fetched (putting *implicationhood* side by side with *redness* or *circularity* appears to be an exercise too mind-boggling to be taken seriously).

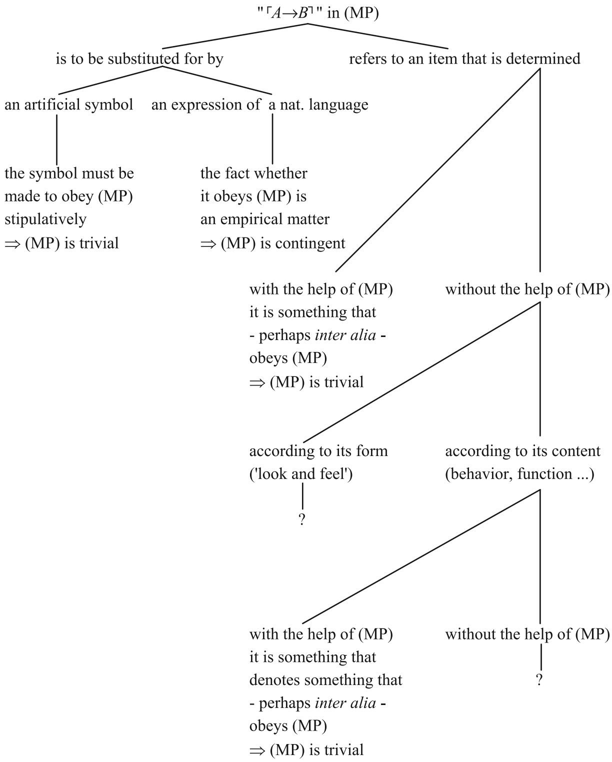
Hence it seems that implication must be identified by means of something other than its form. But by means of what? Its meaning? (Let us note that this makes straightforward sense only if we construe implication as a linguistic item, it is not so clear that it makes sense if we construe it as a mental or ideal entity—for such an object may be more prone to *be* a meaning than to *have* a meaning. But this is not worth dwelling on now.) So what must an item mean in order to be an implication?

One answer is that it must *stand for* something or *represent* something. What could an implication represent? Perhaps the well-known truth table for material implication? (This would yield equating implication with its material variety, which would prevent us from talking about, e.g., intuitionist implication, but let us waive this.) But if this were the case, the triviality of (MP) would be forthcoming again. Another answer might be that it must *function* in a certain way. And here it is hard to imagine the specification of the functioning of implication which would not involve, directly or indirectly (MP). All in all, *contingency* or *triviality* of (MP) appear to be the only two options.

I suspect that many of the discussions about the nature of logical laws are fuelled by the implicit assumption that there *is*, somewhere in the Platonist realm or in the structures constitutive of the human mind, an item that is *essentially* implication, but for which we must establish (albeit not empirically) whether it obeys (MP). I hope that the above considerations help render such an assumption essentially dubious: *implication* is a *functional* concept, and hence it makes no sense to say that something falls under it *essentially*, irrespectively of what function it has. The view underlying such an approach to (MP) seems to me to be the one that Wittgenstein [25, p. 40] ridiculed as "logic as a kind of 'ultraphysics"'—the view that in addition to empirically investigating objects of the physical world that we can ostensibly identify (as we do within natural science) and computing with ideal objects that we must identify by means of definitions (as we do in abstract mathematics), we can also investigate an intermediary realm that is accessible somehow 'quasiempirically' (we can put its denizens somehow 'in front of our mind's eye', point at them and check them for their properties[8]).

[8] See [14] for a discussion of this.

We may summarize the above considerations into the following diagram:



Hence it seems that to avoid the dilemma of *triviality* or *contingency* we would have to be able to fill in the place held by at least one of the two question marks in this diagram; which I do not think can be done. And as I do not think the second horn of the dilemma can be embraced (I hold the attempts at construing logic as an empirical science, perhaps empirical psychology, as shown to be fruitless, already by Frege), I am convinced we are left with the first one.

