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Author(s): Patrick A. Heelan

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Hermeneutical Realism and Scientific Observation

Patrick A. Heelan

State University of New York at Stony Brook

This paper will summarize positions explained and defended more fully in my book, Space-Perception and The Philosophy of Science (Heelan 1982).[1] The philosophical genre of this paper is that of a hermeneutical phenomenology, it addresses questions from the point of view of such writers as, E. Husserl, M. Heidegger, M. Merleau-Ponty, P. Ricoeur, and H-G. Gadamer (see references).[2] Those who are not familiar with this kind of writing may well find the exposition too brief to be persuasive; those who are, may wonder at the audacity of applying such methods of analysis to the natural sciences. It is unlikely that either group will be entirely pleased with the content of what I have to say.

My principal theses are the following: (1) reality is the content of World,[3] and this comprises whatever is or can be given directly in a public way within perception; what is given in perception--a perceptual object--is not an "internal representation", but a state of the World. This thesis states the ontological primacy of perception. (2) Acts of perception are epistemic, contextual, and hermeneutical. (3) The objects of scientific observations are perceptual objects. I shall not, for lack of time, dwell on the first two theses, though what they imply should become clear in the course of the paper. I shall then plunge directly into the third thesis.

1. Scientific objects as perceptual objects

A theoretical scientific entity is a part of a substructure detectable only by instruments, and hidden to unaided perception. By this fact, theoretical scientific entities are, I claim, no more than candidates for inclusion in the real order; to be accepted for inclusion in that order, they must present themselves with the proper credentials which, according to the principle stated above, means to be capable of being exhibited in genuine horizons of scientific observation; in these such quantities are or could be manifestly and

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directly given as perceptual objects to a public of experienced scientific observers. I claim that there are such horizons of scientific observation.

2. Scientific Observation as 'Reading' of 'Text'

The argument for this thesis is based (1) on an analogy between reading a text and "reading" an instrument--both are hermeneutic, and contextual acts--and (2) on the conditions for a perceptual act, which involve the "picking up" of "information" about the present and actual state of the World from the environment directly via the Body.

Theoretical entities or quantities become known by attending to the response of appropriate empirical procedures, such as the use of measuring instruments. There are, however, two ways of attending to the response of an instrument: the first way is where the instrumental response is treated as a physical event associated on the basis of a theoretical inference with a certain theoretical scientific quantity--to do this, one must know the relevant scientific theory; the second way is where the value of that theoretical quantity is 'read' directly from this response--to do this, one must be experienced and skillful in the use of instruments. I want to focus on the latter, and shall call it 'reading' (with single quotes to mark a special sense).

To the extent one 'reads' the thermometer, the thermodynamic argument remains in the background, being merely the historical reason why thermometers came to be constructed in the first place. One can 'read' a thermometer. however, whether or not one knows anything formal about thermodynamical theory. Provided the instrument is standardized, and so can function as (what I call) a "readable technology", the instrument itself can define the perceptual profiles and essence of temperature to this culture.

The process of 'reading' is something like this: a 'text' is 'written' causally on the thermometer by the environment under standard circumstances (ceteris paribus conditions), this 'text' is 'read' as being 'about' a presented state of some scientific system, in this example, the state of temperature; the piece of empirical knowledge so acquired--the current temperature--is expressed in a language that uses scientific terms, like "temperature", in a descriptive way about the World. Such a process, as I shall argue below, is essentially both hermeneutical and perceptual.

3. 'Reading' as hermeneutical

The process of reading, understanding or interpreting a literary text is guided by what Heidegger calls a "fore-structure of understanding", that is, an anticipation about the kinds of things or objects about which the text speaks (Heidegger 1953, pp. 98-114, 188-195). This fore-structure is also called a "hermeneutical circle", in it is "hidden a positive possibility of the most primordial kind of knowing. To be sure, we genuinely take hold of this possibility only

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when, in our interpretation, we have understood that our first, last and constant task is never to allow our fore-having (Vorhabe), foresight (Vorsicht), and fore-conception (Vorgriff) to be presented to us by fancies and popular conceptions, but rather to make the scientific theme secure by working out these fore-structures in terms of the things themselves."(p. 195). These fore-structures may be part of antecedently developed, already entrenched, cognitive systems, or merely heuristic structures awaiting testing and deployment.

