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Inferential Acts and Inferential Rules. The Intrinsic Normativity of Logic

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Abstract: We outline a *pragmatic-normative understanding of logic* as a discipline that is completely anchored in the sphere of action, rules, means and ends: We characterize inferring as a speech act which is in need of regulation and we connect inferential rules with consequence relations. Furthermore, we present a scenario which illustrates how one actually assesses or can in principle assess the quality of logical rules with respect to justificatory questions. Finally, we speculate on the origin of logical rules as a means of supporting our practice of inferring.

Keywords: Logic, normativity of logic, inference

1 Goals and Outline

We pursue two goals: First, we want to present the outlines of a *pragmatic-normative understanding of logic* as a discipline that is completely anchored in the sphere of action, rules, means and ends: We characterize inferring as a speech act (*section 2*) which is in need of regulation (*section 3*). Furthermore, we connect rules for inferring with consequence relations (*section 4*). Second, we want to flesh out our account of the nature of logic to some extent: We present a scenario which illustrates how one actually assesses or can in principle assess the quality of logical rules with respect to justificatory questions (*section 5*). In the final section, we speculate on the origin of logical rules as a means of supporting our practice of inferring (*section 6*).

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2 Inferences as Speech Acts

Logic is concerned with *inferring*. Inferring is a linguistic activity and inferences are *speech acts*.[1] In our multi-layered and diverse discursive practices, inferring always occurs together with the performance of other kinds of speech acts, e.g. assertion, denial, assumption and adduction. Together, inferences and such other speech acts form *sequences of speech acts*, for example arguments, explanations and reports. We illustrate the role of inferring using a simple example:

[1] Example 1: Willy

1	It holds	Willy is a mammal
2	Since	For everything holds: If it is a whale, then it is a mammal
3	Thus	If Willy is a whale, then he is a mammal
4	Since	Willy is a whale
5	Thus	Willy is a mammal

In the opening line of the argument the author claims that Willy is a mammal. 'It holds' is the *assertion operator* (or *indicator*), 'Willy is a mammal' is the *asserted proposition*, the *thesis*. The rest of the argument serves to prove the thesis to be true.[2] In the second line, the author brings an available truth into the argument or, more precisely, he *adduces* a proposition that is already established (or taken) as true. The *adduction operator* is 'Since', the adduced proposition or the *reason* is that all whales are mammals. In the third line, the author infers for the first time. The *inference operator* is 'Thus', the inferred proposition is an if-then-connection concerning Willy: From the proposition of the sentence in the second line, the *premise*, the (intermediate) *conclusion* in the third line is inferred. The move from line 2 to line 3 is an *inference*. In line 4, the author adduces another available truth, this time directly about Willy, in order to infer the proposition asserted at the beginning of the argument. The inference to the last line has not just one but two

1 'Inference' is also used to refer to the linguistic entities through whose utterances acts of inference (or inferential acts) are performed.

2 Note that we use 'proposition' in a somewhat unusual way, namely to refer to the expressions that are uttered with a certain illocutionary force, e.g. asserted, assumed, adduced and inferred. We reserve the more usual 'sentence' for those expressions which result from the application of a force indicator to a proposition (see below).

premises, namely the proposition inferred in line 3 and the proposition adduced in line 4.[3]

In the argument, two reasons are adduced, which then serve as premises. The argument also includes two inferences, and thus two conclusions. The conclusion of the first inference serves as one of the premises for the second inference. Altogether, the argument includes three premises, one inferred and two adduced. Thus, not all propositions that serve as a premise in an inference in an argument are also adduced as reasons in that argument: The premises for an inference can be adduced, inferred or merely be assumed 'for the sake of the argument'.

The argument itself does not consist of propositions, but of sentences, i.e. those expressions by whose utterances the speech acts of assertion, adduction and inferring are performed. Sentences (in standard form) are composed of force operators, here: assertion, adduction, and inference operator, and the propositions uttered with the respective force, e.g. asserted, adduced and inferred.

Inferences are parts of arguments. However, they occur not only in arguments, e.g. in justifications, proofs, refutations, but are also found in other discourses, such as explanations, descriptions, thought experiments, discussions. You could almost say: Where there are discourses, there are inferences. *Inferring is the act typical for all discourses*.

