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Perspectives on the Hermeneutic Philosophy of Science

Abstract: By reviving in a phenomenological manner the forgotten reality of the primary (pre-scientific) meanings (the reality of the life-world), Husserl manages to combat successfully with the type of objectivism that deludes the natural sciences with the image of a reality-in-itself. Nonetheless, his approach succumbs to a kind of objectivism which was always attached to the traditional concept of theory. Several conceptions developed in the traditions of hermeneutic phenomenology try to overcome this deficiency. The present paper puts forward an interpretation of scientists' reflexive attitude towards cognitive structures' interpretative fore-structuring within interrelated practices. To interpret ways of interpretative constitution of objects (including science's theoretical objects) that are meaningful for a certain community amounts to devising an integral hermeneutic circle that unites the proper horizons of those who are doing research and the horizon of interpretation of the research process. This double hermeneutics characterizes the constitutional analysis of the interpretative articulation of scientific domains.

Key words: interpretative practices of scientific research, readable technologies, ethnomethodological description, interpretative fore-structuring, characteristic hermeneutic situation, hermeneutic internalism

1. Introduction

In the early 1970s the question of whether phenomenology could be a kind of critical theorizing gained currency.[1] No doubt, this question was actualized by Habermas' critical reading of Husserl's diagnosis of modern science's crisis. Authors like Aron Gurwitsch, and Maurice Natanson advocated in the 1960s the position that phenomenology is critical just because it provides a critique of science's objectivism and the natural attitude which is its pre-scientific ground. Yet is the critique of objectivism a sufficient condition for having a critical theory? The answer depends on the aims and goals governing the way of overcoming objectivism. Notoriously, Habermas' critical reading of the *Crisis* is inspired by the search for

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[1] See, for instance, O'Neill (1972). John O'Neill addresses the question of whether phenomenology can be a critical enterprise. He makes the case that studies in transcendental phenomenology are supposedly relevant to issues of the reflexive limits of social science knowledge due to its ties with the political reality.

disclosing the "universal" (anthropologically invariant) interest in constituting objectivist theories of nature (or, natural-scientific theories). It is this (quasi-transcendental) search that informs his ambivalent position to the program suggested in the *Crisis*. Habermas' appreciation of that program is essentially linked to the two types of objectivism he distinguishes in his earlier work.[2]

On the one hand, there is the objectivism that deludes the natural sciences with the image of a reality-in-itself. It is a type of objectivism admitting wrongly that the reality which is thematically delineated in natural-scientific research is a "purely objective reality", thereby being not predicated on the constitution of meaning. By reviving in a phenomenological manner the forgotten reality of the primary (pre-scientific) meanings (the reality of the life-world), Husserl manages to combat successfully with this type of objectivism. This is why in the inaugural lecture from 1965 entitled "Knowledge and Interest" Habermas praises Husserl for his criticism of the "objectivist illusion" regarding the image of a reality-in-itself. On the other hand, however, there is another type of objectivism that struggles for freeing scientific knowledge from interest. By means of this objectivism, one attributes to science's theoretical knowledge pseudo-normative power from the concealment of its actual interest. The price Husserl has to pay in defending theory's interest-neutrality is too big: His diagnosis of the crisis of modern science (and the "humanity of modern Europe") remains tied to a sort of affirmative theorizing. It is a theorizing that by being not able to reveal the guiding interest in the objectivist study of nature, proves to be also not promoting the interest of emancipation (i.e. the interest that is at issue in critical theory).[3]

To sum up, Husserl's approach allows one to dismantle the "deficit of reflexivity" both in scientific objectivism and the epistemological legitimation of that objectivism. Nonetheless, this approach succumbs to a kind of objectivism which was always attached to the traditional concept of theory. While criticizing the objectivist self-understanding of the sciences – so Habermas' argument goes – transcendental phenomenology fails to resists the objectivism that appeals to freeing of scientific knowledge from interest. There is no phenomenological reduction that can unfold the "universal species-interests" in constituting the different types of scientific knowledge. The nexus "constitutive interest – scientific knowledge" proves to be *terra incognita* for Husserl's transcendental-constitutional analysis.

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[2] See on this point Habermas (1968, 146-168).

[3] Interestingly enough, twenty five years after his inaugural lecture devoted on the critical reading of the *Crisis* Habermas repeats the basic motives of his reading in a talk delivered at the German Congress for Philosophy (1990). See Habermas (1991, 34-48).

Now, in view of Habermas' criticism the question arises of whether phenomenology does have sufficient resources for overcoming the objectivism (and cognitive essentialism) traditionally associated with the epistemological nature of scientific theory? In raising this question, one has to address the kernel of phenomenology – the constitutional analysis of meaning. In what follows, my aim is to show that Habermas's criticism is justified with regard to Husserl's transcendental phenomenology (including the version of it developed in the *Crisis*). Yet this criticism is irrelevant to the constitutional analysis suggested by hermeneutic phenomenology. More specifically, I will be preoccupied with a version of that kind of hermeneutics of science which is worked out with the intention to surmount the reificationist objectivism by taking into account science's intrinsic resources to address aspects of the problematic of ontological difference. The version of hermeneutics of science which will be outlined here differs in an important respect from Heidegger's existential conception of scientific research. It denies the dramatic division between the ontical and the ontological, thereby admitting the possibility of a kind of ontological reflection within scientific experience.

