Croatian Journal of Philosophy
Vol. XVIII, No. 54, 2018

Informal Reasoning and Formal Logic: Normativity of Natural Language Reasoning[1]

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Dealing with deductive reasoning, performed by 'real-life' reasoners and expressed in natural language, the paper confronts Harman's denying of normative relevance of logic to reasoning with a logicist thesis, a principle that is supposed to contribute for solving the problem of incongruence between descriptive nature of logic and normativity of reasoning. The paper discusses in detail John MacFarlane's (2004) and Hartry Field's (2009) variants of "bridge principle". Taking both variants of bridge principles as its starting point, the paper proceeds arguing that there is more than one logical formalism that can be normatively suitable for deductive reasoning, due to the fact that reasoning can assume different forms that are guided by different goals. A particular reasoning processing can be modelled by specific formalism that can be shown to be actually used by a real human agent in a real reasoning context.

Keywords: Logic, real-life reasoning, normativity, deductive reasoning.

1. *Introduction*

The paper deals with the normativity of reasoning, specifically with *deductive reasoning*, performed by 'real-life' reasoners and expressed in natural language. Deductive reasoning in a 'real-life' situation might seem as a kind of oxymoron. If reasoning is deductive it seems that it should be in accord with the rules of deductive logic. As it is well empirically documented, everyday reasoning can hardly satisfy deductive logic's standards. The question of normativity I am interested in is whether formal logic, or at least a kind of formal logic, can still have a decisive

[1] The writing of this paper was supported by the Croatian Science Foundation under the grant number IP-06-2016-2408.

normative implication for reasoning. Why is this question important? It is important due to the fact that a drastic denial of normative impact of logic to reasoning leaves us without the safe criteria of normativity. We are in this case left only with the appeal to intuitions that are supposed to be the arbiter of correctness of reasoning. On the other hand, if there is a plausible theoretical connection between logic and reasoning, whereas logic can also be of non-classical, even non-monotonic kind, our understanding of reasoning will be on a much firmer ground.

The problems for applying normativity of logic to reasoning, in the formal setting, are in their sharpest form stated by Harman (1986). He famously proclaimed the independence of logic to reasoning arguing that there is a huge gap between logic *that describes the relation of implication* and the normativity of reasoning that has to do *with what we should believe*. However, this paper is defending the *logicist thesis*. The logicist thesis is the claim that there is, to use MacFarlane's formulation: "some connection between logical validity and the evaluation and criticism of reasoning" (MacFarlane 2009: 2). In other words, general logicist thesis proclaims that logic (it needn't be classical logic, even not one of the necessarily truth preserving kind of logic) has a decisive normative role for reasoning.

In §2 the paper starts with some remarks on reasoning, particularly concerning the difference between deductive reasoning and deductive logic. This difference certainly justifies Harman's denying the normative role of logic for reasoning. Nevertheless, a number of philosophers have recently put forward their versions of normativity of logic opposing Harman's view. Let me mention some of them: J. MacFarlane (2004), Hartry Field (2009), Peter Milne (2009), Caterina Dutilh Naves (2013, 2015). They want to answer Harman's challenges articulating what I call *logicist thesis* in the form of different versions of *bridge principle*, a principle that is supposed to contribute to solving the problem of incongruence between descriptive nature of logic and normativity of reasoning. The paper discuses in some detail John MacFarlane's (2004) and Hartry Field's (2009) variants of "bridge principle". They both take for granted that on the one side of the bridge there is a particular valid logical form (MacFarlane takes it to be classical logical validity while Field allowed different kinds of logical validity) and on the other one, more or less uniform, deductive behaviour that is to be normatively captured by proposed formalism. However, contrary to them, I'm proposing the picture of deductive reasoning that manifests itself in different forms, each of which can be modelled by a different logic.

In §3 the concept of normativity will be considered. I will tackle the general question of the role of normativity in researching reasoning and in more details the issues of the scope of applicability of normative rules and of the ways in which the normative impact of logical rules on reasoning can be understood. Concerning the first issue, I'm embracing the view that norms can be applicable to those who apprehend them, while regarding the second issue I advocate the view that logic can be

normative in a stronger sense, as a *guidance for reasoning*. It contests the thesis promoted by Ferrari and Moruzzi (2017) that only the weaker sense of normativity can have the normative role in logic, claiming that normative rules are mere *criteria of correctness*.