The task of hermeneutical interpretation does not have as its goal just some or any understanding consistent with the text, but a reading that attains to "the things themselves" (Husserl's term originally) about which the text speaks. Such a task is not, as Heidegger says, a work of arbitrary fancy, but controlled, on the one hand, by the totality of the text and its parts, and on the other, by the fore-structure of understanding that permits us to read the text as referring to specific kinds of things and objects. This fore-structure of understanding, according to Heidegger, has three parts: (1) Vorhabe, a set of praxes, embodiments, skills, etc. that mediate applications of the descriptive categories or terms to that to which they refer, (2) Vorsicht, or a set of common descriptive categories, a common descriptive language, as it were, and (3) Vorgriff, a particular hypothesis about the subject matter in hand (p. 191).

The hermeneutical task is circular in a peculiar but "virtuous" or "non-vicious" way, because it involves the simultaneous and mutual determination of the (meaning of the) whole by the (meaning of the) parts, and vice versa; on the one hand, the fore-structure of understanding--the "hermeneutical circle"--provides a conjectured meaning for the text as a whole and for its parts, but, on the other hand, what kinds of conjectures one entertains about the (meaning of the) whole depends on clues scattered in the text itself. One moves from a partial disjointed set of insights (let me say, clues) to an understanding of the whole and back to the not-yet-understood portions of the text, the process guided by the attempt to discover the outlines of "the things themselves".

A satisfactory solution to a hermeneutical inquiry would fulfil the following conditions, (1) all the clues lie on (or sufficiently near) the proposed solution, and (2) one is persuaded that none of the as yet undiscovered clues lies too far off the proposed solution; the terms "sufficiently", and "too far off" imply reference to the goals and purposes of the inquiry. Every hermeneutical inquiry then is fraught with a certain ambiguity and uncertainty. It is also laden with values, and directed by a teleology.

When the text is imperfect or corrupt, or when the interpreter is removed historically or culturally from the subject matter, the hermeneutical task is in addition accompanied by a special kind of effort, it is clouded by obscurity, and possesses an essential incompleteness (Gadamer 1965, pp. 235-240 and passim). The variety and tentativeness of scientific traditions, that were the concern of Duhem

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and Poincaré, and are currently topics of lively discussion in the Conventionalist debate, are also connected with the possibility of alternative scientific 'readings' of experimental data (Fleck 1935; Hesse 1980; Holton 1973; Kuhn 1977, and Rorty 1979). I am, however, in this paper less concerned with the indeterminacy aspect, than with displaying the existence of a hermeneutical component in scientific observations, the presence of which is easily obscured both by the practised familiarity with which these are often performed, and by the ideology that represents them as unproblematic, because "observational".

All hermeneutical processes possess the dual structure associated with the acquisition or expression of information. The term "information" refers both to the signs that are read and to the meaning given to those signs. I shall distinguish between these by calling the text or the 'text', "information$_1$", and its meaning or content, "information$_2$". Note that, in the literary analogue, syllables, phonemes, or other linguistic signs--information$_1$--once read for their meaning--information$_2$--cease to be objects in the World, like houses or trees, and become more like windows to a room that by their (more or less) transparent quality give direct access to the contents of the room beyond. One does not perceive the syllables of a text: one reads them. Polanyi has already pointed this out (Polanyi 1964, chap. 4). In a reading, the physical character of the text disappears from direct view leaving no objective trace whatsoever, it becomes to that extent "non-objective", and I take that to mean "belonging to the conditions of the knowing subject"; it becomes in fact physically part of the cognitive subject as embodied; it becomes a modulation of the particular somatic information channel of the embodied cognitive subject used in this particular reading.