The first horn, the *triviality* horn, consists, to recall, in accepting (MP) as a trivial consequence of the definition of "$\to$". According to this view, it is an inferential pattern that grants implication the meaning it has, and (MP) is a matter of this meaning. This is, in effect, the kind of construal of (MP) that Horwich calls "semantogenic".[9] This leaves us with (c) and (e) as the only options—and given this, it does suggest that logic is located in something that might be considered as a product of evolution. We will return to this result later. Now the question is whether the trivial, semantogenic construal of (MP) and logic in general can be made fully plausible.

[9] See [10].

3. The Space of Reasons

We have to defend that the *triviality* horn of our dilemma is less hopeless than the *contingency* horn. Does it not lead to the conclusion that logic boils down to trivialities? A conclusion to which it leads beyond doubt is that *obeying* (*MP*) is the same thing as *having implication*, and more generally, that *being governed by the laws of logic* is the same thing as *having a certain interlocked battery of* (*logical*) *concepts*. Does saying this amount to saying that logic is trivial?

I do not think so, for while this standpoint does render (MP) a trivial consequence of the definition of implication, the actual possession of implication has nontrivial consequences: for the possession enables our thought to operate within a complex and interlocking conceptual scaffolding, thereby raising it to a brand new level—to become what we call *rational*.[10]

Consider, for the sake of comparison, chess. Is the rule that a bishop can move only diagonally in any sense special? Just as (MP) is merely a trivial corollary of the definition of the concept of implication, so this rule is simply a trivial corollary of the delimitation of what it takes to be a *bishop*. A bishop is *nothing else* than a piece that can move only diagonally, and this is what the rule unpacks. Moreover, the same rule was used to (co-)constitute the role of bishop in the first place. Is this role particularly special? It does not seem so. It represents just one of a vast number of possible ways to restrict the moves of a piece over a board.

However, there *is* a sense in which this rule is special; it constitutes, together with certain other rules, the game of chess. This game *is* very special: for many people it is the most intellectually stimulating enterprise of this kind we humans have ever devised. It is reasonable to presume that the balance of the rules of chess is distinctive—that even a slight change in any of them might lead to a significant distortion (whereby I do not mean to exclude the improbable possibility that some changes of the rules might make the game even better). In this sense, any of the rules is special insofar as it takes part in this distinctive edifice.

Our language is an edifice unique in a similar sense. It is an essential part of the equipment of us humans differentiating us from other animal species. And though individual natural languages differ, there seems to be a backbone that they are bound to share (and here I do not mean a *grammatical* backbone on the lines of Chomsky's "universal grammar", but rather a *semantic* backbone). It is, for example, hard to imagine a language without anything like negation; and indeed without anything like implication. More precisely,

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[10] In this sense, my view is close to that of Hanna [9] who claims that we humans posit a distinctive "logic faculty". However, what I do not find intelligible is Hanna's understanding of this faculty as something wholly independent of our "language faculty". For me, the rules of logic are always also rules of language.

it is easy to imagine something like this, but it is difficult to imagine that it would warrant the name *language* save metaphorically.[11]

How can we characterize this backbone of the edifice of language more explicitly? Negation, implication, conjunction etc. all presuppose a framework of inference (or consequence[12]): we have seen that the concept of implication is one side of the coin the other side of which are rules like (MP); and similarly for other logical operators. As the relation of *being correctly inferable from* can be seen as the inversion of the relation *being a reason for* (to say that B is correctly inferable from A is to say that A is a reason for B), we can speak about the space they underpin, together with Sellars [22, p. 159], as about the *space of reasons*.[13]

Note also that our semantogenic understanding of logical rules leads us to the view that the meanings of logical constants—the *concepts* they express, if you want to call them thus—are effectively *roles* conferred on the constants by the logical rules governing them. Thus, our emerging understanding of the concept of implication as co-constituted by (MP) leads us to grasping the concept as an inferential role established by (MP) plus some other rule or rules.[14] The Sellarsian view, which we endorse here, then generalizes this paradigm to the whole of language: meanings are recognized as functional roles in general (in the case of non-empirical expressions, such as logical constants, they are roles conferred on expressions exclusively by *inferential* rules, while for empirical expressions there are some additional role-conferring rules concerned with connecting the expressions to the world).