One indication of this is the large number of natural language inference operators: so, thus, hence, therefore, consequently. You can easily continue the list.[4] Logic is *thus* concerned with the act typical for discourses. Inferring is an *overfamiliar act*. Overfamiliar are actions we perform again and again, and which for this

3 Obviously, inferences are speech acts through whose performance an author proceeds from one state of discourse to another, which holds as well for the other speech acts considered here. However, assertion, assumption, inference, and adduction are all 'simple' speech acts that are performed by uttering a certain proposition with a certain illocutionary force. Thus, in particular, assumption and inference are not speech acts which operate on other speech acts, e.g. assertion (or judgment). This contrasts with the account of, for example, Martin-Löf 1996, where assertions (or judgments) and not propositions are the objects of assumptions and inferences.

4 Given the exposition in the next chapter, one can "characterize logic as the science of the meaningful use of the word 'therefore' (and of the words of other languages that functioning correspondingly)" (Strobach 2013, 11; our translation). However, this does not warrant the following thesis: "Whenever a person meaningfully uses the little word 'therefore' (or 'hence') between sentences, he claims to have put forward a *valid inference*" (Strobach 2013, 11; our translation). Someone who utters 'Thus Willy is a mammal' in the last step of [1] and thereby infers the proposition 'Willy is a mammal' does not put forward a claim about the validity of an inference, but performs a valid inference. The metalinguistic performance of claims about properties of inferences is not to be confused with the performance of object language inferences—the latter, but not the former being strictly unavoidable in our discursive practices (for a defense of this thesis see Meggle/Siegwart 1996, 965–985).

very reason often go unnoticed and are accessible only through special reflective efforts.

3 Inferential Rules

Our discursive practices run smoothly lots of times—but not always. This also applies to inferring. This act can also fail. Again, a simple example:

[2] Example 2: The poor Pope

1	It holds	The Pope is a Protestant
2	Since	For everything it holds: If it is a Protestant, then it is a Christian
3	Thus	If the Pope is a Protestant, then he is a Christian
4	Since	The Pope is a Christian
5	Thus	The Pope is a Protestant

Whoever infers in such a way surely infers wrongly! But why are the inferences in [1] that lead to the proposition that Willy is a mammal in order, while at least one of the inferences to the proposition that the Pope is a Protestant seems objectionable? After all, at least at first sight, they seem to be quite similar.

A first answer: The inferences to the proposition that Willy is a mammal are licensed by our usage of 'if-then' and 'for all', while the second inference in [2] is not covered by our usage of 'if-then'. If we assume that this usage is captured by logical rules, we might say that the final inference to the proposition that Willy is a mammal is covered by an inference rule, whereas the final inference to the proposition that the Pope is a Protestant is not covered by this (or any other accepted) rule. In both examples an instance of a universal proposition is inferred in the move from line 2 to line 3. The rule of *universal instantiation* (or *universal quantifier elimination*) can be formulated informally as follows:

[3] Rule of universal instantiation

If one has reached a universal proposition, then one may infer each of its instances.

The final inference in the Willy example satisfies the rule of *modus ponens*, which is stated under [4], it is the *bedrock of all rules of inference*.

[4] Rule of modus ponens

If one has reached an if-then proposition and also its if-part, then one may infer its then-part.

The inference to the proposition that the Pope is a Protestant does not comply with this rule. Moreover, it does not comply with any other *accepted* logical rule: and an inference that does not comply with any accepted rule is prohibited.

The logical rules form an ensemble of permissive rules that is connected with an *interdiction principle*: Inferences that are not allowed are prohibited. By the way, the inference to the proposition that the Pope is a Protestant, which is thus marked as prohibited or incorrect, has, because of its frequent occurrence, even a name: *fallacy of affirming the consequent*.