Although, on the whole, one is oblivious to the syllables and marks as things on paper, one is not totally unaware of them: it is through them that one is guided through the meaning of the text. There is connected with this a subliminal awareness of pleasure, or perhaps of frustration and discomfort, that arises from the activity itself, from the clarity or unclarity of its typographic and syntactical form, from its natural or forced rhythm, from the musical quality of the sounds, and from the resonances of heard or imagined speech. In all of this, lie the esthetic qualities of a text (sometimes, called the "experience" of reading).

The kind of transformation I want to describe is like that in which the syllables or phonemes of a strange language at first engage our attention as curious objects for possible theoretical study, and end up by being dropped from awareness when we have become familiar with the language and have learned to read the syllables as text or to listen to the phonemes as spoken words. When one knows the language, one obtains direct access to the meaning of a text or spoken word. Such meanings are expressed in judgments about the subject matter--the things themselves--referred to by the written text or spoken word, whether this be a historical event, or a fictional narrative, or an

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abstract logical construction. The transformation just described, wherein intermediaries (information$_1$) in the acquisition or expression of empirical data (information$_2$) "drop out of consciousness", has been noted, for example, by Schrödinger (Schrödinger 1958, p. 8) who ascribed such transformations to processes perfected during the long course of evolution, however, it is a commonplace that many processes perfected through the painful process of learning share this characteristic that intermediaries drop out of consciousness. The paradigm example is reading, but there are other processes that are similar, like playing a musical instrument, sight reading from music, driving a car, and reading an instrument: to a suitably experienced person, processes like these have "the same subjective ease and immediacy as the simplest perceptions." (Sloman 1980, p. 403).

4. 'Reading' as perceptual

The instrumental response as a 'text' shares in the information theoretic aspect of literary texts. In its genesis, a literary text is written in a standard typography, using the vocabulary and background root metaphors paradigmatic for a particular domain, etc., by a writer, following out the rules of language (langue, in the structuralist sense). By comparison, a 'text' in its genesis is 'written' by the ambient environment on a standard instrument under paradigmatic circumstances, and the production follows scientific laws and theories (in something like a model-theoretic or structuralist sense). In both cases, the process of interpretation--as opposed to genesis--involves (1) the physical causality of the text or 'text' stimulating "resonance" in some somatic information channel of the reading or 'reading' subject, and (2) the use of some hermeneutical circle to get the meaning of the text or 'text'. In both cases, when the hermeneutic task is accomplished, one is in direct possession of that meaning. The meanings, however, in the two cases are of different kinds.

While literary texts may speak about the World, they do not manifest, show, or exhibit states of the World. A 'text', however, can and usually does exhibit some state of the World actually present and manifesting itself. (Note, however, that a scientific observation may also be about some past state of the World, but this is something I shall not deal with here.) Returning, for the purpose of illustration, to the thermometer; the position of mercury on the scale functions as a 'text'. Through a 'reading' of this 'text', one gains knowledge in the form of judgment of the current thermodynamic temperature, "The present ambient temperature is [say] 70°"; this judgment is empirical, direct, and uses scientific terms descriptively of the World. I now claim that this 'reading' fulfills all the characteristics of perceptual knowledge. These are (1) that it is direct knowledge (that is, it is not mediated by inferences, nor does it terminate at an "internal representation" or a "model" of the known object, constructed, say, out of sensations or using logical or mathematical structures); (2) that it "picks up" information (information$_2$) from experience, this connotes the existence of a somatic information channel constituted in part, for the (potentially) skilled or experienced scientist, by some

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standard instrument (or "readable" technology), the "resonant" states (or states of information$_1$) shape what it is about the object that is revealed, and are coded (by the instrument) for the profiles of the object known (information$_2$); (3) that it is hermeneutical, that is, it acquires its meaning through the employment of a hermeneutical circle using the terms of a scientific theory descriptively; (4) that it's object, a state of the World, is experienced as given directly in a public way to the knower by the World, and (5) that it terminates in a judgment which purports to describe what is actually here and now existent in the public World, present and manifest to the knower appropriately embodied, and of which the expression is a descriptive statement using the terms of a scientific theory.

