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A DYNAMIC VIEW OF HYPOTHESES GENERATION IN ABDUCTION

Un punto de vista dinámico de la generación de hipótesis en la Abducción

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ABSTRACT: This paper explores our proposal's conceptual depth and implications for the hypothesis generation as conditional. To do so, we will contrast it mainly with reading passages from one of the paradigmatic presentations of hypothesis generation: the work of C.S. Peirce. Indeed, in his work, the notion of hypothesis gains a relevant place from a logical point of view. In particular, we will focus on (i) showing that "hypothesis" in Peirce can hardly be identified with just a section of the rule that subsumes the surprising case and (ii) we will show that the proposed hypotheses generation as conditionals allows for a complementary and enlightening reading of his idea of abduction.

Keywords: hypotheses, conditionals, abduction, inferential relation, cognitive process.

RESUMEN: Este trabajo explora la profundidad conceptual de nuestra propuesta y sus implicaciones para la generación de hipótesis como condicional. Para ello, la contrastaremos principalmente con la lectura de pasajes de una de las presentaciones más paradigmáticas de la generación de hipótesis: la obra de C.S. Peirce. En efecto, en su obra, la noción de hipótesis adquiere un lugar relevante desde el punto de vista lógico. En particular, nos centraremos en (i) mostrar que "hipótesis" en Peirce difícilmente puede identificarse con sólo una sección de la regla que subsume el caso sorprendente y (ii) mostraremos que la propuesta de generación de hipótesis como condicionales permite una lectura complementaria y esclarecedora de su idea de abducción.

Palabras clave: hipótesis, condicionales, abducción, relación inferencial, proceso cognitivo.

1. Introduction

As already presented and defended in Redmond and Lopez-Orellana (2022; 2023; also see Redmond 2021), our proposal to understand the hypotheses generation as the generation of conditionals was motivated by the need for resolving and giving logical justification to the so-called surrogate reasoning in modelling processes in science. Indeed, we positioned ourselves against understanding them as a type of representation-based thinking (Swoyer 1991; Frigg & Nguyen, 2016, 2017) and proposed that hypotheses should be understood, from a logical point of view, as conditionals.

In the present paper, we aim to conceptually deepen and explore the scope of our proposal for hypothesis generation in logic as conditionals. To do so, we will contrast it mainly by reading passages from one of the paradigmatic presentations of hypothesis generation: the work of C.S. Peirce. Indeed, in his work, the notion of hypothesis gains a relevant place from a logical point of view. In particular, we will focus on: (i) showing that it is hardly possible to identify "hypothesis" in Peirce with just a section of the rule that subsumes the surprising case and (ii) showing that our proposal of hypothesis as conditional allows us to clarify some complexities in the author's ideas. Regarding (i) it should be added that this is the standard reading of hypothesis in Peirce, which we will call *static*. In this sense, in addition to selected and paradigmatic texts by Peirce, we will make critical remarks on the classical interpretation of K. T. Fann (1970) as well as Francesco Bellucci and Ahti-Veikko Pietarinen (2023), which is an excellent work and can be considered a good representative of the static approach. Regarding (ii), we do not seek to justify our view of the

hypotheses as conditional in his work but to show that our approach broadens the understanding of his ideas.

2. Peirce: Abduction and hypotheses generation

The selected Peirce texts correspond to "Deduction, Induction, and Hypothesis" (1878) and are the same ones Bellucci and Pietarinen (2023) commented on in their article. As noted above, the overall goal is to make it clear that our reading of the hypotheses as conditionals best explains C. S. Peirce's purpose. Let us start with the quote:

> Hypothesis is where we find some very curious circumstance, which would be explained by the supposition that it was a case of a certain general rule, and thereupon adopt that supposition. Or, where we find that in certain respects two objects have a strong resemblance, and infer that they resemble one another strongly in other respects. (CP 2.624)

We will only stop at the first sentence[1]. Peirce affirms that to explain a surprising fact, we must assume something. The latter seems to be the most characteristic of abduction —which does not correspond to the other ways of reasoning: the introduction of a supposition. Furthermore, what do we suppose? We suppose that "it was a case of a certain general rule," i.e., we assume that such a circumstance would be no longer "curious" if it were a case of a certain general rule. Then, a hypothesis is a cognitive process of subsuming a curious fact under a rule that explains it. Based on the above, we could affirm without fear of being wrong that finding a rule is the leitmotiv of abduction. In this sense, the latter is that we daily look for explanations (rules) for surprising situations. It follows from these lines that "hypothesis" is identifiable with the process as a whole and not with a part of it. So far, we have left what this quotation says and what it does not say concerning our topic. Nevertheless, the example Peirce gives below adds something else that needs clarification:

