Technics as Hermeneutics

In this paper, I outline, how technics can be understood as a special case of herme-
neutics. My argument hinges on the concept of practice, which, according to Joseph
Rouse, is hermeneutic activity. I show how Rouse's practical hermeneutics and Don
Ihde's material hermeneutics can be considered to be founded on the pragmatist
theory of meaning. For John Dewey, interpretation is thoroughly technical.

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1. Introduction

Hermeneutics first emerged as a discipline for the interpretation of sacred texts in several religious traditions. However, in the 19th century, Friedrich Schleiermacher (1768–1834) enlarged its jurisdiction to all of language. Later, Wilhelm Dilthey (1833–1911) enlarged hermeneutics even more to all meaningful human activity. One of Dilthey's lifelong projects was to defend the methodological independence of human and social sciences from the imperialist claims of the philosophers of natural science of his time. Roughly, his thesis was that natural sciences operate upon unambiguous observations and uninterpreted formal languages and thus have a claim to objectivity, whereas human and social sciences are necessarily interpretive and depend on the person who makes the interpretation.

For many decades, it was considered that natural sciences can be distinguished from human and social sciences on this basis. Philosophers of natural sciences – the most influential of whom subscribed to logical positivism and empiricism – and philosophers of human and social sciences alike seemed to be happy with such a sharp division of labour. However, the collapse of logical positivism and empiricism, which has taken place gradually since the 1950s, has revealed the existence of profound hermeneutic features in natural sciences.

Ludwig Wittgenstein's posthumously published later works (e.g. [1953] 2009, 1958, 1969) began to question many tenets of logical positivism and empiricism. In particular, his concepts of *language-game*, *hinge propositions*, and *form of life* are fundamentally at odds with the then-received view in analytic philosophy. His thesis was, in short, that concepts make sense only within a language-game, which consists of language and the actions into which it is woven ([1953] 2009, 8); that knowledge is founded upon hinge propositions; and that language-games and hinge propositions presuppose a form of life. Hence the interpretation of concepts or knowledge requires the adoption of a particular form of life, which qualifies as hermeneutic activity.

According to the Duhem–Quine thesis, observation is theory-laden, or, equivalently, theories are empirically underdetermined (Duhem [1906] 1954; Quine 1951). In the radical interpretation of that thesis, it is not possible to make an observation without presupposing some theory. Hence all observation involves interpretation in terms of a presupposed theory, which qualifies as hermeneutic activity.[1]

Michael Polanyi ([1958] 1962, [1966] 1983) questioned the then-prevailing notion that all knowledge could be expressed explicitly and representationally independently of practice, and introduced the notion of *tacit knowledge*. The underlying idea of this is that in order for representational knowledge to be effective, it must be personally translated into practice, which qualifies as hermeneutic activity.

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[1] It seems that the theses of Pierre Duhem and W. V. O. Quine are not strictly the same; indeed, their differences may be as great as their similarities. What is common to both though is that they question the independent or self-sufficient determinacy of observations. Thus both lean towards a version of Kantianism: recall that Kant ([1781/7] 1956) argued that observation necessarily involves conceptual activity and hence cannot be considered absolute or objective – as a revelation of *Dinge an sich* (things-in-themselves) independently of how we conceive them.

Thomas Kuhn ([1962] 1996) argued that science evolves in cycles of periods of normal science, the accumulation of anomalies, a crisis, and revolutionary science. In a period of normal science, scientists agree about a paradigm. In a period of revolutionary science, a new paradigm is created, thereby beginning a new period of normal science. Concepts are incommensurable between different paradigms; and the choice between paradigms is arational. Hence Kuhn's concept of *paradigm* comes close to Wittgenstein's *form of life* in the respect that the interpretation of a concept requires the adoption of a particular paradigm.

For decades, the theses of Wittgenstein, Quine, Polanyi, and Kuhn were discussed under different titles, but not as hermeneutics. Joseph Rouse (1987, 26–69) was among the first science and technology studies (STS) scholars to take the hermeneutic character of natural science seriously. He began with a novel interpretation of Kuhn. Traditionally, Kuhn has been held up as a proponent of a theory-driven picture of science. Rouse (1987, 26–40), however, argues that this is a misunderstanding: Kuhn seemed to suggest that science is practice instead, and that "paradigm" denotes shared practice, not shared belief. Rouse contrasted these two ways of understanding Kuhn. Both involve a universal hermeneutics of natural science. The traditional picture of Kuhn is associated with theoretical hermeneutics, while Rouse's alternative interpretation is associated with practical hermeneutics. In theoretical hermeneutics, interpretation takes place strictly within language and consists in the formulation of hypotheses. Practices are evidence for such interpretive hypotheses. On the other hand, practical hermeneutics understands practices themselves as meaningful and significant in their own right and interpretation as one practice among others. In this sense, language need not be involved. Rouse seems to reject theoretical hermeneutics as overintellectual and detached from actual life and its concrete particularities.

Roughly a decade later, Don Ihde (1998, 139–195) took up Rouse's practical hermeneutics and incorporated it within his philosophy of human–technology relations, which could be called *instrumental* or *material phenomenology*. In his earlier works (Ihde 1974; [1977] 2012; 1979; 1990), he had developed Patrick Heelan's idea that using an instrument transforms an experience (Ihde [1977] 2012, 100). Such a transformation shows and magnifies certain properties of objects unobservable to the naked eye. The more experience is transformed, the more it requires interpretation to make sense of it. He also employed Bruno Latour's (1987, 67–68) definition of an *instrument* as an *inscription-producing device*; in Ihde's case, these "inscriptions" are the visual outputs of scientific instruments. Ihde argued that in order to understand the meaning and significance of scientific imaging, interpretation is needed. Because instruments transform experiences, such imaging does not present objects as they appear to the naked eye; if it did, it would be pointless. Hence, without proper interpretation, they would remain unintelligible. However, because of the non-linguistic nature of pictures, the notions of meaning and interpretation must be expanded beyond language.

Both Rouse and Ihde provide important and interesting insights about the interpretation of practices and the instruments they involve, but they do not explain *what exactly* is being interpreted. In other words, they do not explain the *meaning of meaning* they implicitly invoke. Thus there arises a question about what the meanings *are* that underlie practices and instruments.

In this article, I try to fill in that loophole in the defence of Rouse and Ihde. I suggest that the pragmatist theory of meaning, introduced by Charles S. Peirce (1839–1914) and developed further by John Dewey (1859–1952), provides the theoretical basis of practical hermeneutics. In particular, Peirce's original version of the theory took *non-linguistic meanings*, which practices and instruments seem to exhibit, into account. Peirce even seemed to have modelled scientific inquiry as a special case of *semiosis*, or the process of the interpretation of signs, already by the turn of the 20th century, if not earlier.[2] Hence, arguably, he anticipated the interpretive or hermeneutic turn in the philosophy of science instituted by Wittgenstein, Quine, Polanyi, and Kuhn, by at least half a century. Dewey, who applied the evolutionary theory to many areas of philosophy, rejected essentialism and replaced it with a study of the conditions of the genesis and development of phenomena – the missing link between evolution and technics (Dewey 1910, 1–19). Thereby he also accounted for the emergence of meaning in the discovery of cause—effect relations through experiment. In short, the pragmatist theory of meaning rejects the reifying notion that meanings are *objects* – least of all *abstract* objects. Rather, they are *potentially enacted*: they are *habits*. But habits are public, observable and causal processes and hence qualify mainly as *objective*, though they may have a subjective facet too (Dewey 1916a, 54–58; 1922, 14–88).

I ultimately conclude that Dewey's account on the genesis of meaning is *technical* through and through. This suggests that *technics is inherently hermeneutical*.

I begin this paper by briefly citing Rouse's practical hermeneutics and Ihde's visualism. I then continue by reviewing the pragmatist theories of meaning and discuss the genesis of meaning together with explaining how they can accommodate Rouse's and Ihde's insights. Then, I make some critical remarks, before finally concluding with some suggestions for further inquiry. This article expands on Lindholm (2022).