Like all perceptual knowledge, a scientific observation is not apodictic in the natural attitude, that is, though usually perceivers suitably trained perceive unproblematically in the natural attitude, they do not perceive apodictically, for to perceive apodictically, is to be able to sample at will the perceptual profiles of the object, and presupposes the reflective attitude. However, like all perceptual knowledge, to the extent that profiles and invariants can be clearly articulated, a scientific observation too is capable of aspiring to apodicticity in the reflective attitude. It is this capacity to become apodictic that establishes the possibility of genuine scientific horizons in the World. This capability distinguishes the hermeneutics of literary texts, from the hermeneutics of perception and scientific observation: while both are underdetermined, the former is about meanings as unexhibited, possibly unexhibitable, possibilities (as states of the World), and the latter is about exhibited possibilities.

Returning to the question of the ontological status of scientific entities: if 'reading' a thermometer is a perceptual process, then, because of the ontological primacy of perception, I argue that thermodynamic temperature and other scientific entities like it, enter the World as recognizable objects of definite kinds described by scientific theories, and so belong to the furniture of the earth. The perceptual hermeneutical process of scientific observation is then a horizon- or World-building process, it is reality in the process of constitution.

A striking example of the use of instrumentation to generate a new field of perceptual knowledge is the Tactile Visual Substitution System (TVSS) of Collins and Bach-y-Rita (Morgan 1977, pp. 197-200). This is a device for use by the blind: it consists in a video camera attached to the temples, from which the output is fed to a ten-inch square array of electically driven vibrators in contact with the skin of the back or abdomen. The blind person who uses this device initially experiences only a tickling sensation, which then gives way to the experience of solid objects external to the subject, and located in a three dimensional space. Morgan writes: "In general, there is little doubt that the TVSS allows the blind to see. Or to 'see,' as Bach-y-Rita prefers to say. . . as experience with the TVSS proceeds, the judgements become more and more automatic, until they are ac-

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complished in much the same way as a sighted person perceives objects." (p. 203).

5. Observation as Theory-Laden

The claim that theoretical entities or states are observable runs contrary to a basic principle both of traditional empiricism and traditional phenomenology; for both, something is observable, exactly if it could under appropriate circumstances be observed with the unaided senses. This is also van Fraassen's position in his recent work (van Fraassen 1980).

Now the position I have been defending is exactly the contrary: I claim that theoretical states and entities are or become directly perceivable (alternatively, "observable", in the new stipulated sense) because the measuring process can be or become a "readable technology", a new form of embodiment for the scientific observer. In this view, the term "observation" no longer means unaided perception. It implies that theoretical states and entities are real and belong to the furniture of the earth, because (and to the extent that) they are perceivable in the perceiver's new embodiment. It also implies that the nature and aim of scientific explanation is to make manifest the processes and structures of the real, the real now being taken as what is or can be given publicly in some World.

6. Some conclusions

(1) Hermeneutical activity is never unique, final and definitive; consequently, the contents of perception, and a fortiori of scientific observation, are never unique, definitive, final, absolute, apart from history and particular social and cultural milieux (see Heelan 1982, chaps. 10, 11, 14, and 15, and Ihde 1979).

(2) Acts of perception, and consequently, acts of scientific observation, are always contextual, and involve an antecedent realized embodiment and a set of learned skills for the subject (Vorhabe)--in the case of scientific observation, this includes the use of standard instruments. Different perceptual contexts may involve different sets of contextual conditions; it should not then be a matter for surprise that different contexts whether of perception or of scientific observation sometimes turn out to interfere with one another performatively in a way that suggests an explanation of the phenomenon referred to by Bohr, as complementarity (see Heelan 1970).