Looking at scientific research as a reading process manages to get rid of that reificationism by developing in particular a hermeneutic view of scientific objectification. However, it is not my aim to discuss this view here.[4] In the remainder I will rather concentrate my efforts on the concept of critique implied by this kind of hermeneutic phenomenology. In a tentative manner, the approach to scientific-research-as-reading serves the purpose of a critical philosophy since it succeeds in overcoming the Cartesian dualism by linking a critique of science's self-imposed identity in terms of objectivism and epistemological foundationalism with a hermeneutic theory of scientific practices and the constitution of research objects within the dynamics of these practices. Furthermore, this approach acquires the status of a critical theory by dismantling scientism as an "ideology" *sui generis*. In other words, it plays the role of a "critique of ideology", thereby preserving the original distinctive feature of critical theory. The approach to scientific-research-as-reading tries to unfold scientism as a "false consciousness" concerning (i) science's cognitive specificity (and methodological rationality), (ii) science's professional ethos, and (iii) science's ultimate goals and aims. Scientism promotes an image of science that is in a drastic discrepancy with the interpretative nature of scientific research. Overcoming the imposed image and identity of science (that is legitimized by objectivist-foundational epistemology and philosophy of science) in favor of a view of the dynamics of interpretative practices (i.e.

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[4] For a detailed analysis of natural-scientific objectification in terms of hermeneutic phenomenology, see Ginev (2006).

practices distinguished by "readable technologies") taking place in scientific research would imply a new way of devising science's cognitive specificity and the ethos of the research work. This is the task of hermeneutic phenomenology of science as a critical philosophy. On the main idea of what follows, scientism can be overcome when the tendencies of recognizing the ontico-ontological difference in several research programs get intensified.

2. Is the Ontico-Ontological Difference Thinkable in Scientific Terms?

On a paraphrase of Heidegger's celebrated dictum, science does not think because it is not able to reflect upon (or, to make its own theme) the ontico-ontological difference. Notoriously, Heidegger is inclined to treat this state of affairs not in terms of science's constitutive deficiency. The forgetfulness of this difference within the cognitive experience stemming from scientific inquiry is rather – so his argument goes – a prerequisite for having an effective (according to epistemological criteria of efficacy) research process. If science would have been able to reflect on the ontological possibility of the ways in which ontic domains of scientific research come into being, then this reflection would have been destructive for the constitution of such domains through (what Heidegger calls) the "mathematical projection of Nature". Is nowadays this diagnosis concerning science's inability to think – a diagnosis pronounced not at the advent of hermeneutic phenomenology but after the *Kehre* – acceptable for those who while being working scientists (and being far away from the orbit set up by the assumptions of a certain foundational philosophy of consciousness), display discontent in looking for a philosophical identity of science in terms of scientism, representationalism, essentialist realism, objectivism, and instrumental rationality?

Before outlining a line of philosophical arguments against Heidegger's diagnosis, let me stress that science itself displays tendencies to refuting it. There is at least one area of scientific research where the dilemma "either thinking ontologically or doing research ontically" became invalid. I have in mind the research programs of the "Heideggerian Artificial Intelligence". Ironically enough, the programs in Heideggerian AI refuted Heidegger's dictum that science is unable to think the ontological difference. In these programs existential aspects of the facticity of being-in-the-world are approached in such a manner that the difference in question becomes a theme of investigation. To be sure, in most of these programs the ontico-ontological difference is not explicitly at issue. Furthermore, in many respects the programs in question are closer to ethnomethodology than to hermeneutic philosophy. The champions of Heideggerian AI are rather preoccupied with designing, for instance, mobile robots distinguished with

"intelligence without representation" (Rodney Brooks); models of everyday comportment based on a "situated activity view" (Philip Agre); models of routine practices that are not organized according to predetermined plans and algorithms; heuristic, praxiological, and hermeneutic revisions of the model of conscious symbolic reasoning; a theoretical discourse about usability (in Heidegger's sense of readiness-to-hand) that is detached from narrow kinds of cognitivism; and a methodology of a design for situations of "throwness of unhampered use".[5] In all these cases, the focus is on the concernful everydayness of different kinds of human work-world rather than on the existential totality of Being's meaning.

Nonetheless, the hermeneutic dialogue between the designer and the user requires a reflection that integrates a kind of ontico-ontological difference in the research process. More specifically, this dialogue promotes a sort of interplay between ontic interpretation (of usability, user's experience of employing tools, situated action, everyday contextuality, routine practices, etc.) and ontological interpretation of how a micro-world gets articulated as a meaningful world. The ontic interpretation specifies a type of entities, events, and processes, thereby delineating a domain of possible objects of inquiry, whereas the ontological interpretation calls into play a double hermeneutics. The latter consists in an interpretative investigation of how those who are subjects of practical experience of using contextually things that are ready-to-hand articulate meaningfully within their practices a micro-world. The apex in development of Heideggerian AI up to now is Fernando Flores's program of "ontological design" where the task of differentiating between ontic explanation and ontological reflection is explicitly addressed. Terry Winograd cogently argues that Flores's concern is with "unconcealing the fundamental ontology that underlies the use of computers, in particular the use of computers in work." (Winograd 1995, 121) The structure of "social connectivity" is the main ontological theme in this program. Flores spells out the doctrine that the ontological concept of designing as related to social connectivity opens up a wide range of empirical studies of new artifacts, equipments, buildings, and organizational structures. His theory of the process of design is structured around the ontico-ontological difference.