2. Theoretical and Practical Hermeneutics

Rouse (1987, 41–68) reviewed two ways of accounting for the hermeneutic features of science: theoretical and practical. Arguably, both kinds of universal hermeneutics had already appeared in the works of Dilthey (1956; 1957).

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[2] Peirce seems to have entertained the idea that the acquisition of knowledge in general, and science in particular, takes place in signs already in 1868–9 (see "Questions Concerning Certain Faculties Claimed for Man" (Peirce CP 5.213–263; EP 1, 11–27) of 1868 and its follow-ups "Some Consequences of Four Incapacities" (Peirce CP 5.264–317; EP 1, 28–55) of 1868 and "Grounds of Validity of the Laws of Logic: Further Consequences of Four Incapacities" (Peirce CP 5.318–357; EP 1, 56–82) of 1869). But it is in his mature philosophy and semiotics where that notion comes to fruition. That was crystallized in his 1906–9 distinction between the *dynamical object* and the *immediate object* (which he had called the *primary object* and the *secondary object*, respectively, in 1903; see his original definition in (Peirce CP 2.310–311; EP 2, 275) and its development in (Peirce CP 4.536; EP 2, 407), (Peirce EP 2, 480–481). The latter denotes an object as represented by a sign: how that object appears at any stage of inquiry. The former denotes the real object independently of how the sign represents it: how it appears at the conclusion of the inquiry, defined as the point where everything about the object is known, and no further increase in knowledge is possible. Peirce professed fallibilism from early on (see his 1868–9 papers mentioned above) and hence should have concluded that we cannot possibly determine when that point has been reached. He also should have concluded that the dynamical object might change, which makes it imperative to constantly keep checking whether the immediate object is adequate.

Theoretical hermeneutics takes its departure mainly from Quine's philosophy of language. In theoretical hermeneutics, interpretation takes place within language, it consists of forming hypotheses, and it is analogous with translating a sentence. It denies language-independent access to the world. It takes practices simply as evidence for theories or beliefs. It considers observation statements as hypotheses, and maintains that all hypotheses acquire their meaning in relation to all other hypotheses, or a "web of belief." Hence the difference between observation and theory is merely relative. The aim of theoretical hermeneutics is truth, or accurate representation.[3] Theory is understood as disengaged from and independent of practice. That makes experiment and discovery incidental. Only rational reconstruction matters. Observation is merely theory by other means, and not even independent means. This seems to create an unbridgeable gap between language and the world. Rouse suggested that theoretical hermeneutics can be modelled by Mary Hesse's (1980, 125–128) self-programming learning machine. (Rouse 1987, xii, 47–53, 69–72, 98.)

Practical hermeneutics, on the other hand, sets out from Heidegger's notions of being-there (*Dasein*) and being-in-the-world (*In-der-Welt-Sein*) as explained in his *Sein und Zeit* ([1927] 1977). It is analogous with engaging in a practice. It interprets practices themselves. It is not confined to describing and predicting behaviour but also understands the point and significance of doing certain things and not others. Everyday practices interpret the world by adjusting behaviour to the surroundings, by practically responding to them. This need not be representational. Such interpretation takes place in accounting for things: using, avoiding, taking note of, caring for, and discarding them. Learning a skill is learning a field of possibilities. This need not be explicit. Interpretation takes place by presupposing a background, but it is not constituted by hypotheses or theories but rather by ways to be in the world. The background is a configuration of equipment, persons, and the physical setting which is already disposed towards certain possibilities. The understanding thus acquired is not a conceptualization but a performative grasp of how to cope with situations that cannot be abstracted from the world. (Rouse 1987, xii, 47–50, 58–65.)

In theoretical hermeneutics, the interpreter is not committed to how things are. Hence the choice of hypotheses and theories is in principle arbitrary. We can remain indifferent about them. That allows theoretical hermeneutics to abstract from particular conditions. In practical hermeneutics, the situation is quite otherwise. The presuppositions of interpretation are conditions that are not open to deliberation, negotiation, or choice. We cannot renounce them without losing grip. Hence they *matter* to us. (Rouse 1987, 64–65.) Thus Rouse seems to reject theoretical hermeneutics as overintellectual and remote or even detached from actual practical engagement with the world. I would call theoretical hermeneutics an updated version of Cartesianism where the soul is simply replaced with language.

Perhaps the difference between theoretical and practical hermeneutics can be expressed as the difference between determining *what the case is* and what it is to *be*. The latter is rather shown than said. (Rouse 1987, 67–68)

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[3] Rouse considers Richard Rorty to be a theoretical hermeneuticist, but I believe that Rorty would have opposed the representationalism that Rouse assigns to theoretical hermeneutics.

For the purposes of this article, I define *practical hermeneutics* as the thesis that practices are meaningful in their own right; that a practice consists in a configuration of people, their skills, their activities, their purposes, equipment, and environment; that interpretation is itself a practice; and that the world is interpreted by practically responding to it.

The main upshot of practical hermeneutics is that scientific practices, including experiments, already involve interpretation. Another implication is that the concept of *nature* is ineliminably political: because nature is accessed through practice, what it is to be natural is at stake in practices; what is considered "natural" or "unnatural" has normative significance and is sanctioned by society; and, because nature is experienced as a field of opportunities for action, much of our self-understanding arises from our understanding of nature. The counterfactuals that support causal claims depend on agency; and, conversely, our sense of agency depends on discovered causal relations. Hence nature is not neutral but plastic. Rouse concluded that a practical configuration of the world that involves agents, their practices, their material setting, and what makes sense to do is a necessary condition[4] for anything to be intelligible at all. (Rouse 1987, 181–185.)

3. Visualism

Don Ihde (1998, 139) argued that science can do a hermeneutics of things by turning them into scientific objects. He continued Rouse's practical hermeneutics that he considered ontologically oriented, in distinction from the linguistically oriented theoretical hermeneutics (Ihde 1998, 147–148). He believed that the field was clear for introducing his ideas, the purpose of which was "to reconverge what began to diverge with early modernity," because of recent developments in philosophy of science: logical positivism had dwindled, the sociology of scientific knowledge (SSK) had arisen, and the feminist philosophy of science had emerged (Ihde 1998, 139–150). Ihde is primarily interested in what he calls *visualism* in science – how scientific objects are accessed via the technological construction of images. He argues that the hermeneutics of science is of a special kind: not necessarily linguistic or even propositional but first and foremost *bodily* and *perceptual – visual* in particular. Here he follows Husserl and Merleau-Ponty. The scope of scientific imaging ranges from isomorphic to non-isomorphic depictions of scientific objects. The less it retains isomorphism with the object, the more hermeneutic activity is required to make sense of it. (Ihde 1998, 151, 184, 187, 196) The interpretation of visualizations of data is a matter of *learning to see* – to figure out which patterns indicate something else and which do not. Such learning takes place dialectically with the development of the instruments of observation, recording, and visualization. (Ihde 1998, 177–180.)

He outlined a "weak program" that identifies hermeneutic dimensions implicit within current science praxis (Ihde 1998, 151–169) and a "strong program" that ex-

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[4] Rouse did not specify, whether it is a necessary, sufficient, or necessary and sufficient condition. I thank my friend Miika Oksman for pointing this out.

amines the cutting edges of science's knowledge constitution in a hermeneutic way (Ihde 1998, 170–183). He defined the former as "an attempt to reconstruct accounts of science praxis, showing the implicit *hermeneutic practices* already at play within science" (Ihde 1998, 152) and the latter as "potentially more normative" and as "an attempt to push, positively, certain P–H [phenomenological and hermeneutic] practices by way of suggestion and adaptation toward science practice" (Ihde 1998, 152). Ihde's description of the "strong program" and how it differs from the "weak program" were vague. I gather that the "strong program" builds upon the "weak program," but also extrapolates already existing possibilities into the future.

