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Inquiry
An Interdisciplinary Journal of Philosophy

ISSN: 0020-174X (Print) 1502-3923 (Online) Journal homepage: www.tandfonline.com/journals/sinq20

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To cite this article: James W. McAllister (2026) Common sense and the difference between natural and human sciences, Inquiry, 69:2, 937-962, DOI: 10.1080/0020174X.2023.2240430

To link to this article: https://doi.org/10.1080/0020174X.2023.2240430

Published online: 07 Aug 2023.

INQUIRY
2026, VOL. 69, NO. 2, 937–962
https://doi.org/10.1080/0020174X.2023.2240430

Routledge
Taylor & Francis Group

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Common sense and the difference between natural and human sciences

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ABSTRACT
This article proposes a new account of the relation between the sciences and common sense. A debate between Alfred North Whitehead and Arthur S. Eddington highlighted both the tendency of the natural sciences to repudiate commonsense conceptions of the world and the greater closeness of the human sciences to common sense. While analytic writers have mostly regarded these features as self-evident, I offer an explanation of them by appealing to Wilhelm Dilthey and the phenomenological tradition. Dilthey suggested that, whereas the natural sciences could individuate their phenomena purely from empirical data, human sciences were compelled to refer to commonsense understanding in order to individuate mental phenomena. I apply this insight to episodes from the history of science, and use it to contrast the work of Alfred Schutz and Carl G. Hempel in philosophy of social and natural science. In the final section, I argue that Dilthey's framework also offers resources to challenge present-day reductionism about mental phenomena.

ARTICLE HISTORY Received 9 March 2023; Accepted 14 July 2023

KEYWORDS Common sense; Wilhelm Dilthey; human sciences; mental phenomena; natural sciences; reductionism

1. Introduction

Since antiquity, scholars have noted that knowledge takes at least two forms. The first is everyday, practical conceptions of the world that people share widely and apply in concrete cases; the second is specialist, formal or technical conceptions that are the product of systematic investigation and reasoning within disciplinary settings. Over the centuries, thinkers have characterised this dichotomy variously as the opposition

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between *doxa* and *episteme* and the sensible and the intelligible, and have linked it to distinctions between appearance and reality and the subjective and the objective (Fine 2021; Marková 2016, 9–90). Almost all scholars have considered the latter term in each case as superior to the former, and the transition between them as progress towards knowledge of a higher grade.

More recently, the two forms of knowledge have come to be identified with common sense and science respectively. Most mainstream writers agree that science is an improvement on common sense. They say that, whereas commonsense accounts of the world tend to vagueness and inconsistency, science gives us a picture that is precise, well founded and systematic. Furthermore, scientists replace theories readily in response to new evidence, whereas commonsense conceptions of the world evolve only slowly.

If knowledge comes in these two forms, questions naturally arise as to the stance that science should take towards common sense. Should science maintain continuity with the commonsense picture of the world? Alternatively, to what extent can and should science repudiate the ontology that common sense posits?

Two historical episodes in particular have suggested that discarding the commonsense picture was an important element of scientific progress. The corpuscularism of Robert Boyle and others in the seventeenth century inaugurated a systematic project of explaining macroscopic appearances by appeal to microscopic mechanisms that bore little resemblance to perceptible occurrences. This was a radical ontological departure from everyday knowledge. Boyle's influential distinction between primary and secondary qualities, elaborated by John Locke, restricted the status of fundamental reality to the quantifiable properties of size, shape, extension and motion. It demoted many concepts of everyday experience, by contrast, such as colours, sounds, tastes and smells, to products of the mind's interaction with primary qualities, placing them outside the scope of scientific inquiry (Alexander 1985). The structure that natural philosophy attributed to the submicroscopic world thereby discredited the everyday picture of the macroscopic world. George Berkeley, in response, tried to restore primacy to everyday conceptions by considering primary and secondary qualities alike as sensible properties in a perceiver's mind. That proposal, however, gained little purchase among natural philosophers.

The second episode, the rise of quantum mechanics from the 1920s onwards, can be viewed in this regard as an extension of the corpuscular project. Quantum mechanics is a prime example of modern scientific theory that portrays aspects of the commonsense picture of the world as an illusion: it repudiates everyday concepts of identity, causality, continuity and visualisability, among others. It seems to cast doubt even on the possibility of a coherent 'picture of the world' at all (Lewis 2016, 22–24).