It follows that especially *propositions* are understood as roles: they are the kind of roles that certain expressions come to instantiate once the language in question acquires the requisite logical structure, once it is turned into the

[11] This claim is related to Davidson's argument against relativism (see [6]): if we are not able to interpret something, i.e. to detect at least the most basic structure of what *we* call language in it, then why should we think of calling it *language*?

[12] Let me, in the present context, neglect the difference between consequence and inference. (I have dealt with them elsewhere; see [16]).

[13] See [23] for a broader context. See also [18].

[14] What can be added to (MP) to complete the role-delimiting set of rules is, for example, the usual

$$\frac{\begin{matrix}[\mathrm{A}]\\ B\end{matrix}}{A \to B.}$$

Alternatively, we can follow Koslow [12] and instead of adding a rule add the condition that implication is the *weakest* sentence fulfilling (MP) in the sense that if for any other C

$$\frac{A \quad C}{B,}$$

then

$$\frac{C}{A \to B.}$$

space of reasons. A sentence comes to play the role of a proposition—to express a proposition, if you prefer this mode of expression—once it has a negation, can be conjoined with other sentences, can imply other sentences etc. *Concepts*, then, are the roles parts of sentences come to play once the sentences start to play the roles of propositions. Hence from this vantage point, propositions and concepts are not independent entities stood for by expressions, but rather roles of the expressions. Propositions are the roles sentences acquire once they become elements of the space of reasons, i.e. of the space constituted by the most general inferential rules constitutive of the logical vocabulary of language; and concepts are roles subsentential expressions acquire once they become constituents of such vertices.[15]

Of course, taking a more abstract stance, we can see propositions and concepts as ideal entities independent of natural languages. A proposition thus conceived is a vertex of a certain complex abstract structure, the edges of which are constituted especially by the relation of inferability induced by rules of inference. It is simply a node of a structure of inferential relations, an intersection of the relations of negation, conjunction etc. And it is this structure that comes to be embodied by human languages, in a certain stage of their development. In this mode of presentation, we can see sentences of human language as coming to express propositions; but we should still keep in mind that this "express propositions" is nothing over and above "instantiate roles", roles that become available when logical relationships among the sentences become sufficiently complex.

In this way, the space of reasons (made up of propositions governed by the relation of being-a-reason-for/being-inferable-from) transforms our thinking, not only by introducing a new mode of thought, *viz.* reasoning, but also by furnishing us with propositions and consequently concepts, that become essential 'vehicles' of our thoughts. Indeed, propositions and concepts can be seen as molded by the space (often, to be sure, with the employment of empirical material). And consequently, one who is in possession of logic (which means in possession of a language with a logical structure) rises to a brand new level of thinking.

4. Objections to the Semantogenesis of Logical Rules

The most frequent objection to the semantogenic explanation of the validity of rules like (MP) is what has been called by Boghossian "bad company"[16]: if we admit semantogenesis, so the objection goes, then we will open the door to disasters generated by various monster-concepts. The most well-known of such monster-concepts is Prior's *tonk*,[17] the addition of which to any language

[15] See [15] for a more detailed discussion.
[16] See [2].
[17] See [19].

makes it collapse, in the sense that everything becomes inferable from everything.[18]

We will argue against a general version of this objection (where you can have many other 'problematic' operators in place of *tonk*), but first let us observe an interesting thing about *tonk*: (MP) itself can serve as a variant of the elimination rule for *tonk*. This is to say that introducing, aside of (MP) as formulated above, also the rule

$$\frac{\ulcorner A \to B \urcorner}{B} \tag{MP*}$$

we turn → into a version of *tonk*, making everything inferable from everything. Hence not only can we have malicious inferential patterns; but (MP) itself can easily be made part of such a pattern.

This indicates that the problem is not so much with individual inferential rules, but with inferential *patterns*. (And indeed, the literature on proof theory is abundant with proposals on how 'well-behaved' patterns, i.e. patterns whose stipulation will not have the disastrous effects of the *tonk* kind, should look - the key words are *harmony*, *normalization* etc.) But this only reinforces the claim made above: that talk about the viability of (MP) makes nontrivial sense only on the background of the assumption that → is an implication (or indeed some other specific kind of operator); where in the proof-theoretic contexts this amounts to fixing other inferential rules governing the sign.