Logical rules are rules—and thus *normative* statements of a general nature (cf. Siegwart 2011). With regard to their deontic status they are *permissive* rules. However, as just mentioned above, the entire set of rules is subject to the interdiction principle. As rules, inference rules fulfill functions that are usually fulfilled by rules:

[5] Functions of (sets of) rules

a) Support of existing practices
b) Establishment of new practices / actions
c) Instruction and relief of agents
d) Acquisition and transfer of skills
e) Control and evaluation of:
   – Actions
   – Action results
   – (Skills of) agents
f) Providing a basis for appeals and decisions

More specifically, the following applies: Logical rules specify which propositions an agent may infer in which discursive situations. More precisely: Logical rules specify which preceding (sequences of) speech acts have to be performed for an agent to be allowed to infer a certain proposition. In that regard, they can be called *inferential* (or *inference*) *rules* and, more generally, *speech act rules*.—The formulation of speech act rules presupposes a grammatical categorization and structuring of the uttered expressions: 'proposition' is a technical term!

Logical rules also provide *usage rules* for expressions significantly associated with the speech act of inferring; in the examples the force indicator 'thus', the if-then-connective and the universal quantifier. If one equates use and meaning, one can also call them *meaning rules*.[5] Logical rules do not only specifically regulate logical expressions but also provide categorial regulation for, for example, propositions *qua* propositions and unspecific regulation for the sub-expressions of propositions.

The logical core expressions include the following connectives, quantifiers, and the identity predicate.

[6] Overview of the logical (core) expressions

Connectives:	not__, __and__ , __or__, if__then__, __if and only if__
Quantifiers:	For all __, For at least one __
Predicate:	.. is identical with ..

These are, as we can establish by a brief observation of our speech and writing, expressions that—if Hegel may be quoted here—“are on our lips in every sentence that we utter” (Hegel 2010[1832], 13).

4 Inference Rules and Consequence Relation(s)

To repeat: As do all our actions, inferring may fail. Logic supports inferring by establishing systems of logical rules. Logical rules make correct and incorrect inferences distinguishable. Authors can base their inferences as well as the assessment of the inferences made by themselves and others on logical rules: The whole canon of the functions of rules and the relationships between agents and (systems of) rules can easily be called up.

Systems of rules always delimit fields of possibilities, spaces of action, of doing and omission. In this, legal, ludic, discursive, moral and other systems of rules agree. In the case of logical rules, the need to illuminate this scope arises. For this

5 Note that in the example we have elimination rules. According to our view, such rules are just as meaning-conferring as introduction rules. We do not assume that the logical constants (or other expressions) receive their meaning by a ‘semantic theory’ which is prior to the rules and with respect to which the rules have to be (or can be) justified. For an overview see Contu 2006.—The rules of dialogical logic can also be seen as meaning-conferring. However, dialogical logic in its usual forms seems not concerned with the act of inferring (for an overview see Keiff 2011). Similarly, it can be argued that “inferring has no official place in Brandom’s ‘inferentialism’” (MacFarlane 2010, 88). Brandom offers an inferentialism without inferential acts.

purpose, the *system of inference rules* is transformed into a *consequence relation* or a *derivability relation*.

It is therefore necessary to distinguish strictly between the inference operator ‘thus’, the inference (action) predicate ‘.. infers .. (from ..)’ and the structural consequence or derivability predicate ‘.. follows from ..’ or ‘.. can be derived from ..’.

[7] Three well-distinguished, related concepts

a)	thus__	(inference operator)
b)	.. infers .. (from ..)	(inference (action) predicate)
c)	.. follows from ..	(structural consequence predicate)

We use the inference operator to make inferences. We need the inference action predicate to formulate inference rules. We use the structural consequence predicate to investigate the possibilities and limitations of rule-conforming inferring.—This triplicity is transferable to all speech acts, in particular the cognitive ones.

Roughly speaking, one proceeds from logical rules that govern inferential acts to a consequence predicate by ‘cutting out’ the inferring agents and transforming the logical rules into clauses in the inductive definition of a derivation predicate. The sentence sequences to which the derivation predicate applies are then exactly the sentence sequences for which it holds that agents acting in accordance with the logical rules could (at least in principle) utter them. The consequence relation is then defined in terms of what propositions are derivable from what (sets of) propositions. The consequence relation thus obtains exactly between those sets of propositions X and those propositions A for which it holds that an agent acting in accordance with the logical rules could (at least in principle) derive A from members of X.[6]