The "weak program" is partly based on the insights of the earlier, non-hermeneutic tradition itself. Many philosophers of science have divorced science from the lifeworld (*Lebenswelt*),[5] but Ihde argues that such dualism is false: scientific practices and instruments keep science strictly within the lifeworld. Laboratories and their instruments give a "voice" to things, which yields information about them, by recording measurements in visual outputs like graphs or diagrams. Thereby they make non-visual phenomena visual. But it is not the object measured alone that "speaks"; it is the system of the object and the measurement apparatus. Hence "instrumental artifacts" and calibration errors are always possible and must be accounted for (Ihde 1998, 185–186). In order to determine the part of the object, the part of the instrument can be eliminated by making "instrumental phenomenological variations": for example, by using different instruments, a multivariant set of measurements, intersubjective checking, deliberate application of focus shifts, and figure/ground reversals (Ihde 1998, 185–186). Due to the effect of instrumentation, the objects are not simply "given" but, rather, made "readable." That creates the need for the instrument to be as transparent as possible. In an important sense, the resulting images are constructs, but the very effect of a successful construction is emphatically to present the object as authentically as possible. In other words, construction of the image is needed in order to cancel the effects of the environment of the object and of the instrument used. The "weak program" is manifested in imaging technologies such as oscillography, spectrography, intestinal probes, X-ray imaging, ultrasound, sonograms, MRI, fMRI and PET scans, radioactive tracers and dyeing, uranium series dating, carbon 14, electron spin resonance techniques, thermo-luminescence techniques, DNA fingerprinting, MDNA lineage tests, computer-assisted tomography, and radio astronomy. Ihde recognized three trajectories in the "weak program": optical imaging; non-optical imaging, which begins with X-ray imaging and continues in, for instance, fMRI and PET scans; and microscopy, which continues, for instance, in electron microscopy and radio crystallography. These trajectories retain a degree of isomorphism with the object. The situation changes, however, with oscillographs, spectrographs, charts, graphs, and diagrams. Even mathematics can be made perceptual by depicting curves and surfaces, while computer graphics makes it possible to depict even fractals and chaotic and random phenomena. (Ihde 1998, 151–169)

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[5] For Husserl's concept of *Lebenswelt,* see his ([1936] 1976). He added this notion to his phenomenological philosophy after Heidegger's *Sein und Zeit* ([1927] 1977) without even mentioning his pupil.

As concerns the "strong program," Ihde extrapolated a number of technological possibilities already present in contemporary instrumentation. As indicated above, the development of visualizations is accompanied by learning to see. One important contemporary technique to assist in such learning is image manipulation – especially zooming in and out, enhancement, contrast, and false colour –, often performed by computers. Some image manipulations even make it possible to convert non-isomorphic images into visual ones. The effect of the atmosphere can be computationally removed from telescope images. Thermal imaging extends human vision into serpentine vision, light amplification into feline vision, and wide-angle imaging into insect vision. Several sources of visual information can be fused into composite images. Computers allow even more imaginary transformations of the visual: avatars, online meetings, computer graphics, virtual and augmented reality, and holography. (Ihde 1998, 170–183, 191–192; [1977] 2012, 164–165.)

Ihde also probed beyond visualism. Multisensory technologies are commonplace in entertainment, such as cinema. Simulated learning environments, such as pilot simulators, were an early instance of virtual multisensory reality. In such applications, isomorphism with non-mediated reality remains important to re-create the situation in question. Virtual reality can be combined with isomorphic displays in augmented reality. Remote sensing and manipulation have become possible with robotics and teleoperation methods with feedback. Pilots of fighters and ships can be assisted by displays that allow visualizing large amounts of information in a single picture and make the environment observable even in difficult weather or underwater conditions. These technologies may not be science, but nothing prevents applying them in science as well, at least in principle. (Ihde 1998, 184–195.)

For the purposes of this article, I define *visualism* as the thesis that interpretation of the visual outputs of instruments is hermeneutic activity.

4. The Pragmatic Maxim

Charles S. Peirce introduced pragmatism in collaboration with William James (1842–1910) as a method for clarifying meanings. Peirce had already worked out some of its basic ideas by 1868–9 (see Peirce CP 5.213–357; EP 1, 11–82), but he published its first extensive formulation in his *Illustrations of the Logic of Science* of 1877–8, a series of articles (Peirce CP 2.619–660, 2.669–693, 5.358–410, 6.395–427; EP 1, 109–199). In the second article, "How to Make Our Ideas Clear" of 1878, he announced his thesis, which has traditionally been called "the pragmatic maxim":

> Consider what effects, which might conceivably have practical bearings, we conceive the object of our conception to have. Then, our conception of these effects is the whole of our conception of the object. (Peirce CP 5.402), (Peirce EP 1, 132.)

He explained what he meant in two preceding passages:

[...] what a thing means is simply what habits it involves (Peirce CP 5.400; EP 1, 131).

Thus, we come down to what is tangible and practical, as the root of every real distinction of thought, no matter how subtle [*sic*] it may be; and there is no distinction of meaning so fine as to consist in anything but a possible difference of practice (Peirce CP 5.400; EP 1, 131).

As such, his thesis remains problematic. For instance, Horkheimer ([1947] 2004, 33) and others have pointed out that the pragmatic maxim leads to an infinite *progressus*, if taken literally. The conception of the object is the conception of its practical bearings; then, the conception of the practical bearings is the practical bearings of these practical bearings, and so on, ad infinitum. That may be problematic: if such progress arises, we have to wait infinitely long until we can determine the meaning of a thing. That is a serious problem and deserves a careful solution. I reply to this criticism at the end of this section.

Peirce himself added many times after 1900 that the practical bearings involve not only what actually takes place but also *conditional*, *potential* and *conceivable* effects – what is discover*able* experimentally (Peirce CP 5.18, 5.196, 5.412, 5.425–427, 5.438, 5.453, 5.465; EP 2, 134–135, 145, 234–235, 332, 339–341, 346, 354, 356, 400–401). He adds in "What Pragmatism Is" in 1905 that *rational* meaning consists in *general kinds of experimental phenomena*, where "phenomenon" is to be understood objectively, like "effect" in "the Hall effect" or "the Zeeman effect."[6] He meant that *if* the actions of the experimenter fulfill*ed* certain conditions, certain effects *would* follow. He also said that everything that influences conduct can be experimentally discovered. (Peirce CP 5.425–427; EP 2, 339–341.) This is what he means when he states that the pragmatist method of ascertaining the meaning of a symbol is the experimental method (Peirce CP 5.465; EP 2, 400–401). He also said in 1908 that nothing can be understood save in the terms of habits (Peirce CP 6.481; EP 2, 447--448). Short (2007, 173) called that revision "the subjunctive version of pragmatism."

Peirce's definition, as such, does not restrict meaning to language. *Anything* can be meaningful, provided that it has potential practical effects. On the other hand, Peirce himself *did* restrict the application of the pragmatic maxim to scientific and philosophical concepts (see e.g. Peirce CP 5.438, 5.467; EP 2, 346, 401–402), (Short 2007, 263), (Vehkavaara 2007, 268), (Stjernfelt 2014, 295). I do not see any reason for that; the maxim seems applicable to pretty much anything.

If I am correct, then Peirce's maxim is fit for handling *non-linguistic meanings*. Though the term might look like an oxymoron to somebody trained in 20th century philosophy with its obsession about language (cf. Ihde 1998, 116), it does denote a class of phenomena. It includes aposematism, perceptual and motor functions of

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[6] Hence "phenomena" in Peirce's sense are repeatable configurations of the *world*, not of a "subject." This notion differs from the subjectivistic interpretation of phenomena of, for instance, Kant ([1781/7] 1956) and Niiniluoto (1999, 91). Hacking ([1983] 2010, 220–232) and Rouse (2002, 263–300) also have a notion of "phenomenon" which is strikingly similar to Peirce's. I consider them synonymous.

cognition (Lakoff and Johnson 1999) and, as I will show in the next section, cause–effect relations conceived as means–ends relations. There seems to be no reason, why such phenomena could not be *described* in language. If there is no vocabulary, people are at liberty to introduce one. But that does not *make* them language.