Does the "bad company" argument undermine our semantogenic construal of (MP)? Not really. Every expression introduced by an inferential pattern has, in virtue of the pattern, an inferential role. Some of the roles, like that of *tonk*, are pernicious; but they are roles nevertheless. Consider a rule that might be added to chess: whoever first moves a rook, wins. This rule essentially changes the role of rook, so let us call the new role *winrook*. It is very unlikely (though not inconceivable) that a winrook would be a part of an interesting alternative of chess. And similarly, it is unlikely that *tonk* might be a part of an interesting alternative to our language. (Though we must be aware of the fact that a rule always operates on the background of other rules and that weird behavior of a rule on the background of a set of rules might be partly or wholly neutralized by changing the background set of rules. Thus, as Cook or Wansing have shown, the effect of *tonk* ceases to be straightforwardly disastrous once we suspend some structural rules[19]).

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[18] The connective is governed by the following two rules:

$$\frac{A}{A \ tonk \ B} \qquad \frac{A \ tonk \ B}{B.}$$

Putting this together obviously yields us

$$\frac{A}{B,}$$

for every A and B; hence in any language containing the connective any sentence is inferable from any other.

[19] See [5] and [24].

Taking this approach seems to imply that logic is a 'more or less' matter, which would appear to be as unwanted a consequence as the contingency of logic. This is true, but to a lesser extent than it might at first seem. It is possible to think of "variant logics", analogously to "variant chess".[20] But note that to create a variant of the chess game that would not be trivial and that would be sufficiently interesting to compete with chess is not an easy thing—it is definitely not a matter of randomly subtracting, adding or modifying the rules of chess. Most of such changes would lead to a game that would be either utterly trivial (like our variant of chess with winrooks), or just a pale comparison to chess. The reason is that the uniqueness of chess consists not in the individual rules, but in the way the rules interlock; and tampering with any one of the rules might easily disturb the delicate equilibrium yielded by the interlocking.

In the same way, the rules of logic institute a delicate equilibrium, an equilibrium that is present in natural languages in less perspicuous forms and that we strive to represent in idealized forms by the formal languages of logic. From this perspective, the concepts expressed by our usual logical operators *are* concepts (they are roles within this complex edifice), whereas the one expressed by *tonk* is *not* a concept (it is a role within a trivial structure). But it is also possible to admit the latter as a kind of concept (that is, however, in contrast to the former ones, quite useless).

In this sense we can say that implication is a universal human possession; and in that sense also that (MP) is universal. True, as we have already seen, the specific devices individual languages possess (like the English "if ... then ...") may not be such that they would unexceptionally obey (MP); but (MP) seems to be a part of what results if we present the most basic semantic structure of such a language in an idealized form. However, it is impossible for a being to be considered a rational, thinking creature unless it is in possession of some logical machinery, i.e. unless it 'lives' within the space of reasons.

To elucidate this standpoint a bit more, let us consider the elaboration of the "bad company" argument provided by Schechter and Enoch [21]. The authors claim that semantogenesis amounts to the following "Meaning-Justification Link" and argue that this link is not generally feasible and that there is no natural way to restrict it:

> "(*Meaning-Justification Link*) If a belief helps to constitute the conceptual role for a concept, any thinker possessing the concept is justified in holding the belief. If a belief-forming method helps to constitute the conceptual role for a concept, any thinker possessing the concept is justified in employing the method."

Let us now inspect whether the "Link" adequately expresses our semantogenic view, and if yes, what restrictions are implied. Let us start from a wholly trivial claim implied by our approach:

[20] See [20].

(*Triviality*) If a rule (of a language game) helps constitute a role for a word, anyone who uses the word in this role endorses the rule.

This is trivial simply because using a word in a role constituted by some rules is nothing over and above endorsing the rules (hence talking about roles is only another way of talking about the corresponding rules). Especially this is true of *inferential* rules.