3. Two Perspectives on Scientific Practices

In the human sciences one admits that what one is studying is constituted by a self-interpretation. There is inevitably an image of self-understanding incorporated in the objects of study. Consequently, one

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[5] On the tendencies in the historical development of the "Heideggerian conceptions of Arteficial Intelligence" see Terry Winograd (1995, 108-127).

cannot avoid the issue of how the way of self-interpreting constitutes cultural artifacts that become objects of study. In confronting with this issue, one usually tries to contextualize the "text" of the object under investigation. The more this contextualization is advanced (i.e. the more contexts of reading the "text" are delineated) the more the constitutive role of the self-interpretation incorporated in the objects becomes elucidated. The contextualization (textualizing by delineating a context) in its turn is an interpretative process. In this double hermeneutics (contextual interpretation of interpretative constitution of cultural artifacts) neither the possible contexts nor the "text" get a status of a presence-at-hand. To be sure, the contextual interpretation gains currency in natural-scientific programs as well. A case in point is the idea for a "contextualized locality". Halvorson and Clifton (2004) advance this idea in taking issue with EPR argument for the incompleteness of quantum mechanics. According to these authors, by implementing the idea of contextual locality, one is able to show that in certain contexts one is warranted in attributing certain elements of reality to distant (unmeasured) systems.

To be sure, the appeal to various forms of contextualism is a distinctive feature of other contemporary programs in quantum mechanics (and in other domains in which one deals with "entangled systems") as well. Yet does this contextualism entail the need of a double hermeneutics? Obviously, the philosophical-anthropological assumption that there is a moment of self-interpretation incorporated in the objects of study cannot be applied to natural scientific domains. It seems a little bit strange to speak of contextual interpretation of something that is contextually constituted (by means of interpretative procedures) in the natural sciences. Nonetheless, there is a sense in which the research process in these sciences can be approached from the viewpoint of double hermeneutics. To demonstrate the possibility of such an approach requires a scrutiny of scientific practices in a manner that attributes to them "readable technologies" (Heelan). In trying to highlight this claim, I will compare the approach that leads to a double hermeneutics in understanding scientific practices with ethnomethodology of scientific practices. My aim is to show the intimate relationship between the tenets of double hermeneutics and the integration of the ontological difference in science's cognitive experience.

The plurality of scientific practices (and not scientific praxis as a whole) is the focus of two traditions of science studies. Ethnomethodologists and students of science with hermeneutic orientation are united in the struggle against cognitive essentialism and explanatory determinism (including the causal-naturalist scenarios of explanatory sociology of knowledge) when treating scientific practices. They share significant philosophical claims about the specificity of scientific research. Both programs were inspired by the idea to find a third alternative in coping with science's research practices

beyond the dilemma between foundational epistemology and social constructionism. (Actually, for ethnomethodologists more pressing is the task to avoid the twin pitfalls of sociological scientism and epistemological skepticism. Yet the former is a consequence from a version of foundationalism and the latter follows from that kind of constructionism which cognitive sociology of science is licensing.)

Ethnomethodological studies of science privilege the practice of observation in science. Observation in the process of doing research is regarded to be the most significant ingredient in an elaborate system of concerted scientific practices and their equipments. It is the respecification of this scientific practice that informs the postanalyitic status of the program in the first place. To put it in Lynch's (1993, p. 283) words, "what scientists actually do when they accountably make observations and test hypotheses has an unknown relation to general epistemological treatments (including those of a critical epistemology)… An investigation of observation would seek to demonstrate how a vernacular use of the term observation is uniquely adequate to some practice." Now, the same role "observation" plays for the ethnomethodologists of science, the process and pocedures of "reading" are playing for the champions of interpretative-phenomenological science studies.

The point of departure of the hermeneutics of science was Patrick Heelan's (1983a) attempt to apply paradigms of meaning constitution taken from the phenomenological and hermeneutic traditions to the investigation of the constitution of research objects in normal scientific everydayness. According to Heelan, the reality that is ready to hand in the process of scientific research is constituted as manifolds of meaningful "texts" by means of "readable technologies". In this formulation, reading and constitution are intimately related. Texts are not written before initiating a research process that takes the form of reading process. Texts which science reads are artifacts of doing scientific practices, caused to be written by Nature on human instruments within the dynamics of changing configurations of such practices. Hermeneutics of science opposes the traditional distinction between the context of discovery and the context of justification. Investigating the interpretative constitution of scientific domains requires a phenomenological paradigm of meaning constitution. Studies in hermeneutics of science outline a specific context of constitution that is reducible neither to the empirical (psychological and sociological) inquiries into scientific discoveries nor to the normative (epistemological-semantic) reconstructions of science's cognitive products.