To the best of my knowledge, not many people have tried to defend Peirce's maxim. Hence I restate a sketch of an argument published in Lindholm (2023). What is to be shown is that *the meaning of a thing consists in the potential practical effects of that thing*.

First, let us show that potential practical effects are a necessary condition of meaning. For a *reductio ad absurdum*, suppose that a thing has meaning but no potential practical effects. In the absence of potential practical effects, its existence would be completely insignificant for any embodied interpreter. This insignificance contradicts the hypothesis that the thing has meaning. In fact, we would not even know that such a thing existed in the first place. Hence having potential practical effects is a necessary condition of meaning.

Second, let us show that potential practical effects are a sufficient condition of meaning. For a *reductio*, suppose that a thing has potential practical effects but no meaning. This amounts to saying that a thing could potentially determine the outcome of a practical affair but we would not understand it. But taking such potential determination of an outcome into account already bestows the thing in question with meaning. Again, this contradicts the hypothesis. Hence having potential practical effects is also a sufficient condition of meaning.

Together these arguments show that meaning and potential practical effects are equivalent. Or at least so a Peircean could argue. Peirce himself devised different proofs for his maxim: an argument from phenomenology (Peirce CP 1.317–321; EP 2, 360–370), an argument from normative science (Peirce CP 1.573–574, 5.448n, 5.549–554; EP 2, 371–397), and an argument from semiotics (Peirce CP 1.560–562, 5.11–15, 5.464–496; EP 2, 398–433; MS 318). Peirce's arguments are significantly longer and more sophisticated than my rough-and-ready sketch.

Now I present my reply to Horkheimer's criticism which I have already given in Lindholm (2023). Peirce's semiotics, to which he dedicated his final years, shows how to solve this problem. However, his conceptual apparatus is complex; so I will simply sketch the essentials here.[7]

A *sign-relation* is a triadic relation between a *sign-vehicle*,[8] an *object*, and a possible *interpretant*. The sign-vehicle can be *anything* that means something else to a potential interpreter – that is, it has potential practical effects. The interpretant is what the sign in its significant function essentially determines in its interpreter, or, in other words, the total proper effect of the sign taken by itself. (Peirce CP 2.242, 2.274; EP 2, 13, 272–273, 290–291, 409–410, 429.) There are different kinds of interpretants, and they constitute the meaning category. These definitions are *functionalist* (Stjernfelt 2014, 107): *anything* that functions like a sign-vehicle is a sign-vehicle; and this functionalism carries over to Peirce's subdivisions.

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[7] An interested reader may consult the second volume of *The Essential Peirce* (Peirce EP 2) and *Semiotics and Significs* (Peirce and Welby SS).
[8] Sometimes Peirce calls the sign-vehicle *representamen*.

Peirce (CP 4.536, 8.183, 8.341; EP 2, 407, 480–481, 495–496, 498) distinguished between two objects: the *immediate object*, which is the object as the sign-vehicle represents it, and the *dynamical object*, which is the object independent of representation. The two objects are not like Kant's ([1781/7] 1956) phenomena and noumena; the dynamical object is completely knowable. Hence the distinction between the two objects is merely relative. The immediate object is part of the dynamical object and indicates, how the rest of the dynamical object can be known by *collateral experience* (Peirce CP 6.318, 6.338, 8.178–179, 8.183, 8.314; EP 2, 404–409, 429, 480, 493–498).

Peirce allowed the interpretant to be another sign-vehicle with the same dynamical object. In this process, the immediate object develops. Then the new sign-vehicle can elicit another interpretant. Thus there may arise an indefinitely long procession of signs interpreting previous signs – that is, *semiosis*. But semiosis is goal-oriented (Short 2007, 91–150, 158, 171–174), (Vehkavaara 2007, 263–264, 273): it tends towards improvement, and hence it will eventually terminate, if the dynamical object is completely known. The accumulation of knowledge about the dynamical object consists in the establishment of habits for dealing with it. The terminus can be a "quality of feeling," an "exertion" (i.e. an action), or a habit of action. (Peirce CP 4.536, 8.332; Peirce MS 318.) Hence interpretation need not be intellectual; otherwise we could never get from thought to action (Short 2007, 201). In the terminus of semiosis, the immediate object coincides with the dynamical object, i.e. the dynamical object is completely known in all its aspects, and all possibilities for its interpretation, i.e. habitual encounters with it, have been exhausted.

By considering Peirce's semiotics, a *progressus* – semiosis – is indeed possible; but, ideally, it will terminate. By successive interpretations, the immediate object changes. If inquiry is ideal, this change will consist of gradual improvements. It is goal-oriented: it terminates at the discovery of the dynamical object – when the immediate object coincides with the dynamical object. Thereby a *final logical interpretant* – a habit of action – is formed. In this way, Peirce's semiotics is a description of the self-normative character of scientific inquiry. Peirce is not saying that real inquiry lives up to these norms. It is possible that real inquiry will never succeed in discovering the dynamical object; and even if it did, we might not know that. He is only saying that the norms that apply to the ideal case also apply to the real case, and the former provides a standard for the evaluation of the latter.

Thus Horkheimer was indeed correct in that, at least potentially, there arises a *progressus*, but it tends to termination. Semiosis terminates when the dynamical object is completely known. But pragmatists usually subscribe to Peirce's fallibilism,[9] or the doctrine that anything can be questioned if positive grounds for doubt arise.[10] If fallibilism is indeed true, then we have no criterion to determine when something is completely known and no further improvement in knowledge is possible.

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[9] For Peirce's own account of fallibilism, see "Questions Concerning Certain Faculties Claimed for Man" (Peirce CP 5.213–263; EP 1, 11–27); "Some Consequences of Four Incapacities" (Peirce CP 5.264–317; EP 1, 28–55); "The Fixation of Belief" (Peirce CP 5.358–387; EP 1, 109–123); and "How to Make Our Ideas Clear" (Peirce CP 5.388–410; EP 1, 124–141).

[10] Isaac Levi (1983) is one of the notable exceptions. He rejected fallibilism in favour of what he called corrigibilism. I am unsure whether these positions differ except in name.

Moreover, the dynamical object can change, which makes a constant revision of all concepts necessary. Hence the final conclusion about anything must be postponed indefinitely (cf. Short 2007, 331). Thus Horkheimer's objection ceases to be an objection and becomes a description of the increase of knowledge in an idealized inquiry.

Fallibilism applies to pragmatism itself. Hence the argument sketched above should not be taken to claim universality but, rather, as a *hypothesis to be tested.* Pragmatists should acknowledge the possibility that their ideas can fail, even if they are widely applicable. Robin (1997) may have hit upon the truth when he suggested, in effect, that *the real proof of pragmatism is to apply it.* William James seems to have suggested a proof of pragmatism by living by it (Rydenfelt 2009, 48). The validity of pragmatism can be only established experimentally on strictly pragmatist grounds. Experimentation is needed to determine whether and how pragmatism fails. Then the possible negative results can be used to *improve* pragmatism. Hence pragmatism is akin to a *research programme* rather than a ready-made doctrine.

5. The Genesis of Meaning

John Dewey (1929b, 81–84) provided an account of how meaning emerges from experiment. First, a known change (possibly nothing) is introduced. Then something else (possibly nothing) changes as a result. This change is measured. Then these changes are correlated. The operations are repeated in varied conditions. If the correlation persists in different circumstances, an experimental practice can arise, which associates these changes. Thereby they become signs of each other: the presence of one is a (fallible) sign of the presence of the other.