Many writers have concluded from such episodes that scientific progress naturally involves abandoning commonsense conceptions of the world. This article tries to construct a better-rounded view of the relation between common sense and science. My questions are: to what extent are different sciences able to pursue the strategy of repudiating commonsense pictures of the world? What determines whether this strategy is available to a particular science?

I shall proceed by juxtaposing approaches and topics usually kept apart: analytic philosophy of science and Continental phenomenology, and methodology of the natural and human sciences. I will argue that the relation in which a scientific discipline stands to common sense depends on the way in which it is able to individuate its phenomena of study, and that putting this relation centre-stage helps to clarify differences between the natural and the human sciences.

In the next section, I review a debate between Alfred North Whitehead and Arthur S. Eddington that has set the terms for much thinking about common sense in analytic philosophy. While placing Eddington's frequently quoted discussion of the 'two tables' into a broader context, I shall highlight two important explananda that this debate yielded. In section 3, I look at the rise with Wilhelm Dilthey of a different way of conceiving the relation between common sense and scientific knowledge. I illustrate and test Dilthey's approach by reference to episodes in the history of science in section 4. I use this framework to revisit influential contributions to mid-twentieth-century philosophy of science by Alfred Schutz and Carl G. Hempel in section 5, and to evaluate reductionist approaches to mental phenomena in section 6. I draw some conclusions in section 7.

2. The Whitehead–Eddington debate

We open with analytic philosophy. An exchange between Alfred North Whitehead, who worked in the analytic tradition before turning to metaphysics and process philosophy (Rusu and Desmet 2012, 214–215), and Arthur S. Eddington, an astrophysicist with philosophical interests, has been an important source for thinking about the relation between common sense and science in Anglo-American philosophy. The debate was notable for the explananda that it placed on the philosophical agenda. The exchange was conducted in lectures spanning twenty years: whereas the speakers did not cite one another's interventions explicitly, the mutual references are unmistakable.

The exchange began when Whitehead was president of Section A, Mathematical and Physical Science, of the British Association for the Advancement of Science (BAAS). He delivered his presidential address, 'The Organisation of Thought', at the 1916 Newcastle-on-Tyne meeting. Whitehead posed the question, 'How does exact thought apply to the fragmentary, vague *continua* of experience?' (Whitehead 1917, 357). Whitehead suggested that all experience was mediated by what he called the 'apparatus of common-sense thought', being 'the concepts of definite material objects, of the determinate lapse of time, of simultaneity, of recurrence, of definite relative position, and of analogous fundamental ideas, according to which the flux of our experiences is mentally arranged for handy reference'. Our experience of both scientific entities and everyday objects, such as furniture – 'Consider in your mind some definite chair', Whitehead invited the reader – was shaped by such commonsense categories.

Whitehead proceeded to argue for two claims about the relation between science, common sense and experience. First, because common sense represented the initial encounter of exact thought with experience, science could never completely sever links with it:

> In the first place, science is rooted in … the whole apparatus of common-sense thought. That is the *datum* from which it starts, and to which it must recur. … You may polish up common sense, you may contradict it in detail, you may surprise it. But ultimately your whole task is to satisfy it. (Whitehead 1917, 357)

Second, both common sense and science went beyond experience: 'neither common sense nor science can proceed with their task of thought organisation without departing in some respect from the strict consideration of what is actual in experience' (Whitehead 1917, 357). Science took more distance from experience than common sense did, however. This enabled science to propose conceptions, even of everyday objects, that were foreign to common sense: '[P]hysicists and chemists have dissolved the simple idea of an extended body, say of a chair, which a child understands, into a bewildering notion of a complex dance of molecules and atoms and electrons and waves of light' (Whitehead 1917, 363). Whitehead's suggestion that science at the same time presupposed and corrected common sense was to remain a central theme of his philosophy (Rusu and Desmet 2012, 223–231).

Eddington had reason as well as opportunity to attend to Whitehead's lecture. They had known each other since 1902, when Whitehead was Eddington's teacher at Cambridge. Eddington took part in the same BAAS meeting as recorder of Section A, speaking in a 'Discussion on Gravitation' immediately after Whitehead's presidential address (BAAS 1917, xli, 364; Desmet 2011, 299).