My proposal, in §4, concerning MacFarlane's and Field's Bridge principles is that more than one logical formalism can be normatively suitable for deductive reasoning due to the fact that reasoning can assume different forms that are guided by different goals. Namely, reasoning shows up in a variety of forms. It arises in everyday argumentations and debates aiming at a kind of shared agreement, but also appears in other contexts such as juridical debates or in scientific, philosophical, even mathematical dialogues. In each of these contexts reasoning might have different goals. The goal of proving the theorem is different from the goal to show that an accused is guilty beyond any reasonable doubt, which is, again, different from the goal to make understand one that the bus will start from platform 1 when it is so stated in timetable and no other information is available. Each of these reasoning forms can be captured by suitable logics.

Let me now indicate what I mean by a *form* of reasoning. It is an inference form that is relevant for a particular real-life situation in the sense that this form is **just** sufficient for achieving a particular goal. As Varga, Stenning, Martignon, (2015: 1) put it, "computational efficiency is an opportunity cost of expressive power". This form of reasoning is normatively justified if this form can be connected with a kind of validity that the thinker can apprehend or recognize as valid.

2. *Remarks on reasoning and Harman's objections to normative role of logic*

a) *Deductive reasoning and deductive logic*

By deductive reasoning I mean a process of reasoning that guarantees a transition of the truth from a set of propositions, believed or known by the agent, to the conclusion. Let me illustrate the process by an example of a reasoner who, from the beliefs:

> *The 8 am bus from Rijeka to Zagreb starts either from platform 1 or from platform 2,*
> *The bus does not start from the platform 2,*

infers to the conclusion

> *Therefore, it starts from platform 1.*

This piece of reasoning is a subject to assessment. It is a correct reasoning. Talking about correctness or goodness of the episode of reasoning we inevitably invoke the normativity dimension (consider either as the first or as the third person perspective) of reasoning. However, as it is well known, normativity, particularly normativity of deductive reasoning, is a highly contentious topic. We will briefly tackle some of the

issues. The first one is the relation between deductive reasoning and deductive logic. To say that deductive reasoning preserves the truth in inferring from the premises to the conclusion is to indicate, in one way or the other, that the normative standard for deductive reasoning is *deductive logic*. By deductive logic many logicians and psychologists mean a logical calculus that *necessarily preserves the truth,* notably, classical predicate logic[2] (CPL, henceforth). CPL by definition is extensional and truth-functional. Valid reasoning in this sense is represented by the argument in which conclusion is a logical consequence of its premises expressed as: *if all its premises are true, conclusion can't be untrue.*[3] Deductive reasoning that as valid is determined by basic properties of classical logic: monotonicity and necessarily truth preservation.

In accord with this line of thinking, deductive reasoning in natural language is deductively valid if it can be correctly translated into an argument that is semantically valid in a formal system (notably, CPL). We can consider this formulation as a standard view of deductive reasoning. This view presupposes two things: it equated the deductive reasoning with deductive logic, and further, it equated logical validity with the necessarily truth preservation.

The problem with the view that deductive reasoning is equal to deductive logic (that implies that the notion of logical consequence is CPL notion) is that reasoning performed in natural language is not syntactically or extensionally valid but at best intentional (semantically valid). Reasoning in natural language, in contrast to an argument form expressed in formal language, is sensitive to propositional content that should be interpreted in connection to the real world. In this interpretation people's knowledge of the world and evidence they have play an important role in their reasoning (what is irrelevant in the formalized classically valid argument). The real-life reasoning in natural language, therefore, hardly satisfies properties of deductive logic. The inferences performed in this domain are hardly *necessarily* truth preserving. Even more, they are often non-monotonic.

Having formulated the difference between reasoning and logic, the crucial issue of the paper becomes visible, namely, can we, in spite of the described characteristics, consider everyday reasoning as deductive? Many would say that, in so far, if it is not classically logically valid it is not deductive either. We are here faced with the dilemma: either real-life reasoning is not deductive, or deductive reasoning is to be weakened and broadened in a sense.

[2] Due to the limitation of the paper I'm neglecting the view held by in no way marginal number of logicians that see intuitionistic logic in the position of *the* logic that necessarily preserves truth.

[3] According to Tarski, logical consequence should be understood in terms of necessarily truth-preservation (Tarski 1956: 411), which, in turn, can be sharpened model-theoretically as follows: a sentence p follows logically from a set of sentences S just in case every model of S is a model of p (Tarski 1965: 417).