(3) If scientific inquiry is essentially hermeneutical, then the same categories must be used from the start in both the explanandum and in the explanans: this is contrary to the assumptions of the deductive-nomological model of scientific explanation. Moreover, a hermeneutical account would also rule out a purely inductive account of scientific explanation: in this latter the descriptive scientific categories are first exemplified in the explanandum and then used in the construction of explanatory premises; in the hermeneutic account,

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however, they arise simultaneously for the explanans and explanandum, and transform the observational field from the start of the inquiry.

(4) Turning to the current debates in epistemology and the philosophy of science: in the first place, my position is neither that of Scientific Realism, nor of Instrumentalism. It could be called "Hermeneutical Realism" (in Heelan 1982, I called it "Horizonal Realism " to stress the perceptual character of this kind of realism): science has the intent of describing the elements and structures of reality, hidden to (theoretically and instrumentally) unaided perception, but manifested as genuine perceptual essences--horizons--with the aid of theoretically structured instruments used as "readable" technologies.

(5) In the second place, contrary to many theories of scientific reference, Hermeneutical Realism holds that there is no identity of reference between individual objects given to unaided perception (such as this patch of sensed color, or other object of a manifest image) and individual objects of the relevant scientific image (such as this spectral mix of wave lengths, or other "theoretical" object); there are only many-to-one and one-to-many mappings of perceptual objects contextually defined within mutually incompatible but complementary contexts.

(6) In the third place, Hermeneutical Realism is neither that of Conventionalism, nor of Cultural Relativism. Like them, however, it admits of plural incompatible empirically descriptive frameworks among which, I would hold, some are complementary, but it differs from both by insisting on the fact, necessity and limitations of Vorhabe (in this case, trained bodily expertise and the ability to construct "readable" technologies) for linking descriptive categories to their appropriate empirical objects; the plasticity of Vorhabe places limits on the descriptive frameworks that can be conventionally chosen or used in a culturally relative way, I surmise that these limits can only be known through empirical, historical, and cultural studies.

Notes

[1]In Part I of this book, I attempt to establish the thesis that under some very general conditions we can and do see a World of hyperbolic objects (shaped by a hyperbolic visual metric); once the appropriate theoretical model is set up, evidence for the thesis is provided by optical illusions, the history of pictorial art, and daily experience. The theses proposed in this paper are defended in Part II of this book.

[2]Phenomenology as a philosophical tradition has grown up around the critique of certain pervasive attitudes, such as objectivism and scientism, that define the traditional status of experimental science

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in our culture, and has attempted to counter these claims by appealing to the intuition of directly experienced objects. Hermeneutics deals with signs and their interpretation, particularly with the interpretation of literary texts (see Bleicher 1980). Other philosophers who have used phenomenological methods about various aspects of the natural sciences are, to name a few, John J. Compton, Hubert Dreyfus, Gary Gutting, Aaron Gurwitch, Don Ihde, Joseph Kockelmans, Theodore Kisiel, Wolfe Mays, Hans Seigfried, Elizabeth Ströker.

[3]The terms "World", "horizon", and "Body", are technical terms. The horizon of an object is taken in this paper to mean inner horizon, this is the set of perceptual profiles of an object generated by its essential law (perceptual essence). World is the general background reality context that is experienced as given to our perception together with the individual objects that we perceive. Body (with capital letter) designates the perceiver, and connotes the specific embodiment or somatic information channel used by the perceiver for a specific class of perceptions; the somatic information channel may comprise structures of the neurophysiological system, somatic processes such as hands, feet, etc., technological extensions ("readable techologies"), as well as some stimulus field that is directly modulated by the objects known.

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