In 1927, Eddington delivered the Gifford Lectures at the University of Edinburgh. He took as topic the way in which science represented and interpreted the world. Like Whitehead in 1916, Eddington touched upon the relation between science and common sense; also like Whitehead, he used furniture for an example. 'I have settled down to the task of writing these lectures and have drawn up my chairs to my two tables. Two tables! Yes; there are duplicates of every object about me – two tables, two chairs, two pens' (Eddington 1928, xi). Eddington emphasised the difference between the tables:

> One of them has been familiar to me from earliest years. It is a commonplace object of that environment which I call the world. How shall I describe it? It has extension; it is comparatively permanent; it is coloured; above all it is *substantial*. (Eddington 1928, xi)

The second, which Eddington called his 'scientific table', was quite different:

> It is a more recent acquaintance and I do not feel so familiar with it. It does not belong to the world previously mentioned – that world which spontaneously appears around me when I open my eyes … . It is part of a world which in more devious ways has forced itself on my attention. My scientific table is mostly emptiness. Sparsely scattered in that emptiness are numerous electric charges rushing about with great speed; but their combined bulk amounts to less than a billionth of the bulk of the table itself. (Eddington 1928, xii)

Whereas Eddington's writing is not completely unambiguous, he seemed to argue that science had shown that the commonsense picture of the world did not correspond to anything: 'I need not tell you that modern physics has by delicate test and remorseless logic assured me that my second scientific table is the only one which is really there – wherever "there" may be' (Eddington 1928, xiv). To begin with, our everyday experience of objects as extended, permanent and coloured was an illusion:

> But the solid substance of things is another illusion. It too is a fancy projected by the mind into the external world. We have chased the solid substance from the continuous liquid to the atom, from the atom to the electron, and there we have lost it. But at least, it will be said, we have reached something real at

> the end of the chase – the protons and electrons. Or if the new quantum theory condemns these images as too concrete and leaves us with no coherent images at all; at least we have symbolic co-ordinates and momenta and Hamiltonian functions devoting themselves with single-minded purpose to ensuring that *qp* – *pq* shall be equal to *ih*/2π. (Eddington 1928, 318–319)

In other words, scientific progress gave us an increasingly abstract description of the world, revealing our commonsense conceptions, such as of solidity of everyday objects, as illusion. Unlike Whitehead, Eddington did not think that recovering the commonsense picture of the world was a task of science.

We go back to Whitehead for a final lecture, 'Nature and Life', at the University of Chicago in 1933, in which he revisited the relation between science and common sense. Whitehead opened with the familiar world of perception, again including furniture:

> [W]e can conceive Nature as composed of permanent things – namely, bits of matter, moving about in space which otherwise is empty. This way of thinking about Nature has an obvious consonance with common-sense observation. There are chairs, tables, bits of rock, oceans, animal bodies, vegetable bodies, planets, and suns. (Whitehead 1934, 10–11)

Whitehead noted that science had left this picture of the world behind, however:

> When we survey the … course of scientific thought throughout the seventeenth century up to the present day, two curious facts emerge. In the first place, the development of natural science has gradually discarded every single feature of the original common-sense notion. Nothing whatever remains of it, considered as expressing the primary features in terms of which the universe is to be interpreted. The obvious common-sense notion has been entirely destroyed, so far as concerns its function as the basis for all interpretation. One by one, every item has been dethroned. (Whitehead 1934, 14–15)

Whitehead made clear later in the lecture that he was thinking here above all of the expulsion of perceptual qualities, such as colour, sound and smell, from the scientific view of the world, which seventeenth-century corpuscularism initiated (Whitehead 1934, 19–21). He went on to look to endeavours beyond physics:

> There is a second characteristic of subsequent thought which is equally prominent. This common-sense notion still reigns supreme in the workaday life of mankind. It dominates the market place, the playgrounds, the law courts, and in fact the whole sociological intercourse of mankind. It is supreme in literature

> and is assumed in all the humanistic sciences. Thus, the science of Nature stands opposed to the presuppositions of humanism. (Whitehead 1934, 15)

This passage is notable in extending the discussion to the human sciences, contrasting them with the natural sciences. In comparison, whereas Eddington applied his structuralist philosophy to mental phenomena as well as to physical objects (French 2014, 79–87), he did not comment on the relation between scientific and commonsense conceptions of the mental in his Gifford Lectures.