Deductive reasoning can be weakened so that it can be modelled by formal systems, other than CPL that possibly suits better real-life reasoning's salient characteristics. Here is one of those characteristics: it is often the case that real-life inferences are not classically valid, in the sense that *if all premises are certain, so is the conclusion*, but instead, (at least) some premises are *probable in a various degree*. Suppose, as Hayek (Hayek 2001) invites us to suppose, "that we want the probability of a conclusion of a given valid argument to be above a particular threshold". The answer to this question can be given through *probability logic* that is "the study of the transmission (or lack thereof) of probability through inferences" (Hayek 2001).[4] In this logic the traditional concern with the truth of premises is replaced with the concern about their probabilities. Such logic is certainly deductive, although non-monotonic (initially assigned degree of probability to the conclusion may later be retracted in the face of a new evidence) and not strictly truth-functional.

The other salient characteristic is that in everyday situations a conclusion from a given set of premises is often reached *defeasibly*. It means that the real-life reasoner reserves the possibility to *retract* from the originally reached conclusion in the light of new information or adding a new proposition to the original set of premises. This characteristic can be modelled by different variants of *default logic*.

Coming back to our dilemma, Gilbert Harman, supposing that deductive logic is equal to classical logic, is the leading authority of the view that reasoning does not correspond to deductive logic. In so far they are distinct. Logicists hold **a** different stance.

b) *Harman's objections to normative role of logic*

Let me outline the alleged difference between the descriptivism of logic on one side and the normativity of reasoning, on the other, posed by G. Harman (1986). According to this, logic merely *describes* logical relations; it does not *prescribe* what we should believe. For example, logicians *describe* an argument as a valid saying that it is impossible for the premises to be true without the conclusion to be true. Their main interest is in the relation between propositions and in what follows from what. There is nothing normative in this claim.

In a nutshell, Harman's reasons for divorcing logic from reasoning are:

> *Objection from belief revision*: claims about logical validity are not explicitly normative in their content. They do not tell us what we should believe. If, for example, one believes p and believes p *implies* q and recognizes them to jointly entail q, one is not under any particular normative obligation to believe q (for instance, if q is at odds with one's other beliefs, it would be unreasonable to accept q).

[4] In his article Hayek (2001) presents the general features of Adams' probability logic (1998), although other systems of probability logic are at stake.

> *Clutter avoidance*: There is a worry about "clutter avoidance" (is one really obliged to believe all of the infinitely many trivial logical consequences of one's beliefs?).
> *Excessive demands*: Norms of logic (might be) so demanding that no human being could possibly satisfy them. Namely, due to the limitations of cognitive resources and computational powers, no one can believe all consequences of his beliefs.

The *normative claim*, in contrast to merely logically descriptive one, has to do with thinkers (actual or potential) that perform the inferences, with the goals their reasoning process aimed to and with the doxastic states engaged in the process. The normative counterpart of the above descriptive example might be expressed in this way: in order to be *rational*, a *reasoner* (actual or potential) *should*, if she *believes* (or accepts) a set of propositions and *believes* that the conclusion follows from the premises, *believe* or *accept* the conclusion. At any rate, there is a significant difference between the rules of logic (or logics) and its normative counterpart. The normative claim, in contrast to descriptive ones, has to mention a reasoner's goal, her doxastic state and the particular deontic operator.

c) *Logicists' answers*
MacFarlane's bridge principle

In spite of the mentioned difference between logic and reasoning, in everyday reasoning processes reasoners tend to preserve the truth of the premises in the conclusion (although the truth preservation need not be necessary, as we will see in Field's formulation), and hence to obtain the deductive character of the informal reasoning. The logicists, in order to meet Harman's challenges, aimed to connect the formal logical consequence (or validity or implication relation) with the informal understanding of consequence in the way that formal consequence can be normative for informal reasoning.