> I once landed at a seaport in a Turkish province; and, as I was walking up to the house which I was to visit, I met a man upon horseback, surrounded by four horsemen holding a canopy over his head. As the governor of the province was the only personage I could think of who would be so greatly honored, I inferred that this was he. This was an hypothesis. (CP 2.625)

1. We find the second sentence especially interesting since Peirce postulates that analogical reasoning is subsidiary to abduction. We will leave this analysis for a future paper.

Now, we will stop at the second sentence. We will see that Peirce adds something new, and we will try to interpret it in contrast to the quote above. Indeed, from our point of view, Peirce adds that the process ends with *a part of the rule* as a conclusion. That is, "to be the governor of the province" is a part of the rule "if the horseman is the governor of the province, he is honored with horsemen with canopies." How to reconcile that in the quote Peirce puts all the emphasis on the *assumption of a rule and* here only on *a part of it*? It does not seem to be the same cognitive process.

The static approach interprets this part of the rule as the hypothesis itself. Moreover, what part of the rule is it? If we represent the rule to ourselves as a *conditional*, and we are not straying too far from either Peirce or the statics approach in general at this point, the rule part is the antecedent of the conditional[2]. For this reason, while in (1) what Peirce *adopts* as a conclusion is the conditional, in (2), he concludes the *antecedent* of it. However, neither in the quote nor in the example with the new addition is any sign that abduction for Peirce consists in proposing the antecedent of a conditional and even less in identifying this antecedent with the notion of hypothesis. Posed in this way, it even seems paradoxical to have to look for an antecedent when we do not know what the conditional is. However, the latter opens an interesting discussion.

Furthermore, the whole secret is hidden in understanding what kind of conditional we are thinking of here. It is not clearly about the material conditional. But then, what are its characteristics? For the moment, we will only point out that *retroduction*, as defined by Peirce, points in the direction of the example: "starts at consequences and recedes to a conjectural antecedent from which these consequences would, or might very likely logically follow" (MS 0905, 1908)[3]. However, even understanding abduction in this way, from our point of view, we believe that it is not about the antecedent but about the construction of the conditional itself. From our point of view, the above observation is aligned with Frankfurt's (1958) criticism of abduction: concluding the *assumption* of the conditional is not arriving at a new idea because it is already present in the rule. That is, in the case of Peirce's example, it would not be a logical conclusion.

Let us return once more to the quote and suppose, instead, that Peirce understands by "*supposition*" the conditional's antecedent. That is to say,

2. "The form of inference, therefore, is this: The surprising fact, C, is observed; But if A were true, C would be a matter of course, Hence, there is reason to suspect that A is true" (CP 5.189).

3. For more details of the quote, see Robin (1967).

Peirce would refer to the antecedent of the conditional when he says "... by the supposition that it was a case of a certain general rule..." But even doing this reading, which seems very appropriate, he is not identifying the assumption with hypothesis. Rather, we would say the opposite, and it is the thesis that we would like to defend: that the hypothesis must be distinguished from the assumption and that both play a fundamental role in abduction.

3. Assumption and hypothesis

Distinguishing between assumption and hypothesis (Redmond & Lopez-Orellana, 2022; 2023) is a consequence of adopting our dynamic perspective. Indeed, introducing a hypothesis as conditional entails accepting the provisional nature of its antecedent. In Peirce's example, we believe our point is made clear: "the horseman is surrounded by horsemen with a canopy" ceases to be a surprising fact according to the hypothesis "if the horseman is the governor of the province, he will be surrounded by horsemen with a canopy" and the assumption: "the horseman is the governor of the province". In other words, and we consider this very relevant: there are two moments of provisionality in this cognitive process: on the one hand, *assuming* this rule (which is not necessary) and, on the other, the provisionality of its antecedent that must be saturated to verify the effectiveness of the hypothesis. Only the latter can lose its provisional character.