The consequence relation thus characterized then allows the establishment of the usual metalogical concepts such as (in)consistency, (in)compatibility, (in)dependence and so on.—One can also characterize the consequence relation connected with a certain set of logical rules in alternative ways, i.e. not by recourse to rules of inferring. This can facilitate metalogical investigations.—If one uses a mathematical, here: one of the usual set-theoretic languages for

6 It is usual practice for logicians to start directly with the inductive definition of a derivation or consequence predicate. For an example of the steps from a set of rules to a consequence predicate see Cordes/Reinmuth 2011, chap. 3.2. Note that the clauses in the inductive definition of a derivation predicate are often called rules as well. For simplicity’s sake, we ignore here the case of consequence relations which cannot be defined by derivability.

this project, it is appropriate to speak of an investigation of 'abstract structures'. However, this does not change the fact that one ultimately investigates *scopes of action*.[7]

By the way: 'provable' and 'true' are other prominent 'scope concepts'. In the second case it is about capturing the entirety of propositions that can be qualified as true by correct (actual and potential) alethic acts, in the first case one is concerned only with those truths that can be established by (actual or potential) proofs.

A final enlargement of the pragmatic perspective: As theoretical philosophy, philosophy is concerned with the epistemic acts, their purposes and the rules that govern them: Inferring, defining, proving, arguing, interpreting, reconstructing, measuring, observing, generalizing, asserting, hypothesizing, denying, plausibilizing, speculating, contemplating etc. provide examples for simple and complex epistemic acts. Naming the purposes of epistemic acts, (re)constructing rules and justifying them as useful or showing their (un)suitability as well as analyzing the states that can be reached de facto or in principle by acting in accordance with certain rules is the core business of theoretical philosophy—of which logic forms part and parcel. As a corollary we have: Action, ends and means, norm and regulation are also a subject of theoretical philosophy—and do not exclusively belong to the field of practical philosophy.[8]

7 Harman has taken issue with the claim that logic provides norms for reasoning in his sense of "a procedure for revising one's beliefs, for changing one's view" (1984, 107, see also Harman 1986; 2002), and MacFarlane and Field have tried in response to establish a normative connection between logical facts about validity or consequence and reasoning in this sense (MacFarlane 2004; Field 2009; see also Steinberger 2016). By contrast, we see logic as being ultimately concerned with rules for deductive reasoning in the sense of a verbal activity which consists in the performance of certain speech acts, not least inferential ones. We also hold that deductive reasoning in this sense enters into any kind of rational and deliberate attempt at "revising one's beliefs"—and where there are inferential acts there is a normative role for logic (see also Peregrin 2014). We agree, however, with MacFarlane that getting "a clearer understanding of what the concept of logical validity is for" (2004, 2) may help us to avoid an "intuition-mongering methodology" (2004, 2) when it comes to assessing the merits of different logics. Dutilh Novaes (2015) also sees logic as normative for the performance of certain speech acts, though she focuses on the emergence of deduction from certain dialogical practices. She rightly stresses that speech acts are inherently dialogical insofar as they are typically directed at a certain audience. Milne 2009 investigates the normative role of logic (more precisely: logical consequence) with respect to the commitments incurred by the act of assertion (and by belief).

8 The pragmatic understanding of logic presented here goes back to Hinst 1982; on the broadening of this perspective to the whole of our cognitive practice outlined above see Siegwart 1997; 2007.

5 Illustration: A Scenario for the Justification of (Systems of) Logical Rules

So far we have (largely) spoken as if we were entitled to speak of *the*, thus of exactly one, system of logical rules. This uniqueness illusion is wrong: Indeed, there exists a plurality of diverging systems of logical rules. In this respect, the situation is in a way worthy of analysis very similar to that in ethics. This fact leads to the question of how we argue for or against one or the other logical rule, one or the other system of logical rules. In a first approach to this question, we will consider two scenarios: a standard form of rule criticism (*section 5.1*) and a rule-theoretically instructive meta-critique thereof (*section 5.2*).