The logicists hold that logical validity on one side and how we ought to think, on the other, should and can be connected. In this sense MacFarlane says:

> Why do we bother studying this notion (validity) at all? Surely it is because we think there is some connection between logical validity and the evaluation and criticism of reasoning. If we could get clearer about this connection, we could transpose questions about logical validity into questions about how we ought to think. (MacFarlane 2004: 2)

To meet Harman's challenge John MacFarlane has meticulously proposed the way to establish a connection articulated as a *bridge principle* able to override the gap between logical system that is descriptive and the normativity of reasoning (2004). Its goal is to "transpose questions about logical validity into questions about how we ought to think" (MacFarlane 2004: 2). Just to indicate the idea, the bridge principle (BP) is a *material conditional* that connects a valid logical form,

say: A, B (as antecedent) and a normative claim that is compound of thinker's doxastic states (S believe, S knows) and deontic operators as *should*, is *permit to* or *has a reason* (as consequent). The conditional asserts that, *if* there is a *valid* logical form *then* comes the normative claim: (for instance) if S *believe* that P_1, …, P_n together imply Q*, then S ought* to *believe* that Q. Formally: *'If* P_1, …, $P_n \vDash Q$, *then* Φ' where Φ is a normative principle. MacFarlane's general strategy is to hold fixed *classical logical formulation of validity* as antecedent and combine elements in normative claim (consequent) in order to get the most "natural" and "realistic" combination of the mentioned parameters, for which the classical validity can play a normative role, avoiding in this way Harman's objections.

To obtain this, MacFarlane combines various types of *deontic operators* (strict obligation, permission or defeasible reasons for belief), the scope of the deontic operator in the conditional (narrow or wide: does deontic operator govern the consequent of the conditional, both the antecedent and the consequent or the whole conditional?) and doxastic states (believing and knowing).

Let me present in somewhat systematic way the parameters used in determining the normativity claim of the bridge principle:

(1) *Deontic operators*
(o) 'Ought'/obligation
(m) 'May'/permission
(dr) Defeasible (pro tanto) reason.

(2) *Polarity*
(+) Positive (o), (m) or (dr)
(–) Negative (o), (m) or (dr)

(3) *Scope of the deontic operator—e.g. 'o' denoting 'ought'*

Narrow scope: (n) (if P, then o (Q))
Wide scope: (w) o (if P, then (Q))

Governing both the antecedent and the consequent of the conditional:
(b) o (if P, then o (Q)).

To complete the parameters the doxastic states of the subject are to be added. Namely, doxastic *restrictions* can be imposed on the antecedent part of the principle, in the sense that subject knows, apprehends or recognizes that particular form is logically valid. If such restriction *is* imposed the principle takes subjective or internal reading, contrary to objective reading when such restriction is not imposed. Although the combination of all parameter settings gives 36 bridge principles in total, I will illustrate MacFarlane's idea with four examples using only 'ought' operator, positive polarity, narrow and wide scope and doxastic state "know".

> (Narrow scope): If A, B ⊨ C, then if you believe A and you believe B, you ought to believe C.

(Narrow scope + 'know'): If you know that A, B ⊨ C, then if you believe A and you believe B, you ought do believe C.

(Wide scope): If A, B ⊨ C, then you ought, if you believe A and you believe B, you believe C.

(Wide scope + 'know'): If you know that A, B ⊨ C, then you ought, if you believe A and you believe B, you believe C.

MacFarlane chose wide scope + 'know' formulation as the appropriate form for the normative claim. Nevertheless, his final decision for BP slightly changes the above formulations giving to BP an even stronger subjective reading. He takes the logically valid *schema* instead of classical logical consequence to figure in the position of the antecedent. The stronger subjective or internal note is given in the formulation that the subject knows that schema S is valid and, furthermore, the subject apprehends the given inference as an instance of S. The formulation is:

> If [you know that] the schema S is formally valid and you apprehend the inference A, B / C as an instance of S, then (normative claim about believing A, B, and C). (MacFarlane 2004: 22)

Eventually, MacFarlane gives the final form to BP, which I will take as his definite stance:

> If schema S is formally valid and you apprehend the inference A, B / C as an instance of S, then you ought to see to it that if you believe A and you believe B, you believe C. (MacFarlane 2004: 24)

Hartry Field's variant of BP

In (Field 2009) Hartry Field developed his view on normativity of logic and offered his variant of BP. Unlike MacFarlane, he introduces *degrees of beliefs* expressed in the notion of probabilities, as doxastic units, instead of *full beliefs*. On the other side, similar to MacFarlane, he gives a subjective reading to the formulation of BP. Let's take a closer look at his variant of BP:

> If it's obvious that A_1, ..., A_n together entail B, then one ought to impose the constraint that P(B) is to be at least P(A_1)+ ... +P(A_n)−(n−1), in any circumstance where A_1, ..., A_n and B are in question. (Field 2009: 259)