Let us look at another example to explain our point further. Let us consider a case from the experimental field: if we inquire about the material nature of a piece of rock that we brought back from Mars and we see that it expands when we subject it to high temperatures (a curious circumstance), our assumption will be that the material that composes it is mostly metallic under the rule: if it is a metal, it expands with heat. In other words, the hypothesis is: if this piece of rock is mostly metallic, then it expands with heat. This last conditional would be our *hypothesis* if the reason why this piece of metal expanded were a curious fact and for the *assumption* that the rock is mostly metallic.

So, what place would *explanation* occupy in this formulation? When Peirce says it *would be explained by*, from our point of view, he is referring to the conditional itself, the rule, and not to its antecedent. We will develop this point below.

4. Abduction, syllogism and conditionals

Abduction, syllogism and conditional We will carry out below, to contribute to our argument, a more detailed analysis of the argumentative scheme that corresponds to the abduction or hypothesis in the quote and the example of Peirce that we gave above. According to Peirce, the hypothesis or abduction is, together with the induction, another way of *inverting* a deductive syllogism (CP 2.623, CP 2.625). In this sense we would have the following:

Deduction:

Every governor is a bearer of servants with a canopy (if he is the governor, he owns canopied servants).	Every M is P	Rule
This horseman is governor.	Ma	Case
This horseman is bearer of servants with canopy.	Pa	Result

We make the corresponding inversion to produce the hypothesis or abduction, and we are thus left with the fact that the surprising fact corresponds to the minor of the deductive syllogism:

This horseman is bearer of servants with canopy	→	Surprising fact	Pa	Result
Every governor is a bearer of servants with a canopy (if he is the governor, he owns canopied servants)	→	This would be the rule we found to explain the above.	Every M is P	Rule
This horseman is governor	→	This is the assumption that we must provisionally accept for the surprising fact to be a case of the rule, that is, for it to be (provisionally) explained.	Ma	Case

When we say that, if we assume that "the horseman is the governor," the surprising fact ceases to be such," what we are doing is stating the rule (the conditional) under which the surprising fact is explained (i.e., the hypothesis), if we assume that the horseman is the governor. Clearly, we say it once more, what explains is the *hypothesis*, that is, the *rule* that only makes logical sense in this context if we assume that "the horseman is the governor." Furthermore, to close this idea, nothing better than a phrase from Peirce himself: *This sort of inference is called making a hypothesis. It is the inference of a case from a rule and result*. (CP 2.625).

NOTE: If we formalize the deduction in classical logic, we would have: [∀*x*(*Mx*→*Px*)]∧(*Ma*→*Pa*), which is a valid formula. However, the schema that corresponds to the abduction would be [∀*x*(*Mx*→*Px*)]∧(*Pa*→*Ma*), and we already know that it corresponds to an invalid form and therefore requires another way of logical analysis. To this is added that the conditional relation between the antecedent and the consequent that Peirce considers, as we pointed out above, escapes the material conditional.

Some consequences of the above that we would like to highlight are the following:

1. In the first place, that the characteristic of abduction, from our point of view, is not to find an *assumption* but the general rule that manages to explain the surprising case under that *assumption*.
2. Second, that we must distinguish between hypotheses and assumptions.
3. Third, that if abduction is considered an act of scientific creativity, such creativity lies in finding a rule that fits the case (the surprising fact). Being an assumption in such a rule is entirely subsidiary to it.
4. Finally: Abduct is to find a hypothesis, that is, a conditional that has as a consequence the conclusion of the corresponding deductive syllogism.

Let us look at another example: I wake up in the morning on a clear and sunny day, but I find my car wet (fun fact). How to explain this fact? We would say that such a fact would cease to be curious under the assumption that "today is Wednesday" given that "on Wednesdays, the watering truck passes at 5:00 in the morning." The great contribution of our inference is not that "today is Wednesday" but that we found a hypothesis that explains our curious fact based on the assumption that "today is Wednesday." And this hypothesis is "if today is Wednesday, the watering truck passed by at 5:00 a.m." We do not lose sight of the provisional nature of this hypothesis (the explanation could be another), even though we were able to verify for sure that today is Wednesday.

Abduction Scheme:
Surprising Fact: My car wakes up wet.
Rule: if today is Wednesday, the watering truck passed at 5:00 a.m.
Case: Today is Wednesday.