What did this debate deliver? Between them, Whitehead and Eddington placed on the philosophical agenda two essential explananda about the relation of science and common sense, as well as advancing an intriguing hypothesis. The explananda were the tendency of natural science to redescribe phenomena in ways not recognisable to common sense, which Eddington emphasised in 1927, and the second of the 'two curious facts' that Whitehead noted in 1933, that the human sciences stood in a closer relation to common sense than the natural sciences did. The hypothesis, which Whitehead voiced in 1916, was that, if common sense represented the initial encounter of exact thought with experience, scientific knowledge could never completely sever links with it.

What influence did the debate have in analytic philosophy? The response has been uneven, highlighting some aspects but largely ignoring others. Above all, analytic writers have been fascinated by Eddington's imagery of the two tables. This quickly became and has remained a seemingly almost obligatory reference for analytic philosophers writing on the relation between science and common sense. Many of these writers have elaborated their own positions on the relation between scientific and everyday pictures of the world by taking a view on Eddington's distinction. Here are some examples.

L. Susan Stebbing, while pointing out unclarities in Eddington's language, argued that he was wrong to depict the two tables as duplicates of one another. They were very different things. Only the everyday table was part of the physical world and had ontological significance. This table was indeed solid, since it was part of the semantics of the term 'solidity' that tables had this property. What Eddington called 'scientific table', by contrast, was a model created by physicists – and a misleading use of language, since the category 'table' did not feature in physical theorising (Stebbing 1937, 45–64).

Wilfred Sellars saw 'Eddington's "two tables" problem' (Sellars 1962, 73) as an instance of the distinction between what he called the manifest and the scientific images of the world, the frameworks of common sense and science respectively. While calling for a 'synoptic vision' that united science's picture of reality with everyday language, he judged that the scientific image had primacy over the manifest image.

More recently, Amie L. Thomasson (2007, 137–150) has used Eddington's account of the two tables as a foil to deny that science and common sense were in rivalry. Neither the scientific nor the everyday picture of the world purported to be complete, and in fact they occupied distinct ontological domains. Lastly in this short selection, Steven French (2014, 167–171) has critically endorsed the position that Eddington took in his discussion of the two tables in order to put forward eliminativism with regard to ordinary objects.

Each of these writers shows analytic philosophy building in innovative ways upon Eddington's distinction. There has been a much less determined attempt to account for the explananda or to develop the hypothesis that the Whitehead–Eddington debate yielded, by contrast. The analytic tradition has mostly taken for granted the tendency of physics to redescribe phenomena in ways not recognisable to common sense, which Eddington noted: it has not attempted to explain why natural science manifested this feature. Furthermore, the response in analytic philosophy has been concerned almost exclusively with natural science: it has not taken up Whitehead's hint to probe the difference between natural and human sciences in relation to common sense.

The rest of this article returns to the two explananda and the hypothesis that the Whitehead–Eddington debate yielded and attempts to account for them. For this, we look beyond the analytic tradition.

3. Dilthey on natural and mental phenomena

Continental philosophy has elaborated a distinct line of thinking about the relation between common sense and science and, in addition, between natural and human sciences, which complements the reflections of analytic philosophy. Being in part a project to describe phenomena as they present themselves to human awareness, this tradition has found greater epistemic significance in commonsense conceptions of the world.

Late-nineteenth-century German culture saw a debate on the demarcation of *Naturwissenschaften* and *Geisteswissenschaften* and on the viability and autonomy of the latter family of disciplines. The Cartesian-Kantian tradition had handed down an ontological distinction between two domains of reality, extended matter and thinking spirit, but the leading nineteenth-century writers doubted that this was sufficient to capture the difference between natural and human sciences. They explored several new approaches, each of which emphasised a different facet of the distinction.

Wilhelm Windelband, for example, working from a methodological perspective, characterised the natural sciences as nomothetic disciplines that used *erklären* to produce causal explanations based on universal laws of nature, and the human sciences as idiographic disciplines that provided narrative understanding of unique phenomena by means of *verstehen*. Heinrich Rickert took an axiological viewpoint, arguing that, whereas the natural sciences were value independent, the human sciences involved values of aesthetic, ethical, political, religious and other categories. Here, however, we take up yet another approach to the distinction: Wilhelm Dilthey's epistemological perspective, relating to the ways in which natural and human sciences apprehended, individuated, and identified their objects of study, natural and mental phenomena respectively (De Mul 2004, 131–135, 189–196, 221–225; De Mul 2019, 43–50).