The emergence of meaning consists in the reconceptualization of the discovered cause−effect relations as means−ends relations. Once a causal relation has been learned, by directly manipulating the occurrence of the cause, one acquires the capacity to indirectly manipulate the occurrence of the effect. Thus Dewey's account on the emergence of meaning is a direct consequence of Peirce's pragmatic maxim: the meaning of a cause or a means is its potential effects or ends. According to Dewey, that is the purpose of all intelligent activities. If meaning emerges from them, they acquire the status of *art*. (Dewey [1925] 1929a, 136, 177, 180–183, 369–370), (cf. Lindholm 2021.)

This discussion suggests one way in which the pragmatic maxim is inadequate. I have explained that Dewey seems to have maintained that the cause and the effect are signs of each other. But the pragmatic maxim says that only the cause can be a sign of the effect, not *vice versa.* I see no reason why that should be the case. For instance, the reading of a barometer provices information related to an effect of air pressure. But that makes the former a sign of the latter; that is the very purpose for which the instrument has been designed. Hence it seems that, at least in some cases, an effect can be a sign of its cause. It is strange that this did not occur to Peirce given that he studied similar examples of indices, a subclass of signs (see, e.g., Peirce CP 2.285, 5.73; EP 2, 8, 163). Hence I conclude that meanings *can* include *both* possible practical effects *and* possible practical causes. In short, to be meaningful is to be

potentially causally active.[11] At any rate, Peirce was on the right track. His crucial insight was that causality is constitutive of meaning. But he considered only one direction of causality – what will be possible in the future. Obviously, there is another direction – what may have been in the past. That is not a refutation but a generalization – a continuation of Peirce's work.

Note that here the notion of "experiment" and the associated theory of the emergence of meaning are not confined to science in the ordinary sense. Dewey (1916a, 163–178, 237, 317–322) equated *all* experience with experiment at least once. He believed that experiment is the way infants learn their way through the world, anticipating Jean Piaget's ([1936] 1952) concept of "little scientists." All our beliefs are hypotheses that are being tested all the time, and we formulate new hypotheses when novel experiences prompt us. Here the notion of "hypothesis" is not confined to explicit theoretical statements but also denotes an implicit *plan of action* that is available to any animal independently of whether it uses language or not. Thus Määttänen (2009; 2015) has argued that the object of experience is not an assemblage of things or perceptions but an array of *opportunities for action*, or *affordances* (cf. Gibson 1979).

On the other hand, Dewey (1929b, 79–80, 84–85, 124, 199, 220, 240–242, 271, 295); (1938, 60–80) suggested an enlarged notion of science that would encompass any skilled activity that includes intelligent, critical insight for the improvement of its practices. He believed that science and common sense form a continuum of explicitness, publicity, precision and criticism, and that there is only a difference in degree, not in quality. Thus, in this sense, science is art and art is practice (Dewey [1925] 1929a, 354–393), (Lindholm 2021). Then the notion of "experiment" and the theory of the emergence of meaning *are* confined to science in Dewey's enlarged sense.

Dewey's account on the emergence of meaning can be directly applied to Rouse's practical hermeneutics and Ihde's visualism.

Practical hermeneutics is the thesis that practices are meaningful in their own right; that a practice consists of a configuration of people, their skills, their activities, their purposes, equipment, and environment; that interpretation is itself a practice; and that the world is interpreted by how we practically respond to it. Now, a practice is based on causal relations: people engage with it because it is a means towards an end in view. That applies primarily to the control of bodily movements and secondarily to the use of instruments external to the body.[12] A practice is meaningful because it is causally active. Its meaning has thus arisen from the discovery of its causal functions. Bodily movements become meaningful when one discovers what

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[11] Causal activity could, perhaps, also be taken as the definition of *existence*. Then it must be conceptually distinguished from *reality*, that is, being mind-independent. See, e.g., (Peirce CP 1.324, 1.328–329, 1.457, 2.84, 3.200n3, 3.613, 6.336, 8.262).

[12] This distinction between primary and secondary causal functions is just a way to restate Dewey's (1922, 24–26) distinction between active and passive means. Instruments in the ordinary sense are passive means; they acquire the status of a means only when actively used; outside their use they are just objects. On the other hand, habits are active means that have the power to activate a passive means. I have suggested in Lindholm (2021) that Rouse's (1987, 70–126, 209–247); (1996, 125–259); (2002, 161–360) notion of "practice" might capture better what Dewey tried to convey with his notion of "habit."

can be achieved with them. Instruments become meaningful when one discovers what can be achieved with certain bodily movements combined with these instruments.[13]

Visualism is the thesis that the interpretation of the visual outputs of instruments is hermeneutic activity. Now, by definition, what makes them outputs is that they are causally produced by such instruments. Hence the outputs are the meanings of these instruments. What makes them meaningful is how they are used in purposeful activities. Now, one of the purposes of science is to determine facts about objects. Some of them can be determined simply by naked-eye observation (provided that the observer is located and oriented appropriately). But many of them cannot; this requires the technical extension of the possibilities for observation. Instrumentation must ultimately transform some signals produced by the objects into signals observable to the naked eye, however many intermediate transformations that may take. That, in turn, requires knowledge about causal relations: how – that is, under what conditions – a signal can be transformed into another form. The purpose of the instruments is to provide such conditions. Each such transformation creates meaning in Dewey's sense: the signal to be transformed and the instrument that transforms it are the means; the signal that has been transformed is the end; the means and ends function as (fallible) signs of each other; and meaning is thereby constituted by their being causally related.

6. Technics as Hermeneutics

One can easily see that Dewey's account on the emergence of meaning is thoroughly *technical*. Technics is the activity of discovering and using means for achieving an end in view. This, in turn, is based on causal relations. Now, technics can be understood in at least two senses: as a set of skills or as a set of instruments. Practical hermeneutics accounts for both, and visualism seems to be its special case.

The universal character of practical hermeneutics resurrects the medieval notion of the *book of nature*, though in a secular sense. It can be understood as a neo-Kantian thesis, with some important differences. Neo-Kantians are correct in that all experience is interpreted, but they are wrong in considering all interpretation linguistic. (Cf. Määttänen 2009; 2015) I have argued for the existence of non-linguistic meanings. These allow direct access to the world. Hence universal hermeneutics does not necessarily make language an impenetrable barrier between us and the world. That notion dispenses with the sceptical problems that arise from representationalism. If all access to the world were mediated by language (as in theoretical hermeneutics), it would make sense to ask, whether there is any "world" at all beyond language (cf. Rorty 1997, 17). That places important restrictions on the Duhem−Quine thesis: that interpretation presupposes background *practice*, which

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[13] An instrument achieves nothing by itself unless it is an automaton. Whatever a non-automatic device achieves is a result from its being used with skilled movements of the body. Arguably, an automatic device, perhaps one with an adaptive control algorithm (Sastry and Bodson 1989; Åström and Wittenmark 1995), may be considered as having achievements of its own. See the previous note.

may or may not involve background theory. Such practices are mainly non-linguistic. They cannot be arbitrary, because they are based on discovered causal relations turned into means−ends relations – that is, technics. If there were no non-arbitrary non-linguistic meanings, then all interpretation would be arbitrary. Then, in principle, anything could be done with anything, which is hardly plausible.

Peirce's semiotics adds more conceptual resources to practical hermeneutics and visualism. I am not able to do justice to its complexity in this article;[14] hence I confine myself to indicating how it allows direct access to the world. Peirce's best-known subdivision of sign-vehicles is that between *icons*, *indices,* and *symbols*. Icons signify their objects by resemblance (e.g. isomorphism). Indices signify their objects by being actually (e.g. causally) connected with them. Symbols are general signs that signify their objects by a rule, often a human convention. Most linguistic meanings can be analysed as symbols. This division provides a new insight into visualism. Visual displays are icons in the sense that they resemble some aspect of a phenomenon. Simultaneously they are indices by being causally connected, via technical intermediaries, with these phenomena. This makes technics an important anti-sceptical agency.[15] Moreover, visual displays can be symbols insofar as they capture the general features of phenomena. The objects of such symbols are then multiply realizable, repeatable patterns or configurations of the world present in such phenomena.