Finding a hypothesis that *explains* does not mean finding an assumption but the conditional that subsumes the surprising fact under that assumption.

5. Other interpretations

Let us dwell now on how Bellucci and Pietarinen (2023) analyze this topic. If, as Peirce says: the hypothesis or retroduction consists of "starts at consequences and recedes to a conjectural antecedent from which these consequents would, or might very likely logically follow" (MS 0905), then the conjectural antecedent it is not the hypothesis. From our perspective, generating a hypothesis is generating this process. The authors themselves paraphrase it in this sense: "The retroductive process of adopting the hypothesis, i.e., of finding a potential antecedent of which the surprising fact is a consequent, is the first step in inquiry" (Bellucci & Pietarinen, 2023, 14). Adopting a hypothesis is not identifiable with finding a potential antecedent but with the whole process. However, in this statement on the same page, the authors generate some tension:

> […] the hypothesis is a proposition which, if true, would necessitate the truth of the surprising fact. It is the antecedent of a (supposedly) true conditional, *and the conditional is the explanation of the surprising fact. Making an explanatory hypothesis thus amounts to finding an antecedent*. (Bellucci & Pietarinen, 2023, 14, emphasis added)

We have the impression that they are calling the conditional and the antecedent of it a "hypothesis" at the same time. Indeed, if "*Formulating an explanatory hypothesis is equivalent to finding an ante-cedent," how is it that "…the conditional is the explanation of the surprising fact"*? The hypothesis or explanation, is it the antecedent or the conditional? Our answer: It makes perfect sense to affirm that a hypothesis explains or is an explanation. However, this should be distinct from the antecedent from which the surprising fact is derived. The explanation is the rule or conditional that subsumes the surprising fact. Proposing a hypothesis means linking the surprising fact with an assumption, that is, building a conditional. And this connection is not just any but one in which the surprising fact would cease to be such. And then, it is necessary to manage the assumption to know if the rule is effective. For this, the distinction between hypothesis and assumption is essential.

6. Assumption, hypothesis and confirmation

We consider the distinction between the antecedent of the conditional and the conditional itself fundamental because it allows us to explain why

the hypothesis maintains its provisional status after the former is confirmed. Indeed, the authors themselves reflect this tension in the following explanation:

> For example, I can address the man in French or somehow make him raise the coat; if the predictions are fulfilled, if he can replies in French and a long shirt becomes visible under the coat, the experiment has had positive result, and the hypothesis that the man is the governor of the province is confirmed (at least, provisionally). (Bellucci & Pietarinen, 2023, 15)

If the conditional's antecedent is the hypothesis, how can it maintain a provisional character if the experiment gave a positive result? Why is the certainty that the horseman is the governor of the province still "provisional" if the experiment yielded a positive result? Is there any doubt that he is the province's governor, then? Of course not. What happens is that, explained in this way, the antecedent of the conditional or assumption is confused with the conditional itself or hypothesis. The authors are trying to point out above that once the antecedent or assumption has been positively contrasted, the hypothesis (or explanation) is provisionally confirmed. In the example of the horseman, it can be seen clearly: after reliably verifying that the horseman is the governor of the province, our hypothesis that this is the reason why four horsemen surround him with a canopy is only "provisionally" confirmed. The hypothesis is: "If the horseman is the governor of the province, then four horsemen surround him with a canopy." As the authors affirm (Bellucci & Pietarinen, 2023, 14), this conditional is the explanation. However, of course, this hypothesis will be provisional because we could have been wrong, and the explanation is another, despite having verified that the horseman is the governor of the province. The hypothesis never loses its provisional character when the assumption is tested.

7. Fann over Hanson

Fann points out that Hanson distinguishes between "reasons for accepting" and "reasons for suggesting" a hypothesis. According to Fann (1970, 4), the first points to the reasons for accepting the hypothesis as true, while the second points to justifying that the hypothesis is a possible type of hypothesis. This distinction of Hanson (1961, 22; 1958a; 1958b; 1960) is logical because the difference is built on *conceptual grounds*.