Subjective reading is evident in the formulation "if it is obvious", where *obvious* is to be understood as agent-relative. Obviousness as a doxastic restriction on the implication relation "A_1, ..., A_n together entail B" is equivalent to MacFarlane's use of the notion of subject's "apprehension" that the inference is an instance of the schema. Again, in contrast to MacFarlane, the relation "A_1, ..., A_n obviously together entail B" is not understood exclusively as a classical logical relation (material implication).[5] Field allows here the pluralistic reading. He says:

[5] It is not clear whether MacFarlane himself persists on material implication in his final formulation. It is the fact that at the certain point in his paper he changes the notation and A, B ⊨ C replaces with A, B / C that indicate that the relation is weaker than the material conditional.

"Whatever logic is assumed correct, it seems to me that

> if *B* is obviously entailed by *A* in that logic, a proponent of that logic should believe *B* to at least as high degree as *A*"

Let me stay a bit longer at Field's understanding of the relation "A_1, ..., A_n together entail *B*". We already see that the entailment relation or, if you prefer, the consequence relation, need not be classical since the plurality of logic is allowed. As the necessary truth preservation (NTP) is a substantial feature of the classical logical consequence, does Field allow a consequence relation that is not NTP? As a matter of fact, one of Field's important claims is that the relation of logical consequence *is not* the relation of the *necessary* truth preservation. In his own wording:

> I'm inclined to state my conclusion by saying that the validity of a rule does not require that it generally preserve truth. However, some may think that this simply violates the meaning of the term 'valid': 'valid', they may say, simply means 'necessarily preserves truth', or 'necessarily preserves truth in virtue of logical form'…" (Field 2009: 266)

Instead of defining validity in terms of NTP, he proposes:

> Perhaps we should redefine validity, not as (necessarily) preserving truth in general but as (necessarily) doing so 'when it matters'? (Field 2009: 266).

And finally:

> I basically said that a rule 'preserves truth when it matters' if it preserves truth *when applied to premises that can be established or are rationally believable*. (Field 2009: 266)

Comparing two variants of BP, MacFarlane's and Field's, I would say that both of them successfully connect the formal logical consequence with its informal understanding in reasoning, providing in this way the normative standard for reasoning. Still I take that Field's variant suits my purposes better. MacFarlane's formulation of normative rules requires from the agent to make only those inferences that he apprehends as instances of the valid schema. Still, determining a schema as classically valid, MacFarlane requires that it necessarily preserve the truth. In so far, normatively correct inferences are those that are necessarily truth preserving. Field's variant of BP is more liberal, allowing the implication (consequence) relation that is *not necessarily* truth preserving, which is much closer to the real-world reasoning that tends to preserve the truth but usually only "when it matters".

This line of thinking fits well with my proposal claiming that more than one logical formalism can be normatively suitable for deductive reasoning. The idea is that people in real-life situations perform different forms of reasoning, each form guided by a different goal. Being engaged in various forms, accomplishing different goals, they can be normatively warranted from the viewpoint of different logics.

3. *Normativity of reasoning*

In so far we have been discussing the normative role of logic in reasoning. In this relatively short part of the paper we will first make a brief remark on the general question of the role of normativity in reasoning (whether expressed in logical rules or somehow differently). After that, we are going to discuss two important issues concerning normativity. The first one regards the scope or domain to which normative rules can be applicable, while the second one considers different ways in which rules of logic can be normative.

Concerning the first question of the place and role of normativity in examining reasoning, there is a tendency in recent writings to thoroughly eliminate the role of normativity in investigating reasoning. It is in this vein that Elquayam and Evans (2011) advocate the idea of a complete abandoning of normativity in the psychological scientific practice. As it is hard to see good reasons for such a claim[6], I am starting from the opposite view. Concerning the role of normativity in reasoning, the claim is that the very concepts of reasoning, argument and argumentation are entirely normative. This is obvious in the scientific field as well as in the everyday social intercourse. In all kinds of discourse people are prone to recognizing a chain of reasoning as a 'good' one and an argument as a 'correct' one. They do this from the first-person perspective, associating a *degree of confidence* to the correctness of their judgments and other outcomes of reasoning processes. People continually do this also from the third person perspective, assessing reasoning of others as correct or incorrect. In empirical investigations of reasoning, "without norms of some kind, we cannot interpret the data participants produce" (Achourioti, Fugard, Stenning 2014). Therefore, I take for granted the inevitability of normativity in reasoning.