Peirce also created an original theory of propositions on the basis of his semiotics, which Stjernfelt (2014) insightfully outlined. It is based on two other subdivisions of sign-vehicles: (1) that between *qualisigns*, *sinsigns* and *legisigns* (or *tones*, *tokens* and *types*), and (2) that between *rhemes*, *dicisigns* and *arguments*. Propositions are symbols, legisigns (or types), and dicisigns. They contain an indexical part, or a subject, that denotes a dynamical object, and an iconic part, or a predicate, that describes it. By that virtue, they bear truth-value. Propositions, being general types, are in some sense independent of their tokens, or the media of their expression. Hence many, if not all, propositions can be expressed by non-linguistic means. Sometimes nature itself, including ourselves, readily forms propositions for us.[16] This provides a direct access to the world for us. But sometimes we have to create technical means – for instance, visual outputs like photographs, videos, etc. – to complement and supplement nature. In this sense, Ihde's visualism often, if not always, provides directly accessed propositional content about the world, independently of language.

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[14] Hence I advise again the interested reader to consult the first volume of *The Essential Peirce (Peirce EP 2) and Semiotics and Significs (Peirce and Welby SS).*

[15] This notion appears also in Marxism—Leninism. Kuusinen (1959, 98–99) dispels doubt by appealing to practice, technology and industry. Marx (MEW 3, 7) argued in the 8th thesis on Feuerbach that theoretical disputes are resolved by practice and the comprehension of that practice. Engels (MEW 21, 276–277) argued that our ability to produce a phenomenon ourselves confirms that our hypothesis about the phenomenon is at least approximately true. Thus "practice is the criterion of truth" (Kuusinen 1959, 111). Marx did not justify the 8th thesis on Feuerbach himself, but Dewey's notion of language as conceived means−ends relations can fill in for him. Dewey himself argued that we understand a phenomenon insofar as we are able to produce, sustain, and terminate it at will ([1925] 1929a: 428).

[16] The whole fabric of biosemiotics is proof (cf. e.g. Barbieri 2007).

7. Criticism

Traditional philosophers of science might be upset with the thesis that natural science is a matter of interpretation. Somebody might have the prejudice that interpretation should be arbitrary. Hence, if that were correct, then the "knowledge" which science allegedly acquires would have no normative standing. Any belief or statement would be as good as any other. Essentially, anything would go (cf. Feyerabend [1975] 2010).

But, in fact, hermeneuticity need not threaten the objectivity of science. It is not the case that just anything goes. A single object may have several interpretations, but some of them will be better, some worse. Whether an interpretation is apt can be determined with reference to the object itself about which it is made and to the purpose for which it is made. Whether the purpose is attained is an objective matter of success or failure, which, in turn, depends objectively on the properties of the object and its relations to its environment. In this way, the object itself, the purpose of interpretation and the environment do *constrain* interpretation, but that does not necessarily mean *uniquely determining* it.[17]

For instance, a bicycle, cultivating vegetables, or the duck–rabbit (cf. Wittgenstein [1953] 2009, 204–209, 216–218) might be interpretable in a number of ways. A bicycle can indeed be taken as a muscle- or electricity-powered means of transportation along the surface of the Earth or an article to be sold; cultivating vegetables as producing food or as a means of relaxation; and the duck–rabbit as a duck or a rabbit. But it does not seem that somebody could plausibly interpret a bicycle as a spacecraft; cultivating vegetables as playing rugby; or the duck–rabbit as a portrait of J. V. Snellman. Perhaps that could be done satirically, for child's play, or for some other such activity for which correctness of representation can be largely or completely irrelevant; but such use is derivative.

Not only does that hold for natural sciences but for human and social sciences as well. In any science, one must consider some evidence. The rejection of certain evidence can be acceptable but must be well justified. One cannot make arbitrary claims. For instance, judging whether religion *A* equals religion *B,* or whether François Rabelais and Nikolai Gogol have interesting stylistic similarities, must be based on, say, a comparison of the religious practices of the believers, or a stylometric analysis of the works of the authors. Again, satire or child's play might be exceptions.

Another possible criticism turns on historical relativity. Technics changes. Hence our access to phenomena changes too. For instance, the methods of measuring gravity have changed drastically over centuries. That makes technically mediated knowledge historically relative, at least to a degree. When people abandon certain practices for several centuries, they may become unable to be resurrected. This is the case when a certain piece of equipment falls out of use, and after a period of time, nobody might know, why or how that instrument had been used. Hence some knowledge of the past can be lost forever.

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[17] These remarks elaborate on Ihde's (1998, 197–198) anticipation of the same criticism.

I will bite the bullet here and concede that there is some room for historicism. That was already Kuhn's ([1962] 1996) and Rouse's (1987, 26–69) point. Instruments change. People use different instruments in different practices. Hence practices change too. Now, according to the pragmatic maxim, these different practices will have different meanings. Hence concepts and theories are incommensurable between different historical epochs. That may not be a problem as such, but it summons the spectre of relativism: without a universal measure of correctness, it becomes impossible to determine, whether science is progressing or not.

This kind of historicism may be troublesome for representationalist epistemology that conceives truth as accurate representation and progress as improvement in accuracy. But that is not the case with a pragmatic epistemology that identifies knowledge with practice or the ability to solve problems (cf. Dewey 1916b; [1925] 1929a, 354–393; 1929b; 1938); (Lindholm 2021). Let us suppose that our solution to a certain problem changes over time. We can still speak about progress if the change consists in *increasing the efficiency* of the whole body of possible solutions. We can also speak about progress if the change consists in *increasing the effectiveness* of the whole body of possible solutions; that is, if we are able to solve *more* problems than previously. Now the notion of the accuracy of representation may retain some relevance but it ceases to be the measure of goodness. Accuracy does matter in many, if not all, problems. But it is an empirical matter, *how* accurate is accurate enough in order to solve a given problem. A perfectly accurate representation is just a copy of the world, with all its indefinitely minute detail. Re-creating the situation would merely duplicate the problem. What could possibly be the point of such activity? Perhaps an immaterial Cartesian soul could be happy with this, but living organisms cannot: we have purposes and only so much resources. Logic is not self-sufficient but is a part of an ongoing activity: the conclusion of an inference is not the conclusion of an inquiry (Dewey [1910] 1933, 100–101); the solution must also be acted out to resolve the situation. Even if desirable, it is just practically impossible to re-create all the detail of a situation. Even if possible, it would be just useless to add detail when it no longer contributes to solving the problem. The relevant standards are *efficiency* (how much resources must be sacrificed to solve a problem) and *effectiveness* (the number of possible solutions); and the accuracy of representation has relevance only insofar as it contributes to either.

Dewey did not dispense with the notion of truth, however. He subscribed to the correspondence theory of truth. He just emphasized that the application of the truth–predicate is confined to the domain of possible experience (Dewey 1941, 178–179) and that it is not strictly distinct from utility (Dewey 1916b, 240–241, 324–325).

The body of possible solutions of problems is composed of causal knowledge; and if meaning *is* such knowledge, it constitutes the meaning of the world. We understand the world by coping with it. With each solution, our life becomes more meaningful and significant. (Dewey [1910] 1933, 18–21; 1929b, 124–135.)

Dewey's theory of language (1916a, 17–19; [1925] 1929a, 166–207; 1929b, 140–169; 1938, 42–59) may deserve some criticism. He has two notions of language: language as *conceived means–ends relations* and language as *communication*. These two senses overlap partially, but are at least conceptually distinct. It is not always clear,

which definition he is using. The first sense includes a large number of meanings that are clearly non-linguistic – even though Dewey calls them "language." On the other hand, Peirce (EP 2, 221) was clear that his semiotics includes, but does not reduce to, language.