Now, if the hypothesis is the antecedent of a conditional, which seems to be accepted by Hanson, this search for "reasons to accept" does not seem very clear to us. Let us analyze this situation using the example of the horseman. According to Hanson, we would be talking about looking for "reasons to accept" that "the horseman is the governor of the province" is true. This search, in principle, does not seem very logical since logic is not concerned with determining whether propositions (such as this last one) are true or not. But then we could take into account that it does not say "seek if it is True" but rather look for "reasons to accept" that it is True. Nevertheless, what does the latter mean for a proposition that, in this case, is an atomic one? Think of it in contrast to any other proposition of the same format: "The door is open." What would it mean to accept this proposition as True instead of looking for "reasons to accept" it as true? In the first case, we should rely on observations via testing (extra-logical task). And in the second, what should we trust? In addition, if we want to protect the provisionality that a hypothesis must keep, we should distinguish between having "reasons to accept" that something is True and that it is True. Having reasons is clearly not "having observations." The reasons would give logical sustainability to this statement. Nonetheless, how to understand this for an atomic of the type "the horseman is the governor"? What would these "reasons for having or accepting" be true for an atomic proposition? In general, what kind of relation exists between a statement, a statement that is a hypothesis, and having reasons for accepting it? From Hanson, this seems to suggest that the distinction between an atomic proposition and an atomic one that is considered a hypothesis is that "I must have reasons for accepting it" for the latter. But why? What kind of distinction is this for atomic propositions? The distinction between accepting a proposition (understood: accepting that it is True) and having reasons to accept a proposition does not seem like a real logical distinction, but rather the consequences of a larger scheme where these propositions gain their status based on the use that is given to them. The latter seems to be presupposed in Hanson. But this presupposition, according to our point of view (Rescher calls it an enthymematic base; see below), is the most important and defines what type of structures we are considering here. We believe that Hanson is guilty of the same thing he accuses when he says, "They begin with the hypothesis as given, as cooking recipes begin with the trout" (Hanson, 1961, 31).

Nevertheless, suppose that we still set out to find reasons for adopting a hypothesis on probation and regard this task as essentially logical as something we will decide on conceptual grounds. So we look for these reasons for "the horseman is the governor of the province" [A], that is, reasons

to consider it a hypothesis on probation. If we do not know first what it means that A is a hypothesis or why A is a hypothesis, how will we find reasons for it? That is, we cannot say that A is a hypothesis because we have found good reasons to consider it so because it would be circular. If we give someone the task of looking for good reasons to regard A as a hypothesis on probation, they will very meaningfully ask us: A hypothesis for what? And that question makes it evident, from our point of view, that A is not the hypothesis. A is part of a larger structure that gives it meaning.

We believe that a possible way out of these complexities is to rethink it from our perspective. Indeed, from our point of view, what Hanson affirms makes sense only if we consider that the hypothesis is the rule, that is, the conditional that links the surprising fact with an assumption. Otherwise, the reasons for accepting a hypothesis are confused with having the assumption that appears as an antecedent of the rule as true. Indeed, "analyzing reasons to accept a hypothesis" gains all its meaning if the hypothesis is the rule as conditional. Giving reasons for a conditional is giving reasons for the connection we have made between the antecedent and the consequent. Accepting it as true would, in this case, mean accepting the conditional as appropriate for the case we are considering. If this is so, the sustainability of the conditional is guaranteed for mere reasons, and we are left with the task of evaluating the antecedent of the conditional or assumption. And the latter is the one that can gain the status of True without changing the provisionality of the hypothesis that is maintained. In our perspective, having "reasons to accept" a hypothesis means – paraphrasing Rescher – that the fulfillment of the antecedent gives us reasons to support the fulfillment of the consequent. For example, in the hypothetical statement "if x>5, then x>4".

Summing up, we then affirm, for Hanson's case, that "finding reasons" for the hypothesis makes sense if the hypothesis in question is the conditional that has A ("the horseman is the governor of the province") as antecedent and the consequent is the surprising fact. Now, how do we build reasons to accept a conditional? Normally -this is our point of view- the scientific context supports or shows agreement with the reasons for accepting a rule. Moreover, these reasons anticipate the testing of the hypothesis. The scientific context consists of the scientific community and the consideration of theoretical approaches en route in that context. Naturally, this context only supports good reasons that are not a guarantee of success: the trash can is full of hypotheses with good reasons.