Although the host of issues and open questions concerns the area of normativity, we will tackle two of them, namely, what can be the domain of application and how to understand that rules are applicable to subjects.

The question of *domain or scope of applicability* can be formulated in the following way:

Are normative rules of reasoning applicable universally to the wide domain of all rational beings, or are normative rules specific, having a domain of application only to those who apprehend or understand applied normative rules? Relative to the latter disjunct, normative rules have a restricted application relative to the subject's apprehension of the rule.

Concerning the former understanding of normativity, this approach has often been put forward in the traditional but also in the recent literature. The problem with this approach is, I hold, in the aprioristic

[6] Due to the tolerable length of the paper, I am not able to support my judgment with the extended argumentation as that would deserve a separate paper.

determination of normative rules and in the generality its nature is determined. A typical example of such a consideration is Frege's claim: "Logic prescribes universally how one ought to think if one is to think at all" (Frege 1893). In this way, reasoning rules proclaimed as normative are quite general logical principles that are understood as belonging to CPL (for example: reasoning ought to be consistent). At the same time, it is this understanding of normativity that underlines Harman's objections regarding the connection between logic and reasoning. On the other side, normativity as restricted to the subject's apprehension seems to be at the basis of MacFarlane's and Field's approaches. I'm siding with this latter, narrow or restricted, view.

The second question concerns the possible ways in which logic can be normative for reasoning. Recently, Florian Steinberger (Forthcoming) distinguished three ways in which this question can be understood.

According to the *first one*, normative rules are supposed to prescribe *directives* for reasoning in the sense that they have a guiding role (from the subject's, first person, perspective) in deciding what to believe.

According to the second one, they are supposed to give the criteria or standards for the *evaluation* of the *good* reasoning (from the third person perspective).

Finally, normative rules might play a role of the third personal *appraisals* by which one can blame or praise an agent for her inferential conduct.

For the purposes of this paper it is sufficient to consider only the first two roles the normative rules can play; let me call them *directive* and *evaluating* roles. Assigning the *directive* role to normative rules for reasoning one understands normativity in a stronger sense than taking it to have only evaluative role. If normativity is directive it is in principle also evaluative, while the evaluative role does not imply the directive one. It seems that Harman had in mind the directive role of logic for reasoning when he denied its normative influence. Accordingly, in order to defend the *normativity thesis* against Harman's objections, the strong, directive meaning of normativity has to be embraced.

Summing up the discussion in this chapter and putting together the questions of scope and of ways of understanding normativity, among the possible answers to these questions I'm picking up the *restricted*, apprehensive scope of rules' application and the *directive,* guiding role of normative rules. They together determine the desiderata, for, I hope, a promising way to uphold my view of normativity that is going to be exposed in §4.

4. *Forms and norms of reasoning*

The goal of the *normativity thesis* I'm supporting is to uphold a tighter connection between the normativity expressed in logical formal rules and the pre-theoretic comprehension of logical principles used in actual reasoning. MacFarlane and Field have been formulating variants of

bridge principle that have in common the subjective, restricted understanding of rules applicability. I take it to be the significant desideratum of normativity to which I'm adding the directive role of normativity. These two desiderata of normativity, to which I will refer thereof as to *restrictiveness*, and to *directiveness,* can make possible a promising step forward in this direction. *Restrictiveness* and *directiveness* are obviously connected. Logical rules can have a guiding role for those who are able to apprehend them in a certain sense. Expressing the same thing in different way, we can say that only those who have the rule represented in explicit or implicit way can *follow* a rule. Otherwise, the agent's inferential behaviour can be only evaluated from the third person perspective.

Starting from *restrictiveness*, it is an open question in what sense the apprehension of logical rules is to be understood. The view that apprehension should be understood as an explicit mastering of the rule is clearly over-demanding and should be, therefore, ruled out as a candidate. As a promising approach to the answer I take MacFarlane's stance that to apprehend an inference is to see it as having a certain logical structure. But he claims more than that. He claims that:

> On this view, all logical norms have their source in the thinker's "apprehension" of inferences as having a certain formal structure. (MacFarlane 2004: 22)

And in clarifying in what sense apprehension is to be understood, he says:

> My own view is that apprehension should not be intellectualized to the extent that it requires a completely explicit understanding of what an inference schema is, the kind one would get from an encyclopedia article on the subject. It is something more basic than that. But it is important that apprehension be something for which one can take responsibility and give or receive criticism. (MacFarlane 2004: 22).