Ethnomethodologists do not speak of meaning constitution since this would revive the "will to theory" (in this case, a phenomenological theory of meaning). They rather prefer to say that meaning comes into being through contextual placement of tools in accordance with "the grammar of

the practice". Such a claim has much to do with their conception of practitioners' life-world. The meaningfulness of this world is informed by the grammar of the concerted practices. On another formulation, the world is the inter-subjective reality that is in an ongoing process of construction through following rules of the concerted practices. The articulation of meaning seems to be a function of rule following. In assuming that there is nothing that determines rule following, ethnomethodologists of science oppose not only sociology of knowledge but any program that is presupposing essentialism (external determinism) about the practical order of scientific research. The order of rule following is intrinsic to scientific practices' dynamics. In fact, this claim is a corollary to the ethno-methodological description.

At the beginning of his study on the ethonmethodological foundations of mathematics Livingston (1986, p. 6) makes clear what he intents to describe – the moment-by-moment work of theorem-proving at the mathematical work site. The very description should be furnished in a manner that will unfold how the outcome of this work contains qualities allowing it to transcend the local contingencies of the moment-by-moment work. What is described is the life-world of mathematicians in which they produce the "naturally accountable proofs" of ordinary mathematics. Thus, the ethnomethodological description of theorem-proving aims at presenting the mathematicians' activities in line with Garfinkel's celebrated view of "accountability". On this view, in analyzing everyday activities by focusing on members' methods for making those same activities as visibly rational und functionally relevant to achieving practical purposes, the ethno-methodological description demonstrates the accountability of the activities. (Garfinkel 1967, p. vii) This is in the first place a description of how a community's members manage to elaborate on methods for recognizing contextually relevant structures of social action. At stake is an unfolding "contexture" (Michael Lynch's expression) of practical details. Ethno-methodological descriptions avoid carefully the introduction of "contextual factors" that might produce explanatory effects. There is no explanatory moment involved in the description of settings of scientific research where simple or sophisticated equipmental complexes are operating. These settings are "treated similarly as matrices for human conduct that do not simply provide places where human beings work but instead provide distinctive phenomenal fields in which organizations of work are established and exhibited." (Lynch 1993, p. 132)

The accountability of the activities leading to a proof mediates between the two principal moments of the description – the life-world's everyday work and the final cognitive upshot of mathematicians' symbolic manipulations that transcends the particularities of community's life-world. Of course, stressing the mediatory role of accountability does not mean to

provide an explanation of the transition from the routine proving-work's situated accomplishment to the transcendent rigour of the proof. Unfolding this role, however, assigns an epistemic value to the ethnomethodological description. The description manages to demonstrate how the transcendence of the local activities of theorem-proving is accomplished within the life-world of working mathematicians. There is no need to supplement the ethnomethodological description with an "external explanation" of the transcendence. For the sake of stressing the epistemic value of the ethomethodological description of scientific practices, Livingston develops the concept of "life-world pair". This is a pair that consists in a cognitive outcome of mathematicians' lived work, on the one hand, and the practices of this work, on the other. The life-world pair should demonstrate the practical equivalence between life-world activities and semiotic tools in scientific research. The instructive reproducibility of practices is at stake in the treatment of the life-world pair.[6] Livingston makes the case that the life-word pair is a distinctive feature of mathematics and the natural sciences in their status of "discovering sciences of practical action". This claim is highly problematic, and even ethnomethodologists display skepticism about its validity.[7] Nonetheless, it is the only ethnomethodological claim concerning the life-world's foundations of science's cognitive specificity.

To be sure, the idea that practices of doing research are fore-structuring the cognitive results is not alien to ethnomethodological studies. Thus, in appealing to the concept of a "projected gestalt" that avoids a construal in terms of Gestalt psychology, Livingston (1986, p. 205) is touching upon different aspects of the discursive-practical fore-structuring of the proving process. He observes that during the process of presenting a proof on a blackboard the end result is constantly anticipated as a "projected gestalt". Now, is the introduction of this gestalt a kind of minimal explanation in cognitive terms, or a hidden appeal to a kind of interpretative phenomenology? Both options are unacceptable for Garfinkel's upholders.

No doubt, ethnomethodologists have good reasons to abstain from giving an account of the phenomenon of "constant anticipation" in terms of Gestalt psychology. Would they have gone on to do this, they would have introduced a theoretical (explanatory, causal) scenario in their descriptive studies. Nevertheless, the question of how the anticipation of the ultimate result is rooted in procedures and practices remains open. Getting grips with this phenomenon is of prime importance for resolving the main problem of the ethnomethdological work on scientific research – the problem of how contingent practices ("the lived work") located in

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[6] See in this regard Livinston (1987, 119-22).
[7] See in this regard Lynch (1992a, 244).

particular life-worlds of scientific communities can produce "transcendent" (objective) results. To resolve this problem requires figuring out the relationship between all relevant practices taking place in mathematicians' life-world and the structure of objective features. In trying to do this, however, ethnomethodologists are facing a dilemma – they are compelled either to hypostatize the projected gestalt or to come to terms with a vicious circularity between the gestalt organizing background practices and these practices that supposedly transmit the gestalt.[8] Ethnomethodologists do not have resources for ridding of this dilemma because they reject the possibility to transform the aforementioned vicious circularity into a kind of interpretative circle by means of a transcendental reflection.