In works such as *Ideen über eine beschreibende und zergliedernde Psychologie* of 1894, Dilthey elaborated on a distinction between two forms of experience that Immanuel Kant had drawn: outer experience, channelled through sensory perception, and inner experience, or one's experience 'from within' of one's own empirical-psychological states, including intentions, affects and beliefs. Natural sciences rested solely on outer experience, according to Dilthey: we used sensory perception to apprehend natural phenomena, which then became the object of scientific investigation. Things were otherwise for mental phenomena, such as human acts, artworks and artefacts: their physical expressions were given in outer experience, but human sciences grasped their meanings by linking them to inner experience. We observed expressions of mental phenomena, and then interpreted these expressions by reference to our own attributions of meanings to them. Dilthey wrote:

> The human sciences are distinguished from the natural sciences first of all in that the latter have for their object facts that are presented to consciousness as from outside – as phenomena and as given in isolation – while the objects of the former are given *originaliter* from within as real and as a living continuum or nexus [Zusammenhang]. As a consequence there exists a system of nature for the physical and natural sciences only through inferential conclusions that supplement the data of experience by means of a combination of hypotheses. In the human sciences, by contrast, the continuum or nexus of psychic life is an

original or basic given. Nature we explain, but psychic life we understand [Die Natur erklären wir, das Seelenleben verstehen wir]. (Dilthey [1894] 2010, 119)

Dilthey here drew attention to two differences between natural and mental phenomena. First, the former were given singly, whereas in the case of the latter an experienced continuum came first and was only later resolved into individual elements. The second distinction, which followed partly from the first, concerned the ways in which scientists picked out natural and mental phenomena. A natural scientist individuated natural phenomena directly from outer or third-person experience. Because of this, picking out a natural phenomenon did not depend on having engaged in even a preliminary attempt to explain it. When a scholar in the human sciences individuated a mental phenomenon, by contrast, it had already passed through inner or first-person experience, in which phase we made an initial ascription of meanings to it. This meant that it was impossible to pick out a mental phenomenon without having achieved an initial understanding of it (Bransen 2001, 16167–16168).

Dilthey's account thus has implications for our view of *erklären* and *verstehen*. Some writers have depicted these activities simply as counterparts of one another in nomothetic and idiographic approaches, but their roles in scientific theorising are different. *Erklären* is the activity of providing a causal explanation, which a natural scientist carries out once a natural phenomenon has been individuated from observational data, and which may go well beyond common sense. By contrast, *verstehen* is the starting point of the act of individuating mental and social phenomena in commonsense terms. Whereas *erklären* is unambiguously a method of natural scientists to advance scientific knowledge of natural phenomena, therefore, *verstehen* is not primarily a method of scholars in the human sciences. Containing our everyday understandings in terms of intentions, motives, beliefs and feelings, *verstehen* is instead a condition of there being any mental phenomena available for scientific investigation at all (Ricoeur 1978, 1228–1233).

In sum, Dilthey's account suggests that the difference between human and natural sciences is intimately tied to the relation between these sciences and common sense. One family of disciplines relies on commonsense understanding in order to individuate phenomena, whereas the other is able to individuate its phenomena by ostension in observational data, bypassing common sense. We will explore two extended empirical examples in the next section.

Following Dilthey, philosophers and social scientists who took everyday life as the basis of analysis developed this line of thinking in new ways. In the phenomenology of Edmund Husserl, for example, the *Lebenswelt* (lifeworld) was the world of common sense or of daily life, given to and taken for granted in our immediate experience independent of and prior to scientific knowledge (Smith 1995). Alfred Schutz applied the same approach to social science, as we shall see in section 5. More recently, the same themes have surfaced in different guises under the rubric of social construction of reality, stretching from the work of Peter L. Berger and Thomas Luckmann (1966) to that of Ian Hacking (1999).