I'm in accordance with this view on apprehension. Still, it is noteworthy to make some caveats regarding this formulation. Let me start with *taking responsibility and giving or receiving criticism*. This formulation seems to mark what it means that apprehension is *more basic* than explicit understanding. According to this, one apprehends an inference as an instance of inference schema (IS) if one is responsible in the sense that one intends to infer according to IS. One is responsible in this sense for all and only episodes of reasoning that she apprehends as belonging to IS. It goes without ado that IS itself should be valid. But let's note that agent's apprehension has no role in recognizing an IS as valid. Although it is not quite clear whether MacFarlane considers the validity of IS independent of agent's apprehension, it seems as he holds that IS's validity is fixed as necessarily truth preserving (NTP). Accordingly, an agent is normatively responsible for an instance of inference if she apprehends that it belongs to IS, but the kind of required validity for IS is fixed as NTP. Let me call this approach *apprehension plus fixed IS*.

Although it is supposed that this approach can challenge Harman's objections, it seems that it can't meet all of them. It is particularly vulnerable to *objection to belief revision*. Let me use for illustration the example from §2. Here we had a reasoner who, looking at the timetable, comes to know that:

1. The 8 am bus from Rijeka to Zagreb starts either from platform 1 or from platform 2,
2. *The bus does not start from the platform 2,*

and from that she infers to the conclusion

3. Therefore, it starts from the platform 1.

Let's remind that this is an instance of the real-life reasoning where premises sometimes can't be taken with absolute certainty (*reasoning in uncertainty*) or a new evidence can produce the contradiction, for example, the added information that platform 1 is at the moment unavailable. In this case, the agent is faced with contradictory beliefs. If we are trying to model her reasoning in the frame of classical logic, the reasoning is valid even when the reasoner makes whatever conclusion (in accord with the principle *ex falso quodlibet*). Harman takes such a situation as an evidence for separating logic from reasoning (Harman 1986). When new information is added, our agent is forced to abandon her premise 1, but in this case logic does not guide or even recommend any action.

Coming back to MacFarlane BP, when validity of IS is equated with the necessary truth preservation, the *apprehension plus fixed IS* can't solve the problem. But, if we consider other kinds of validity grounded in different logics, including non-monotonic ones (notably probabilistic and default logics) that better suit the real-life reasoning, the solution seems to be more probable. The employment of a particular kind of default logic could be especially suitable in our example. Varga, Stenning, and Martignon (2015) have proposed *closed world semantics,* which is a variant of default logic. Closed world assumption provides a valid, truth-preserving inference that is represented with this conditional (Varga, Stenning, and Martignon 2015: 3):

$$p \,\&\, \sim ab \rightarrow q$$

meaning: *If p and nothing abnormal is the case, then q.*

In the situation as the above mentioned, an agent can apprehend: p & $\sim ab \rightarrow q$ as a valid inference schema and in addition apprehend the episode of reasoning:

> *The 8 am bus from Rijeka to Zagreb starts either from platform 1 or from platform 2,*
> *The bus does not start from the platform 2,*
> *Therefore, it starts from the platform 1,*

as an instance of this schema.

This consideration nicely fits Field's proposal of the BP as closer to the solution we are looking for. This approach is more liberal than MacFarlane's in regard to the possible kinds of validity of inference. Allowing

the plurality of logics,[7] Field's proposal makes it possible to model also those forms of real-life reasoning that fall outside the scope of necessarily truth preserving arguments. Particularly it is possible with reasoning in uncertainty (can be modeled by probabilistic logic) and with defeasible reasoning (can be modeled by default logic).

The proposal of apprehension of both the validity of IS and the validity of instance of reasoning as belonging to apprehended kind of validity corresponds to the view of reasoning appearing in different forms of reasoning. Reasoning as a cognitive activity is not a uniform endeavor and it can't be idealized as having a closed list of characteristics and normative constraints. On the contrary, as it is indicated above, people in real-life situations perform different forms of reasoning, each form guided by a different goal. Being engaged in various forms, accomplishing different goals, they can be normatively warranted from the viewpoint of different logics.