8. Conclusion

I have argued that if the pragmatic maxim is sound, then the pragmatist theory of meaning provides a theoretical basis for Rouse's practical hermeneutics and Ihde's visualism. I have also suggested that this account can – and indeed should – be supplemented by Peirce's semiotics.

I have defended Peirce's pragmatic maxim against Horkheimer's criticism. Peirce's semiotics turns it into a description of semiosis. I have also suggested that the maxim is a hypothesis to be tested.

I have cited Dewey's account on the emergence of meaning from experiment. That seems to provide a counterexample to the pragmatic maxim, but I have turned it into its enlargement. I have shown how to derive Rouse's practical hermeneutics and Ihde's visualism from that thesis of Dewey.

I have also defended universal hermeneutics, based on the pragmatist theory of meaning, against two possible criticisms that stem from the relativity of interpretation and the historical relativity of practices.

My account has been only preliminary so far. But it is easy to expand it and elaborate on it. I have already alluded to the conceptual apparatus of Peirce's semiotics. The analysis of scientific practices and instruments can be continued in semiotic terms. In this way, followers of Rouse and Ihde can learn from classical pragmatism.

On the other hand, the classical pragmatists say relatively little about practices in detail. I have pointed out in Lindholm (2021) that even Peirce, who practised experimental science himself, keeps details at arm's length. Rouse's and Ihde's analyses of particular practices and instruments can fill in the missing detail. Hence the classical pragmatists can also learn from Rouse and Ihde.

One possible line of inquiry that this discussion suggests is the re-evaluation of naïve realism – that is, the position that the world is as it is experienced. At least since Kant ([1781/7] 1956), philosophers have distinguished between subjective phenomena and objective noumena. He reformulated Parmenides's influential distinction between appearance and reality (Diels and Kranz 1960, 28A, B) in modern terms. But Dewey (1929b, 295) rejected both distinctions: he argued that the world as it is experienced *is* the real world; the predicate "real" makes sense only within the confines of experience.[18] Likewise, Rouse (1987, 7–8) argued that the way things

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[18] Here it must be borne in mind that classical pragmatists did not consider experience as exclusively "subjective." Dewey was most emphatic to define *experience* as *biological and social life* (1916a, 2, 6–7) and as organism—environment interaction (Dewey 1916a, 163–178, 37, 317–22; 1938, 1–98; 1941, 183–184). In this sense, experience is a public, observable, and causal process and hence merits the status of objectivity, whatever "subjective" traits it may have besides. Arguably, this notion had appeared already in Peirce (CP 1.324, 1.336).

appear in inquiry *is* their reality. If Dewey and Rouse are right, then "phenomena" do not denote "subjective" events but, rather, repeatable patterns or configurations of the *world*[19] in the way I have already suggested. Arguably, a case can be made for naïve realism in these terms. Dewey himself did so at least once (1916b, 250–263), but his arguments may have dated and hence might need revision.

Another possible line of inquiry is a comparison of the pragmatist theory of meaning with the received view in analytic philosophy that propositions are *abstract entities.*[20] In light of Dewey's account on the genesis of meaning, it seems readily clear that he conceives all meanings – including propositions – as *constructs*. For Dewey (1916b; 1938), propositions are tentative and hypothetical plans of action, the purpose of which is to solve a problematic situation. Hence they are thoroughly *technical*. If Dewey is correct, they are real but hardly abstract and certainly not entities. They do not exist independently of their potential application. They seem to be better captured by adjectives, adverbs, verbs or gerunds that characterize possible courses of action than nouns (Dewey [1925] 1929a, 158–9; [1934] 1980, 263); (Hickman [1990] 1992: 10). This non-reifying view is at odds with analytic philosophy but seems to have received some support from second-generation cognitive science (Lakoff and Johnson 1999).

References

Åström, Karl Johan, and Björn Wittenmark. *Adaptive Control*. Reading, MA: Addison-Wesley, 1995.

Barbieri, Marcello (Ed.). *Introduction to Biosemiotics: The New Biological Synthesis*. Cham: Springer, 2007.

Dewey, John. *The Influence of Darwin on Philosophy, And Other Essays in Contemporary Thought*. New York: Henry Holt & Co, 1910.

Dewey, John. *How We Think: A Restatement of the Relation of Reflective Thinking to the Educative Process*. (Revised edition.) Lexington, MA: D. C. Heath and Company, [1910] 1933.

Dewey, John. *Democracy and Education: An Introduction to the Philosophy of Education*. New York: The Macmillan Company, 1916a.

Dewey, John. *Essays in Experimental Logic*. New York: Dover, 1916b.

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[19] Here "phenomenon" must be understood as synonymous to "effect," as in "the Hall effect" or "the Zeeman effect" (Peirce CP 5.425–427; EP 2, 339–341).

[20] In the mainstream, propositions are usually conceived reductively: either as unstructured sets of possible worlds in which they are true; or as structures composed of universals and particulars. Some take propositions to be *sui generis or a* class of entities not reducible to anything else. There are also others, who understand propositions (1) as *facts* composed of individuals, properties and relations (Jeffrey C. King), (2) as *properties* of being such that the subject instantiates the predicate (Jeff Speaks), or (3) as cognitive event types of *predication* (Scott Soames) (cf. King, Soames and Speaks 2014*).*

Dewey, John. *Human Nature and Conduct: An Introduction to Social Psychology*. New York: Henry Holt and Company, 1922.

Dewey, John. *Experience and Nature*. (Revised edition.) London: George Allen & Unwin, Ltd, [1925] 1929a.

Dewey, John. *The Quest for Certainty: A Study of the Relation of Knowledge and Action*. New York: Minton, Balch & Company, 1929b.

Dewey, John *Art as Experience*. New York: Perigee, [1934] 1980.

Dewey, John. *Logic: The Theory of Inquiry*. New York: Henry Holt and Company, 1938.

Dewey, John. "Propositions, Warranted Assertibility, and Truth." *The Journal of Philosophy 38, no.* 7 (1941): 169–186.

Diels, Hermann and Walther Kranz *Die Fragmente der Vorsokratiker; Griechisch und Deutsch. Erster Band.* (Neunte Auflage.) Berlin: Weidmannsche Verlagsbuchhandlung, 1960.

Dilthey, Wilhelm. *Gesammelte Schriften, Band V*. Stuttgart: Teubner, 1956.

Dilthey, Wilhelm. *Gesammelte Schriften, Band VII*. Stuttgart: Teubner, 1957.

Duhem, Pierre. *The Aim and Structure of Physical Theory*. Princeton, NJ: Princeton University Press, [1906] 1954.

Feyerabend, Paul. *Against Method: Outline of an Anarchistic Theory of Knowledge*. New York: Verso, [1975] 2010.

Gibson, James J. *The Ecological Approach to Visual Perception*. Hillsdale, NJ: Lawrence Erlbaum, 1979.

Hacking, Ian. *Representing and Intervening: Introductory Topics in the Philosophy of Natural Science*. Cambridge: Cambridge University Press, [1983] 2010.

Heidegger, Martin. *Sein und Zeit* (*Gesamtausgabe*, Band 2). (Friedrich-Wilhelm von Herrmann, Ed.) Frankfurt am Main: Vittorio Klostermann, [1927] 1977.

Hesse, Mary. *Revolutions and Reconstructions in the Philosophy of Science*. Bloomington: Indiana University Press, 1980.

Hickman, Larry A. *John Dewey's Pragmatic Technology*. Bloomington and Indianapolis: Indiana University Press, [1990] 1992.

Horkheimer, Max. *Eclipse of Reason*. London and New York: Continuum, [1947] 2004.

Husserl, Edmund. *Krisis der europäischen Wissenschaften und die transzendentale Phänomenologie: Eine Einleitung in die phänomenologische Philosophie, herausgegeben von Walter Biemel* (*Husserliana* Band VI. 2. Auflage). (Walter Biemel, Ed.) Haag: Martinus Nijhoff, [1936] 1976.