Now note that according to our construal of propositions, it is rules that make up propositions—propositions are simply roles constituted by rules. Hence such rules can be called *proposition-forming*. Moreover, once sentences come to instantiate propositions, the roles of the words and expressions figuring in them come to be called concepts; hence we have

If a *proposition-forming* rule helps constitute a *concept*, anyone who *has the concept* endorses the rule.

Now to proceed towards Schechter and Enoch's "Link", we need to replace the term "proposition-forming rule" by "belief-forming method". This is a non-trivial step, for rules, though constitutive of propositions, are in general not instructions on how a subject is to constitute them; rather they form the (inter-subjective) scaffolding of the space of reasons molding propositions. However, we have seen that the flip side of the coin the front side of which is the relation of being-inferable-from is the relation of being-a-reason-for; hence inferential relations *can* be seen *also* as something that *establishes* propositions as substantiated for a subject - and thus perhaps make them into the subject's belief. Hence we can move to

If a *belief-forming method* helps constitute a concept, anyone who *has the concept* endorses the *method*.

The last step needed to get from this to Schechter and Enoch's "Link" is replacing "endorses the method" by "is justified in employing the method". (I ignore the difference consisting in the fact that our formulation employs the term "a concept" instead of "the conceptual role for a concept", for I cannot imagine what the latter can mean over and above the former). It is this step that is, I think, the key to understanding the true nature of Schechter and Enoch's "Link". Perhaps the fact that we endorse a rule (and consequently the reasoning based on it) may be seen as a sort of justification, but if so, it is a justification only in a very weak sense of the word. What we call justification in the fully-fledged sense can take place only within a space of reasons, and hence *presupposes* a framework of rules of this kind, i.e. it cannot support them, for, contrariwise, it must be supported by them.

Bringing this ambiguity of the word "justified" to light can also clarify what is going on in semantogenesis. Reading this term, within the "Link", in the first of the above senses amounts to reading it as what our "Triviality" gets transformed into, provided the complex of rules of which the given rule is a part reaches the threshold of the space of reasons. On the other hand, if we read the term in the second sense, then the "Link" becomes simply unsatisfiable—this kind of justification cannot occur outside of the framework of logic and hence the rules of logic cannot be justified in this way.

5. Universal Logic?

A common approach to the idea of universal logic, which has become popular in recent decades, is fuelled by the thought that just like we have generalized the structures dealt with by traditional algebra to gain an utterly general theory of algebraic structures, so we can generalize the structures dealt with by traditional logic to gain an utterly general theory of *logical* structures.[21] This idea is promising, especially as it resonates with the recent fruitful tendency in logic to assume ever more abstract vantage points over the specific structures logic studies. However, I do not think that taken literally, it is viable. If we generalize the structures dealt with by logic, we do not end up with universal *logic*, but rather again with universal *algebra*. Let me elaborate.

What is universal algebra? It is the study of the most general laws governing all kinds of algebraic structures (and how special instances of such structures are differentiated), such as those dealt with in various traditional mathematical field.[22] A general algebraic structure can be seen as a set of objects (the carrier of the algebra), a set of relationships over the carrier and a set of operations over the carrier. (Details are unimportant for us.) Specific algebraic structures are then based on various kinds of specifications: thus, for example, a *lattice* has no relations, it has the operations of join and meet, and, moreover, these operations fulfill certain conditions.

Can we have an equally general concept of logical structure and see various traditional logics as its specifications? Well, why not? We can start from classical logic, *viz.* from a structure consisting of, say, a set (of 'sentences') plus a unary operation ('negation'), and three binary operations ('conjunction', 'disjunction' and 'implication') fulfilling a certain set of restrictions. (Alternatively, we could concentrate on the algebra embodying the *semantics* of classical logic, *viz.* the two-element Boolean algebra of truth values.) Now we can add, say, intuitionist logic and seek a structure such that both classical logic and intuitionist logic will be its special cases. This structure will have the same assortment of operators, but with more general versions of the restrictions. Taking modal logic on board, we will have to allow for an extended number of operators, etc.