Finally, let us ask ourselves what a hypothesis is. It is not a categorical proposition or affirmation of the type "the horseman is the governor". The latter does not explain anything. The explanation or hypothesis is that "if

the horseman is the governor, that is why four horsemen surround him with a canopy." Being a hypothesis is not a type of proposition like conjunction or disjunction. Being a hypothesis is a relation or interaction that we establish between two statements, where we agree that the truth of the first gives us reasons to support the truth of the second. The latter exceeds the purely formal expressions. This has led many authors to qualify this relation, and we believe that, quite fairly, as *inferential*. Let us dwell on just one of them: Rescher (2007).

8. Rescher: Enthymematic basis [BE] and pragmatic context

Rescher introduces the notion of the enthymematic base to be able to differentiate between certain types of conditionals:

> The bonding of a conditional to its enthymematic basis is such that one of the effective ways of classifying such conditionals is by the subject matter at issue. (Rescher, 2007, 7)

That is, the *subject matter at issue* determines the type of conditional. That is, somehow, the pragmatic context determines the type of *commitment* between the antecedent and the consequent. And if we restrict ourselves here to the case of abduction that concerns us, we could affirm that this *subject matter at issue* is the scientific context in which an attempt is made to subsume a surprising fact under a general rule. Of course, this does not definitively resolve what kind of relation there must be between the antecedent and the consequent for it to be an explanation of the surprising fact. However, whatever the case, which seems very relevant to us, this relation is inferential.

But let us continue a little more with Rescher: from this idea of the subject matter at issue, he proposes the distinction between conditionals built with a rational and causal criterion. He is the first one that especially interests our work. Rescher gives an explanation of it from the following example: "x>4 because x>5". In the latter, Rescher says, we are not saying that x>5 causes x>4 but rather (interesting formulation):

> […] our entitlement to say the one thing provides for an intellect to say the other. (Rescher, 2007, 13)

And then, Rescher establishes a distinction (very interesting for our approach) between performative and inferential. Those of the inferential type maintain implicational consequences, and, he adds next, it is the

case of evidential conditionals. It does not give further details regarding each one, but we retain for our approach that they can be understood as conditionals in which both parties have a logical relation of the same type as those that have premises and conclusions in reasoning[4].

These Rescher's notions help us to describe with greater precision the rational and inferential nature that we believe is present in a hypothesis generated within the framework of an abductive scientific practice, that is, one that seeks to find an explanation for a surprising fact. Therefore, if to abduct is to give a rule that explains, this rule establishes an inferential *commitment* between its parts, and that can be described as "if the antecedent is fulfilled, we have reasons to believe that we can sustain the consequent."

In Peirce's example, the hypothesis supports the following commitment: if the horseman happens to be the governor, there are reasons to maintain that this is the reason why horsemen surround him with a canopy. Of course, this would (provisionally) explain our surprising fact only if the assumption of the rule is fulfilled, that is, that the rider is the governor. For this reason, Bellucci and Pietarinen (2023) developed a simulation of testing that the only thing that makes evident is that we must separate the assumption tested from the hypothesis itself.

Latest observations: The analysis carried out up to here needs to account for why the antecedent and the consequent were connected in elaborating the hypothesis. That is, there could be many other connections with the consequent since it is not a relation of necessity between the parties. Inferential but not necessary, i.e., we would be in the field of so-called non-monotonic or ampliative inferences. We could even present abduction to some extent as a kind of defeasible reasoning. As we pointed out above, we preserve this fundamental character of abduction only if we distinguish the rule's antecedent from the hypothesis itself.

9. Conclusion

In this paper, we explore the conceptual depth and scope of the notion of hypothesis generation as inferential production of conditionals. The

4. In this sense, Rescher continues Strawson's idea for hypothetical assertions: "We should be prepared to say that the man who made the hypothetical statement was right only if we were also prepared to say that the fulfilment of the antecedent was, at least in part, the explanation of the fulfilment of the consequent" (Strawson, 1952, 85).

latter was coined to give a logical justification to the process of surrogate reasoning in the practice of modeling in science. For this purpose, we contrasted our notion with fundamental texts by C. S. Peirce on abduction[5]. The same exercise was carried out with selected texts from the paradigmatic book by Fann (1970) on abduction in Peirce and the most recent text by Bellucci and Pietarinen (2023) on the same subject. In all of them, what we seek, on the one hand, is to make evident the complexities of identifying "hypothesis" with only a section of the rule that subsumes the surprising case; and on the other hand, we show that our proposal of hypothesis as conditional allows an illuminating complementary reading of his idea of abduction.

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