Ihde, Don. "The Experience of Technology´." *Cultural Hermeneutics 2* (1974): 267–279.

Ihde, Don. *Experimental Phenomenology: Multistabilities*. (2nd expanded edition.) Albany: SUNY Press, [1977] 2012.

Ihde, Don. *Technics and Praxis: A Philosophy of Technology*. Dordrecht, Boston and London: D. Reidel, 1979.

Ihde, Don. *Technology and the Lifeworld: From Garden to Earth*. Bloomington and Indianapolis: Indiana University Press, 1990.

Ihde, Don. *Expanding Hermeneutics: Visualism in Science*. Evanston, IL: Northwestern University Press, 1998.

Kant, Immanuel. *Kritik der reinen Vernunft*. Hamburg: Felix Meiner, [1781/7] 1956.

King, Jeffrey C., Scott Soames and Jeff Speaks. *New Thinking about Propositions. Oxford: Oxford University Press, 2014.*

Kuhn, Thomas S. *The Structure of Scientific Revolutions*. (3rd edition.) Chicago: University of Chicago Press, [1962] 1996.

Kuusinen, Otto Wille (Ed.). *Osnovy marksizma–leninizma. Uchebnoe posobie*. (*The Fundamentals of Marxism–Leninism. A textbook*.) Moskva: Gosudarstvennoe izdatelstvo politicheskoy literatury, 1959.

Lakoff, George, and Mark Johnson. *Philosophy in the Flesh: The Embodied Mind and Its Challenge to Western Thought*. New York: Basic Books, 1999.

Latour, Bruno. *Science in Action: How to Follow Scientists and Engineers through Society*. Cambridge, MA: Harvard University Press, 1987.

Levi, Isaac. "Truth, fallibility and the growth of knowledge." In *Language, Logic and Method*, edited by Robert S. Cohen and Marx W. Wartofsky: 153–174. Dordrecht: Reidel, 1983.

Lindholm, Juho. "Science as Art: A Deweyan Perspective." In *The Yearbook of the Irish Philosophical Society 2020—2021. Special Issue: Science and Politics* (Cara Nine, Ed.), 2021. Accessed March 14, 2023. http://www.irish-philosophical-society.ie/wp-content/uploads/2021/06/Lindholm_Science-asArt_IPS-2021-Final.pdf

Lindholm, Juho. "The Pragmatist Basis of Material Hermeneutics", in *World Academy of Science, Engineering and Technology International Journal of Humanities and Social Sciences* 16, no. 11, 2022. https://publications.waset.org/10012795/the-pragmatist-basis-of-material-hermeneutics [accessed August 17, 2023]

Lindholm, Juho. "Scientific Practices as Social Knowledge." In *International Studies in the Philosophy of Science*, 2023. Accessed July 19, 2023. https://doi.org/10.1080/02698595.2023.2196930

Marx, Karl and Friedrich Engels. *Karl Marx Friedrich Engels Werke* (MEW). (46 volumes.) Berlin: Dietz Verlag, 1956—.

Määttänen, Pentti. *Toiminta ja kokemus: Pragmatistista terveen järjen filosofiaa* (*Action and Experience: Pragmatist Common Sense Philosophy*). Helsinki: Gaudeamus, 2009.

Määttänen, Pentti. *Mind in Action: Experience and Embodied Cognition in Pragmatism*. Cham, Heidelberg, New York, Dordrecht and London: Springer, 2015.

Niiniluoto, Ilkka. *Critical Scientific Realism*. Oxford and New York: Oxford University Press, 1999.

Peirce, Charles Sanders. *The Collected Papers of Charles Sanders Peirce* (CP). (8 volumes. Hartsthorne, Charles, Paul Weiss and Arthur W. Burks, Eds.) Cambridge, MA: Harvard University Press, 1958.

Peirce, Charles Sanders. *The Essential Peirce: Selected Philosophical Writings* (EP). (2 volumes. Houser, Nathan, and Christian J. W. Kloesel and The Peirce Edition Project, Eds.) Bloomington: Indiana University Press, 1998.

Peirce, Charles Sanders. *Manuscripts* (MS). In *Charles Sanders Peirce Papers* (MS Am 1632). Cambridge, MA: Houghton Library, Harvard University. (1966: *The Charles S. Peirce Papers, Microfilm Edition, Thirty Reels with Two Supplementary Reels Later Added*. Cambridge, MA: Harvard University Library Photographic Service. Catalogued in Robin, Richard S. 1967. Annotated Catalogue of the Papers of Charles S. Peirce. Amherst: University of Massachusetts Press. Also available online at http://hollis.harvard.edu/?itemid=\000602456 and at https://id.lib.harvard.edu/alma/990006024560203941/catalog

Peirce, Charles Sanders, and Victoria Welby. *Semiotic and Significs: The Correspondence between C. S. Peirce and Victoria Lady Welby* (SS). (2nd edition. C. S. Hardwick & J. Cook, Eds.) Bloomington and Indianapolis: Indiana University Press, 2001.

Piaget, Jean. *The Origins of Intelligence in Children* (Vol. 8). New York: International University Press, [1936] 1952.

Polanyi, Michael. *Personal Knowledge: Towards a Post-Critical Philosophy*. London: Routledge, [1958] 1962.

Polanyi, Michael. *The Tacit Dimension.* Gloucester, MA: Peter Smith, [1966] 1983.

Quine, Willard van Orman. "Two Dogmas of Empiricism." In *The Philosophical Review 60* (1951): 20–43.

Robin, Richard S. "Classical Pragmatism and Pragmatism's Proof." In *The Rule of Reason: The Philosophy of Charles Sanders Peirce*, edited by Jacqueline Brunning and Paul Forster: 139–152. Toronto: University of Toronto Press, 1997.

Rorty, Richard. *Truth, Politics, and 'Post-Modernism'*. Assen: Van Gorcum, 1997.

Rouse, Joseph. *Knowledge and Power: Toward a Political Philosophy of Science.* Ithaca and London: Cornell University Press, 1987.

Rouse, Joseph. *Engaging Science: How to Understand Its Practices Philosophically*. Ithaca and London: Cornell University Press, 1996.

Rouse, Joseph. *How Scientific Practices Matter: Reclaiming Philosophical Naturalism.* Chicago and London: The University of Chicago Press, 2002.

Rydenfelt, Henrik "Pragmatism and the Aims of Inquiry: Peirce, James and Two Seeds of Death." In *Pragmatist Perspectives (Acta Philosophica Fennica, Vol. 86),* edited by Sami Pihlström and Henrik Rydenfelt: 41–51. Helsinki: Hakapaino, 2009.

Sastry, Shankar, and Marc Bodson. *Adaptive Control: Stability, Convergence and Robustness.* Englewood Cliffs, NJ: Prentice-Hall, 1989.

Short, Thomas Lloyd. *Peirce's Theory of Signs*. Cambridge: Cambridge University Press, 2007.

Stjernfelt, Frederik. *Natural Propositions: The Actuality of Peirce's Doctrine of Dicisigns*. Boston: Docent Press, 2014.

Vehkavaara, Tommi. "From the Logic of Science to the Logic of the Living. The Relevance of Charles Peirce to Biosemiotics." In *Introduction to Biosemiotics: The New Biological Synthesis*, edited by Marcello Barbieri: 257–298. Cham: Springer, 2007.

Wittgenstein, Ludwig. *Philosophical Investigations.* (4th revised edition. Anscombe, Gertrude Elizabeth Margaret, Peter Michael Stephan Hacker, and Joachim Schulte, Eds.) Chichester: Wiley-Blackwell, [1953] 2009.

Wittgenstein, Ludwig. *The Blue and the Brown Books*. Oxford: Blackwell, 1958.

Wittgenstein, Ludwig. *On Certainty.* (Anscombe, Gertrude Elizabeth Margaret, and Georg Henrik von Wright, Eds.) New York: Harper and Row, 1969.