In hermeneutic phenomenology, "understanding" connotes not only "understanding of the world as open horizons of possibilities", but also the way of how one understands oneself in accordance with the possibilities one is able to appropriate. These are possibilities of dealing with those entities which practitioners have ready to hand in the settings of their instrumental-practical activities. (From the existentialist point of view that corresponds to the hermeneutic paradigm of constitutional analysis, those who are thrown in the world have not a static being but a potentiality-for-being – a being through the choices of possibilities they make.) The articulation of the world (in particular, the thematic articulation of scientific domains) is the outcome of the interpretative appropriation of possibilities in different settings of instrumental-practical activities. The nexus of understanding (projected horizon) and interpretation (acts of appropriating possibilities) builds the core of the hermeneutic-phenomenological version of constitutional analysis. To make explicit this nexus requires reflecting upon the interpretative process (the "reading process" in scientific research) through which practitioners are articulating meaningfully what is ready-to-hand (research objects of different kinds) in their practices. This is a transcendental reflection upon the transcendence of the world of interrelated practices in which practitioners are thrown.

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[8] The gestalt is at once constituting the relevant background practices and organizing these practices. Each of the two components – background practices and projected gestalt – involved in this circularity makes available what is necessary for the other. The accusation of circularity is the main point of David Bloor's criticism of Livingston's approach to the proving process in mathematics. In advocating the cognitive sociology's explanatory approach, Bloor (1987, 350) argues that the ethnomethodological "account we have been given of how objective structures are supposed to emerge from local, work-site practices in fact takes us round in an uninformative circle". In laying the claim that this circularity can be transformed into an "informative circle" without committing a kind of explanatory essentialism and determinism, the champions of hermeneutics of science are able to oppose both the sociology of scientific knowledge and the ethnomethodology of scientific practices.

The radical question for all kinds of science studies trying to avoid the pitfall of explanatory (externalist) determinism is how to make reflexivity that is intrinsic in scientific practices thematically accessible. For most of Garfinkel's upholders, the answer lies in the advocacy of the claim that an ethnomethodological inquiry of science in the making is more a matter of immersion than of distancing. In some versions of ethnomethodological description, however, there is the motif of taking reflexive stance towards the reflexivity embedded in practices creating social order. Such versions are closely related to hermeneutic-philosophical approach to the issue of reflexivity. Thus, Melvin Pollner (1991) is pleading for integrating the acts-in-context's hermeneutic circle in the ethnomethodological description. This extension of the latter would make it a "radically reflexive" enterprise that would permit a reflexive examination of the ethnomthodologist's relationship to reflexive acts of creating order. Actually, this more comprehensive conception of reflexivity leads to the view I am discussing under the rubric of "double hermeneutics". Pollner's radical reflexivity aims at a contextual interpretation of practitioners' incarnate reflexivity through which the researcher's constitutive relationship will come to the fore. However, ethnomethodologists are as a rule negatively reacting to such hermeneutic revisions that presumably equate ethnomethodological anti-foundationalism with an interpretative-constructive anti-objectivism.

On a particular aspect of "ethnomethodological objectivism", the phenomenon of rule following must be illuminated by avoiding any skepticist construal of the relationships between rules and actions. In arguing that rules determine actions, ethnomethodologists manage to pinpoint the basic contrast between their program of science studies and that program of sociology of scientific knowledge which is essentially inspired by a kind of (skepticist) reading of Wittgenstein's later work.[9] (In this reading, since actions are underdetermined by rules the possible solution to the problem of how orderly conduct gets established is that one

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[9] How to read Wittgenstein's later work is at issue of an interesting exchange between Bloor and Lynch. It seems as if both authors agree that the basic difference between cognitive sociology and ethnomethodology depend entirely on the ways of construing this work. In rejecting the internalist approach to rule-following behavior suggested by Lynch, Bloor (1992, 273) argues that "the internal relation between rule and application is a social relationship. What is more, it is a relation that is clearly analyzable using precisely the conceptual apparatus that ethnomethodologists affect to dismiss." Bloor's reading of *Philosophical Investigations* brings him to the conclusion that Wittgenstein refuted ethnomethodology before it was even born. Lynch (1992b) opposes the "sociological reading of Wittgenstein" by showing the Wittgenstein's account of language games is not a causal statement about rule following. A champion of hermeneutics of science might respond to this exchange by arguing that regardless of whether *Philosophical Invsetigations* are read in a sociological or an anti-sociological manner, it is the very Wittgensteinian framework that is too narrow for giving account of rule-following behavior.

suggested by social constructionism.) On the ethnomethodological construal of Wittgenstein, though the particular procedures (like counting) involved in scientific practices are social phenomena, they cannot be regarded as social objects (ingredients of social institutions) exposed for causal explanations by scientific sociology.