Continuing such generalizations long enough, we may finally end up simply with the general concept of algebraic structure that underlies the theory of universal algebra. So if universal logic is not to collapse into universal algebra, we have to stop *somewhere* on this way. But where? Are we to require that there be limits to the number or to kinds of operators a logical structure has? Well, it is clear that usual logics work with rather restricted sets of operators, but we also know logics with infinite numbers of operators (e.g. certain multimodal logics). So where is a clear boundary between universal logic and universal algebra?

True, we can expect that anything worth the name *logic* will have something at least remotely resembling some of the classical connectives, but does

[21] See esp. [1].

[22] For classical expositions, see, e.g., [8], or [4].

this give us a concrete stop block which would bounce us off on the way to universal algebra? I do not think so. The only way to end up with something very general, but still interesting from the point of view of logic is to extract such a stop from our factual situation—to say that an algebraic structure is in the purview of logic only if it is in some way instrumental to the enterprise of mapping our space of reasons.

I think the idea that the realm of logical structures is somehow naturally separated from the much more inclusive realm of more general algebraic structures may just be another version of the 'ultraphysics' conception of logic mentioned above: of the conception that logic is a quasi-empirical description of a 'non-empirically observable' realm. In contrast to this, I offer a different picture: structures that are reasonably called logical are those that we can and do usefully apply to the study of the most general, topic-neutral semantic rules of natural languages. It seems that, as a *matter of fact*, there is a certain structure or a family of structures, that are distinguished not from a formal viewpoint, but from the viewpoint that they sustain the delicate equilibrium of rules that provide for the upgrading of our thought to the level of a rational, propositional, and reasons-based process.

Needless to say, this delimitation is vague, due to the vagueness of the expression "usefully applied". But this, I think, is inevitable: the vagueness is the result of the fact that we extract the bounds of logic, as it were, from our everyday world. Despite this, I think there is validity in talk of universal logic: it is the common normative backbone of every natural language worth its name, the backbone that acts as the scaffolding thanks to which we can ask for and give reasons, and hence become rational.[23]

6. Conclusion

I conclude that logic is a matter of the most general rules of human languages and especially of a certain sophisticated, interlocked edifice of these rules that appears to be, in such or another form, embodied in all human languages. This

[23] Above I warned against construing logic on an empirical basis; do I now not plead for this kind of construal myself? Am I not claiming that studying logic is studying some structures of empirical languages? Well, there is a sense in which I do, but this is a sense very different from the straightforward empirical construal of logic that I have rejected. I claim that what we are to study are certain *rules* of the languages; and, what is more important, we cannot do it save at the same time *following* the rules. There is no *studying*, no *describing*, no *explaining* save within the framework of these rules, as embodied in our language and consequently our thought.

It is important to keep in mind that logic is, in an important sense, something we cannot take distance from. Thus, if, for example, Kleene [11, p. 23] suggests that to be able to treat logic mathematically "we simply put the logic which we are studying into one compartment, and the logic we are using to study it in another", then there is no guaranty that what he is going to obtain really will be the logic which is "used as a tool of organizing scientific knowledge and as a tool of reasoning and argumentation in a daily life" he insists it should be. The point is that the logic we have to study *must* be the very logic we are using.

is the edifice constitutive of what Sellars called *the space of reasons*, which has enabled us humans to upgrade our thinking to reach a level qualitatively quite different from any previous one—to the level of propositional, conceptual and rational thought. From this viewpoint, logic is, I think, the result of natural selection. This opens up a huge and as yet under-explored territory for the study of its evolution. (There has been plenty of literature devoted to the evolution of language and thought, but only very little dealing with the development of the most basic semantic structures amounting to logic. I suspect that this is due to our still very restricted understanding of *behavioral correlates* of semantics and logic[24]). Hence, although I support the idea of something like *universal logic* and agree that we can see this logic as a matter of some general algebraic structures, nevertheless we should not approach this enterprise as an exclusively algebraic matter—algebra is beyond doubt a valuable tool for studying logical structures, but what makes the studies *logic* in the first place is their anchoring within human argumentative and discursive practices.

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