5.1 A Critique of the Rule of Existential Generalization

One approach to the assessment of logical rules is the method of reflective equilibrium, whose core is nicely presented by Goodman's famous dictum:

[8] Goodman on inference rules and inferences

> "A rule is amended if it yields an inference we are unwilling to accept; an inference is rejected if it violates a rule we are unwilling to amend." (Goodman 1983[1954], 64; in the original in italics)

First we describe a scenario in which a rule is criticized by showing that it allows an unacceptable inference and is accordingly revised (on the basis of this criticism). We thus illustrate Goodman's first case. In preparation, let us consider the following example:

[9] (Accepted) inference with existential generalization

1	Since	Berlin is a major city
2	Thus	There exists at least one major city

This inference is based on the rule of *existential generalization*: If a certain object a has a property F, then one may infer that at least one object with this property exists. A bit more formal:

[10] Rule of existential generalization

> If one has reached a proposition in which the (possibly complex) predicate ‘F’ is attributed to an object a, then one may infer a proposition of the form ‘There exists at least one object that is F’.

Now, however, let us consider the following inference:

[11] (Rejected) inference with existential generalization

1	Since	Pegasus is a winged horse
2	Thus	There exists at least one winged horse

This inference is de facto rejected (by many authors), with the following argument: The premise is intuitively true, while the conclusion is false. We demand of inference rules that they do not lead from true to false propositions, that they are truth-preserving. Existential generalization violates this background principle of truth-preservation. Therefore it has to be rejected.

On the other hand, existential generalization does allow, as documented above, acceptable inferences. Therefore it should not be eliminated *tout court*. Instead, a revision seems in order: The accepted inferences should be covered, the rejected inferences should be ruled out. This, however, demands a substantial broadening as well as a deeper analysis of the sample group. And of course, there are not one but several possible ways of revising the rule, whose advantages and shortcomings would have to be weighed against each other.

To repeat: From a formal point of view, the critique of the rule proceeds by subjecting the rule to the requirement of truth-preservation. With the help of the Pegasus example (and numerous similar examples)[9], it is then shown that the rule of existential generalization allows inferences that violate this requirement. Note: Here and in the following we do not work with a precisely defined concept of truth, but with our spontaneous truth and falsity ascriptions.

9 An example from the founding document of free logic is the inference from ‘Santa Claus lives at the North Pole’ to ‘There exists something that lives at the North Pole’, which Leonard criticizes because “Santa Claus doesn’t exist, so that his living at the North Pole does not prove anything about there being genuine examples of people living at the North Pole” (Leonard 1956, 52). For this example, the role of the mythologist (see *section 5.2*) would be taken by the historian of popular culture.

5.2 A Meta-critique of the Critique of the Rule of Existential Generalization

Rule critique of the type presented just now is sometimes subjected to a meta-critique that proceeds along the following lines: How would one show that the premise 'Pegasus is a winged horse' is true? We would appeal to the Greek myths and point out the two passages that show that Pegasus is a winged horse to the stubborn doubter. In case of a controversy, one would consult an expert on myths, a mythologist.

How would we show that the conclusion is false? Now: Never have winged horses been seen on earth. It is just a fact about the animal kingdom that there are no winged horses. In case of a controversy, a zoologist would be the expert of choice.

In the case of the premise, we follow a *mythological*, in the case of the conclusion a *zoological* path to show their truth and falsity, respectively. This makes already clear that the expression 'is a winged horse' is connected with different ways of establishing its applicability, or, to put it differently, with different meanings, in the premise and in the conclusion. Premise and conclusion contain different units of speech: in the premise an expression with a mythological meaning, in the conclusion an expression with a zoological meaning.

This discursive state of affairs does not fit the conditions laid out in the rule—and vice versa. To cut a long story short: The rejected inference does not comply with the rule of existential generalization, but is just an example for the *fallacy of equivocation*. In general rule-theoretic terms: It is the failed application of the rule that leads to a fallacious inference. Those who think they would infer in accordance with the rule of existential generalization err. However, a sound critique of the rule would presuppose that it had been applied correctly.

If one wants to explain the mistake in the original critique of the rule, if one wants to make the misunderstanding understandable, one could reason as follows: In the premise we have an *elliptical expression*, which the critic of the rule seemingly has not realized: 'is a winged horse' is to be read as, for example, 'is a winged horse according to the Greek myths'. And from this one can infer, without any risk, that there exist winged horses according to the Greek myths. Truth-preservation is not violated.