In continuing this line of reasoning, Lynch (1993, p. 180) observes that for "complex practices of mathematics, the consensual culture of mathematics is expressed and defined mathematically; it is available in the actions of doing intelligible mathematics." This is why to define the cognitive contents of mathematics and science as social phenomena seems to be a piece of vain work. The anti-skepticist reading of Wittgenstein seems to be the antidote against any hypostatization of social essences like socialization, consensus, structural networks of social roles, etc. The character of rule following – so their argument goes – depends entirely on the self-sufficiency of this relationship. By implication, one need nothing extrinsic to this internal relationship to furnish an account of rule following. The alleged social essences are also not extrinsic. They get dissolved in the internal relationship between rules and their applications. In this regard, admissible are only descriptions of those intrinsic moments of rule following which are constitutive of a certain normal scientific order, i.e. an order created by following rules. Accordingly, here is the basic difference between cognitive sociology and ethnomethodology: When sociologists of knowledge go on to introduce social essences and structures in their explanatory scenarios, they are appealing to externalist factors that should account for the relation between rules and behavior.

In hermeneutics of science's perspective, scientists' reflexivity concerns the interpretative fore-structuring of the articulation of a scientific domain. Very often scientists go on to take a reflexive position to what and how they are reading. The debates on how to read measurements in quantum mechanics provide a good illustration of how scientists are reflexive about the readable technologies of their research. In hermeneutic perspective, reflexivity does not simply mean reflexive formulations of scientists' activities. The reading process' intrinsic reflexivity is not to be disentangled from the circularity of interpretative fore-structuring and ongoing articulation of domain's cognitive structure. Due to reflexivity, the very demarcation between horizons of possibilities for doing research and the cognitive products as actualized possibilities becomes progressively blurred. Accordingly, the objects specified by these products (concepts, theories, analytical techniques, formalisms, methods, etc.) are no longer predicated on a status of pure presence. They are rather projecting their status upon possibilities. To take up the example I mentioned, a quantum-mechanical object is to be identified with regard to the research possibilities one is

going to appropriate. The object exists in accordance with that which possibility will be chosen and actualized.

Hermeneutic studies of scientific research put forward interpretations of scientists' reflexive attitude towards cognitive structures' interpretative fore-structuring within interrelated practices. To interpret ways of interpretative constitution of objects (including science's theoretical objects) that are meaningful for a certain community amounts to devising an integral hermeneutic circle that unites the proper horizons of those who are doing research and the horizon of interpretation of the research process. This double hermeneutics characterizes the constitutional analysis of the interpretative articulation of scientific domains.[10] The circular relations between hermeneutic fore-structuring and cognitive structure in a scientific domain's ongoing articulation are not "behind" the interrelatedness of scientific practices. They take place within these practices. Making the circular relations explicit requires a transcendental reflection, i.e. a reflection upon the hermeneutic circularity that makes possible the articulation of a scientific domain as an empirical process. It is this reflection that scrutinizes the conditions under which the employment of certain readable technologies leads to the constitution of objects of a given type. Since the "conditions of possibility" supposedly revealed by this kind of doubly hermeneutic reflection are not attributed to an invariant transcendental instance (like the a priori structure of mind, the transcendental layer of language, the transcendental communication community, and so on), there is no essentialism implied by the interpretative revealing of scientific research' interpretative circles of constitution and articulation.

Making these circles explicit allows one to address the question of what does it mean to give an account of following rule in scientific research. For the champions of hermeneutics of science, the relation between rule and application is involved in the very hermeneutic circle of appropriating possibilities projected by interrelated practices. Rule following as a relation between rule and application is intrinsic to the interpretative circularity of scientific research as a reading process. This claim is to be construed in the sense that the relation would be impossible beyond or outside a circle of interpretative appropriation of possibilities. More specifically, rule following is intrinsic to the interpretative totality of being-in-the-world which in case of science means a constitution of research domains through readable technologies. Rule following comes into being within an open horizon of projected possibilities. The rule is instituted by the way of appropriating and actualizing possibilities. Accordingly, rule following expresses tendencies and regimes of appropriating possibilities in the articulation of a research domain.

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[10] For the very idea of double hermeneutics as it is employed here, see Ginev (1998).

Michael Lynch blames the approach of cognitive sociology to rules in isolating the formulation of the rule from the practice of rule following. Yet by the same token, the ethnomethodological approach can be accused of isolating the relationship between rules and behavior from the interpretative totality of being-in-the-world. As it was already mentioned, in their efforts to overcome explanatory essentialism and causal determinism in giving account of rule following, ethnomethodologists are committed to a certain (philosophical) tradition of reading Wittgenstein. This fact provides an opportunity to specify the philosophical rationale for criticizing ethnomethodology from a hermeneutic-phenomenological point of view. The objection against the purely descriptive approach to scientists' reflexivity is a particular case of the objection that champions of hermeneutic phenomenology raise against the semantic-instrumental reductionism of Wittgenstein's philosophy: The phenomenon of rule following taking place in life-forms' language games is not to be isolated from the existential totality (facticity) of being-in-the-world. By implication, meaning associated with incarnate reflexivity is not to be addressed in terms of a kind of instrumental-pragmatic semantics. It is rather a topic of an existential analytic based on double hermeneutics.