The relevance principle tells us that people economize with their cognitive resources. As Varga, Stenning and Martignon put it "computational efficiency is an opportunity cost of expressive power" (2015: 1). There are some goals a thinker can obtain mobilizing mostly his implicit deductive inferential performance, while for other goals the explicit, reflective thinking will be necessary. The goal of proving the theorem is different from and requires different cognitive effort than the goal to show that an accused is guilty beyond any reasonable doubt, which is, again, different from the goal to make understand one that the bus will start from platform 1 when it is so stated in timetable and no other information is available. Each of these reasoning forms can be captured by suitable logics.

However, for any form and goal of deductive reasoning there is an adequate normative system that can direct this reasoning toward the "rational" achievement of the goal. Which kind of logic is to be employed as normatively relevant for a particular form of reasoning is partly an empirical question. I am proposing the approach to the nor-

[7] The idea of the plurality of logic I have in mind is quite close to Beall and Restall's theory (2006). They consider any logic whose notion of validity satisfies what they call *Generalized Tarski thesis*, GTT.

GTT: "An argument is valid$_x$ in every case$_x$ in which the premises are true, so is the conclusion."

Variable x ranges over types of cases. Shapiro (2014) clarify the relation of logics, validity and cases as follows:

> "Classical logic results from GTT if 'cases' are Taskian models; intuitionistic logic results if 'cases' are constructions or stages in constructions (i.e., nodes in Kripke structures); and various relevant and paraconsistent logics results if 'cases' are situations (of a particular sort). In present terms, then, Beall and Restall take logical consequence to be folk-relative to kinds of cases. In their view, for example, the low of excluded middle is valid relative to Taskian models, invalid relative to construction stages (Kripke models); and the argument of *ex falso quodlibet* is valid relative to Tarskian models (and possible worlds), invalid relative to situations." (Shapiro 2014: 33).

mativity looking at different logical formalisms on the one side and on the other the actual human reasoning behaviour, adjusting one to the other through a kind of reflexive equilibrium.

References

Achourioti, T., Fugard, A., Stenning, F. 2014. "The empirical study of reasoning is just what we are missing." *Frontiers in Cognitive Science* 5: 1159, doi: 10.3389/fpsyg.2014.01

Adams, E. W. 1998. *A Primer of Probability Logic*. Stanford.

Beall, J. C. and Restall, G. 2006. *Logical Pluralism*. Oxford: Oxford University Press.

Dutilh Novaes, C. 2013. "A Dialogical Account of Deductive Reasoning as a case Study for how Culture Shape Cognition." *Dialectica* 96 (4): 587–609.

Elquayam, S. and Evans, J. 2011. "Subtracting 'ought' from 'is': *Descriptivism versus normativism in the study of human thinking*." *Behavioral and Brain Sciences* 34: 233–290.

Ferrari, F. and Moruzzi, S. 2017. "Logical Pluralism, indeterminacy and the normativity of logic." *Inquiry*, doi: 10.1080/0020174X.2017.1393198

Field, H. 2009. "What is the Normative Role of Logic." *Proceedings of the Aristotelian Society Supplementary Volume* lxxxiii.

MacFarlene, J. 2004. "In What Sense (If Any) Is Logic Normative for Thought?" Unpublished manuscript. Presented at the Conference on the Normativity of Logic organized by Central Division APA 2004.

Harman, G. 1986. *Change in View: Principles of Reasoning*. Cambridge: MIT Press.

Hayek, A. 2001. "Probability, Logic, and Probability Logic." In L. Goble (ed.). *The Blackwell Guide to Philosophical Logic*. Oxford: Blackwell.

Hitchcock, D. 2017. *On Reasoning and Argument, Essays in Informal Logic and on Critical Thinking*. Springer.

Shapiro, S. 2014. *Varieties of Logic*. Oxford: Oxford University Press.

Steinberger, F. Forthcoming. "Three ways in which logic might be normative." *Journal of Philosophy*. (http://floriansteinberger.weebly.com/uploads/5/7/9/5/57957573/three_ways_in_which_logic_m ight_ be_normative.pdf)

van Eemeren, F. H. and Grootendorst, R. 2004. *A Systematic Theory of Argumentation. The pragma-dialectic approach*. Cambridge: Cambridge University Press.

Varga, A., Stenning, K., and Mortignon, L. 2015. "There Is No One Logic to Model Human Reasoning: the Case from Interpretation." In U. Furbach and C. Schon (eds.). *Proceedings of the first workshop on bridging the gap between human and automated reasoning*. Berlin: 32–46.

Tarski, A. 1956. *Logic, Semantics, Metamathematics*. Oxford: Clarendon Press.