[12] (Accepted) Pegasus-inference with existential generalization

1	Since	Pegasus is a winged horse according to the Greek myths
2	Thus	There exists at least one winged horse according to the Greek myths

If this diagnosis turned out to be correct and to be applicable to other purported counterexamples, the critique of the rule of existential generalization would collapse and the resulting revision of the rule would be unwarranted.[10]

By the way: Neither would we have an example for Goodman's first scenario. Correction of rules because they lead to unacceptable inferences. And something else: Whether or not a certain case constitutes a case of the application of a rule is not only in legal and moral, but also in logical contexts not at all a trivial question. This also illustrates the more general point that the practice of inferring is subject to the same conditions that hold for all our practices.

6 The Original State: The Beginnings of Logic

At the beginning of the fifth section we eliminated the uniqueness illusion: There is not only one, but several systems of logical rules. Now we lift the existence illusion: There is a state in which we infer, but in which our inferences are not subject to explicit rules of inference, but only to the implicit conventions of our language community—which may be rather vague in critical cases and whose only manifestations might consist in (the traces of) our performance of certain inferences. Put differently: Systems of inference rules are not just there, but have to be developed by us. The situation typically considered by many equilibrists—performance of acts versus system(s) of rules—is a 'late' one: Such a situation emerges from a long development. And of course we can ask here, as in other areas, why we should establish systems of rules in the first place.

Concerning this and to conclude, we present a story: We act first and foremost to satisfy our needs. The primary purposes are given. In this, our linguistic *cognitive practice* plays an important role. Often our actions succeed, but sometimes they fail. In order to stabilize and improve the success of our actions, we begin to reflect on them: Reflection has its source in failures and disturbances and aims at coping with them—it thus (presumably) never stops!

Of course, we also reflect on our cognitive actions—and their failure. We examine the relationships between cognitive and other actions and we begin to isolate individual acts of cognition and to study their interplay. Doing this, we also isolate the act of moving from a given state of discourse to the inference of a proposition. We start to develop a sense for succeeding and failing inferences. This will ultimately depend on the effects of using the results of inferences in (deciding on)

10 For presentation and discussion of criticism of existential generalization that makes use of the Pegasus example see also Burge 1974, 310–311, and Reicher 2014, section 3.2.

our (other) actions. We could thus arrive at the minimal demand that we may not (and must not) infer everything from everything.[11]

Guided by considerations of economy, we decide not to assess the success or failure of each single inference, but to tie their correctness to their adherence to rules. In this consists the move from logical *casuism* to logical *rulism*. In order to be able to formulate such rules, we need a suitable grasp of linguistic entities: We develop a *logical grammar*. And in order to formulate—and justify—the rules, we have to get clear about the purposes that we (want to) connect with the logical operators. This requires in turn that we gain clarity concerning the role and purpose of our cognitive practice. The justification of logical rules will then aim at showing that the inferences they cover are conducive to that practice. Of course, this will also include some adjudication between perceived implicit conventions and proposed rules. In how far standard model-theoretic or proof-theoretic accounts of justification fit this bill is an open question.

We hope that we have made plausible that logic has to have a seat at the table if the genesis and justification of norms is the issue, as a supplier *and* as a beneficiary. Logic, on our view, is concerned with logical rules, rules that regulate the speech act of inferring and related acts, and with the scopes of action—the consequence relations—that are connected with systems of logical rules. Logical rules directly regulate certain speech acts; they are not (though they correspond to) clauses of inductive definitions of derivation predicates. Logic is thus intrinsically normative as it is concerned with (systems of) rules that serve to directly regulate inferential and related acts. Logic certainly also has an indirect normative role with respect to other practices and areas. Here one may speak of an extrinsic or indirect normativity of logic. In the debate about the normativity of logic that centers on bridge principles that link (meta)logical facts about consequence relations (or 'logical laws') with certain practices or the formation and revision of beliefs (see fn. 7), the intrinsic normativity of logic for the act of inference takes (at best) a back seat. Of course, such debates about the extrinsic normativity of logic for certain areas are important. However, under the pragmatic-normative understanding of logic offered here, it would be a mistake to think that the question of whether or not logic is normative is to be settled by such debates as logic is a normative discipline as it is.

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11 Dutilh Novaes (2015) argues that the now common (though not universal) demand for necessary truth preservation arose in the context of certain dialogical practices in ancient Greece.

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