4. The Notion of Characteristic Hermeneutic Situation

The research process in a given domain is always in a hermeneutic situation. *Prima facie* such a situation can be depicted in Heideggerian terms. In the research process the practitioners who are involved in it have ideas about the specificity of domain's theoretical objects in advance (i.e. the research is grounded in a fore-having); they see the outcomes of formal, experimental, and calculative procedures in advance (the research is predicated on a fore-sight); and they envisage the ways of further incorporation of each particular outcome (measurements, experimental results, diagrams, data-models, theoretical models, conceptual innovations, etc.) in new configurations of practices (i.e. the research process is characterized by a fore-conception). The triad of the research process' fore-having, fore-sight, and fore-conception lays out an open fore-structure of each stage of domain's cognitive structuring by means of the (dominant) theory's formalism and its actual semantic models. (Though not challenging the assumption of semantic closedness of domain's basic theory, the theory's possible semantic models are particular manifestation of domain's interpretative openness.) The *hermeneutic fore-structure* "works" against the attempts at codifying a complete cognitive structure of a scientific domain. It always reveals possibilities of modifying (in the extreme case, breaking down) the present codification.

The hermeneutic fore-structure is not something that is statically pre-given to the dynamics of scientific research. In each configuration of scientific practices the unity of fore-having, fore-sight, and fore-conception opens itself in a specific manner. The hermeneutic fore-structure (as possibilities of seeing, having, and grasping domain's empirical and theoretical articulation) does not have a being-in-itself that might be separated from the changing configurations of scientific practices. Nevertheless, there is a general characteristic of how a domain's cognitive structuring gets constantly embedded in an open (and changeable) hermeneutic fore-structure. This general characteristic which persists in the articulation of a domain of scientific research I call a *characteristic hermeneutic situation*. From the very outset the scientific domain becomes disclosed (for a further articulation) in such a situation. The characteristic hermeneutic situation specifies the configurations of scientific practices as configurations of readable technologies. In other words, it specifies the research process as a process of reading. On a more technical level (and following Heelan's thread), a characteristic hermeneutic situation is identifiable by the complementarity of two dimensions of scientific research as a process of textualizing and reading (or better, textualizing-through-reading).

These are the dimension of objectification (de-contextualization) and the dimension of contextualizing. The former dimension refers to representing and reading mathematically idealized entities with quantifiable parameters, allowing the construction of data-models. The de-contextualization is manifested by the formal-semantic isolation of texts (embodying mathematical idealizations, theoretical objects, data-models, research objects and spaces of representation) from their readable technologies. The second dimension refers to the need to re-contextualize the reading process during the empirical and formal construal of a domain's theoretical knowledge. As a rule, the re-contextualization demands a reflection on the hermeneutic situation within the reading process.

The complementarity (or sometimes, the superposition) of both dimensions, which persists in a characteristic manner in all configurations of readable practices is another definition of the characteristic hermeneutic situation of scientific research. (Thus, the characteristic hermeneutic situation, in which the domain of enzyme kinetics becomes disclosed, is the complementarity between the dimension of objectification as it is informed by a formalism that describes the kinetics of irreversible enzymatic reactions in terms of a relation between the reaction rate (the rate of bound substrate conversion to product) and the concentration of the substrate (plus the rate at which bound enzyme is unbound by substrate). The kernel of this formalism is the Michaelis-Menten equation, which rest on strong objectifying assumptions: (a) the product does not bind to the enzyme, thereby precluding the possibility of a reversibility of the reaction; (b) the total enzyme concentration remains constant; and (c) the whole system of

the metabolic reaction that is catalyzed by enzyme remains in steady-state.[11] The dimension of contextualizing was informed by the search of the complexity of the chemical nature of protoplasm as a base of the metabolic processes in living organisms. This complexity can only be unfolded in a plurality of investigatory contexts. In the first decade of the 20th century the work in line with this dimension was stimulated by the rejection of the hypothetical (theoretical) entity of the "energy reach protoplasmic protein". In contextualizing the study of the abovementioned complexity, those who did research along the lines of this dimension succeeded to weaken the Michaelis-Menten formalism (as this was later extended by the so-called Lineweaver-Burk plot).

5. Concluding Remarks

I started this paper with an analysis of Habermas's critique on Husserl's doctrine of scientific objectification. Let me conclude by addressing another aspect of Habermas's position. Steven Vogel is right when arguing that by treating the natural sciences' guiding interest in prediction and control of nature as determined by a mode of action that is built into the structure of the species as such, Habermas precludes the opportunity to address the issue of how interests in constituting scientific knowledge get generated in the dynamics of changing practices of research. By overlooking this issue, he acknowledges tacitly the objectivist picture of science and the positivist view about scientific rationality.[12] There is in Habermas' enterprise a hypostatization of a "species-wide universal interest" that is exempt from a genesis within the practical contexts of being-in-the-world (or to put it in a more Heideggerian parlance, an interest that is deprived of "existential genesis").

The approach to scientific-research-as-reading repudiates any kind of philosophy that in transcendental or quasi-transcendental manner claims that the actual and potential reality of natural-scientific research is constituted by a global knowledge-guiding interest. A philosophy centered around a "transcendental-anthropological epistemology" – so the argument goes – hypostatizes such an interest by ignoring the real dynamics of

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[11] In line with Heidegger's existential conception of science, one may admit that the domain of enzyme kinetics is disclosed by a particular kind of idealization through which a region of Nature itself is "mathematically projected". In this projection the chemical reactions taking part in metabolism as they are catalyzed by enzymes are uncovered beforehand as a domain present-at-hand. This mathematical determinism is unavoidable in Heidegger's scenario of the genesis of science's theoretical attitude from the "average everydayness" of the primordial mode of being-in-the-world. In fact, however, the Michaelis-Menten equation (as a model of chemical equilibrium) is introduced in 1913. Joseph Fruton describes the period from 1830 to 1914 as the time in which biochemistry was in a state of continuous transformation. (See Fruton 1990, 48-71, and Fruton 1992, 74-87.)

[12] On this argument see, in particular, Vogel (1991, 255-58).

changing configurations of practices in which domains of scientific research (and thus, the reality of the natural sciences) get articulated. In opposing the "derivation" of natural science's knowledge-guiding interests from an invariant teleological structure (of conquering instrumentally what is present-at-hand) embedded in the strategic-manipulative human action, the approach to scientific-research-as-reading stresses that all cognitive interests are arising out of characteristic hermeneutic situations.

The interest in self-reflection does not make an exception. In this case, however, the characteristic hermeneutic situation is *terminus ad quo* and *terminus ad quem* of the reflective attitude. The complementarity between the dimension of objectification and the dimension of contextualization becomes explicit theme of scientific study. Consequently, the hermeneutic fore-structure of theorizing gets thematized as well. In reflecting upon its own characteristic hermeneutic situation (in which an autonomous domain is disclosed), scientific research ceases to be a "purely ontic enterprise". The practitioners think not only in terms of achieving results that are acceptable and reliable by scientific community in accordance with the respective cognitive values and epistemological norms and criteria. (This is the ontic layer of their cognitive experience.) They think also in terms of how their domain of research is in a process of articulation within a projected world-horizon of possibilities. In so doing, they integrate the ontico-ontological difference in their cognitive work. At stake in a scientific community guided by the interest of a (hermeneutic) self-reflection is the issue of how the practitioners are in a state of situated transcendence (being at once in particular contexts and beyond each particular context) in the reading process of scientific research.

Scientific research that is able to reflect its own being-in-the-world (i.e. its characteristic hermeneutic situation of disclosing and articulating a scientific domain within an open world-horizon of possibilities) has the potential to provide the resources for its own interpretation in terms of its ontological necessity. In order to clarify this claim, I will pause for a moment on an aspect of Joseph Rouse's criticism of Fine's Natural Ontological Attitude. In accepting that science provides the context for its own interpretation in terms of concepts such as truth, reality, explanation, and justification, Rouse argues with good arguments that the champion of NOA "cannot claim in the same way that scientific practice provides the resources for its own interpretation politically and culturally." (Rouse 1996, 80) To be sure, most of the working scientists are professionally unconcerned with the political and cultural standing of their practices. Ethical, ideological or axiological issues do not typically arise within the articulation of a domain of scientific research. Rouse is also right in asserting that in their occasional concern with such issues (as a response to a political criticism that threatens to undermine the ethos of academic freedom) scientists address the issues by stepping momentarily outside the

interrelatedness of their practices, thereby adopting extra-scientific positions. What Rouse in his criticism of NOA's insufficiency forgets to take into consideration is the fact in certain cases in which the research process is under external political pressure, the practitioners involved in this process are even refusing to get engaged in an extra-scientific debate. Yet they react to the pressure by appropriating new possibilities projected as an open horizon by the interrelatedness of their own practices.

Therefore, the research process remains true to the standards of a kind of *hermeneutic internalism*. Being under external pressure, it designs a new regime of exploiting possibilities that otherwise are neglected or even unseen. Because of its internal-interpretative flexibility the research process provides the resources for its self-reflective resistance against the politically motivated external control. However, the practitioners involved in scientific research as a reading process can enjoy this resistance only on the condition that they reflect (ontologically) on the characteristic hermeneutic situation in which their domain of research is disclosed and articulated. Each external discussion of the specificity or the social-pragmatic significance of the respective domain would be effective and fruitful if and only if it takes into account the domain's "ontological openness" as it is warranted by the standards of domain's hermeneutic internalism. It is an openness that follows from "science's ability to think", i.e. the ability to integrate in its cognitive experience the ontico-ontological difference by reflecting upon its characteristic hermeneutic situation.

There is an important moral from this story: A scientific domain whose research process is distinguished by the ability in question does not need an external normative control. Only the research process is entitled to address the question of what ought scientific knowledge in the respective domain be. An external "knowledge policy making" would have a destructive effect for the constitutive feature of scientific work – the interpretative-reflective openness of the research process. Such a policy would destroy the double hermeneutics (the interpretative reflection on the interpretative fore-structure) on which the research process rests. What the contemporary societies need is not an external-normative "democratic control" over scientific research. They rather need scientific research that can think in its own terms its ontological possibility and necessity.

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