4. Individuating phenomena in natural and human sciences

To illustrate and test Dilthey's account of the differing roles of common sense in natural and human sciences, we study in this section the interplay of three elements in a scientist's individuation of a phenomenon: direct ostension, commonsense understanding, and scientific understanding. First, which conceptual resources are required in order to pick out phenomena in the natural sciences?

To begin with, the realisation has grown in philosophy of science that the individuation of natural phenomena does not require a prior understanding of them on the basis of scientific theory. Whereas some phenomena are predicted on theoretical grounds, scientists constitute other phenomena by laboratory manipulation or exploratory experimentation that owes little to theory. Phenomena, furthermore, endure through subsequent shifts in theory, as Hacking (1983, 220–233) pointed out. Even Thomas S. Kuhn, one of the early proponents of the thesis of theory ladenness of observation, allowed that scientists could discover anomalous phenomena that did not fit the dominant theoretical paradigm and which they therefore found inexplicable (Holland and Lande 2019).

What about the role of common sense in the individuation of natural phenomena? As I shall now argue, picking out a natural phenomenon from experience does not require us to appeal to or even to possess an understanding of it in commonsense terms. We are able to pick out a natural phenomenon by direct ostension – either by pointing to an occurrence that we observe with the naked eye, or by producing and displaying an effect in a laboratory setting. Equally, the ability to reidentify the phenomenon on a later occasion does not require that a scientific account of it preserves a commonsense understanding.

Examples of novel phenomena for which scientists had no commonsense understanding when they individuated them include free fall, magnetism, quantum effects and superconductivity. We shall examine another well-documented case, the discovery of pulsars in astronomy by Jocelyn Bell (later Bell Burnell) and Antony Hewish in 1967. I shall use scientists' testimony in this case study. While I acknowledge that reliance on scientists' own discovery narratives is sometimes problematic, they are an indispensable source for clarifying how scientists pick out phenomena in subjective experience.

Bell and Hewish had been using a new large radio telescope to survey quasars, a class of radio sources that had been discovered recently. Their empirical data took the form of pen traces on strip charts produced by a detector at the rate of 96 feet (30 m) per day. In September 1967, Bell noticed an unfamiliar feature in the output for a certain area of the sky. She called this 'scruff', a term indicating dirt or dross: 'I became aware that on occasions there was a bit of "scruff" on the records, which did not look exactly like a scintillating source, and yet did not look exactly like man-made interference either' (Bell Burnell 1977, 686; see also Hewish 1975). In November, Bell found a second occurrence of the signal using a higher-speed recorder, which resolved the structure more clearly: 'As the chart flowed under the pen I could see that the signal was a series of pulses, and my suspicion that they were equally spaced was confirmed as soon as I got the chart off the recorder. They were $1^1/_3$ seconds apart' (Bell Burnell 1977, 686).

Bell and Hewish decided to switch their investigation to this unexpected signal. They had no understanding of the effect in commonsense terms. In fact, none of their tentative intuitive hypotheses appeared plausible:

> [P]ulses $1^1/_3$ seconds apart seemed suspiciously man-made. Besides $1^1/_3$ seconds was far too fast a pulsation rate for anything as large as a star. It could not be anything earth-bound because it kept sidereal time … . We considered and eliminated radar reflected off the moon into our telescope, satellites in peculiar orbits, and anomalous effects caused by a large, corrugated metal building just to the south of the … telescope. … We did not really believe that we had picked up signals from another civilization, but obviously the idea had crossed our minds and we had no proof that it was an entirely natural radio emission. (Bell Burnell 1977, 686–687)

But Bell and Hewish did not need an understanding in commonsense terms in order to pick out the phenomenon: they individuated and reindividuated it by referring to a feature of the empirical data, scruff. As Bell recounted, she was able to pick out new instances of the phenomenon by recognising scruff in the detector output:

> Over Christmas Tony Hewish kindly kept the survey running for me … and piled the charts, unanalyzed, on my desk. When I returned after the holiday I … settled down to do some chart analysis. Soon, on the one piece of chart, … I saw two more lots of scruff … . Meanwhile I had checked back through all my previous records (amounting to several miles) to see if there were any other bits of scruff that I had missed. This turned up a number of faintly possible candidates, but nothing as definite as the first four. (Bell Burnell 1977, 687)

The individuation and discovery of the phenomenon thus occurred on the basis of a feature of the observational data, scruff, without reliance on an understanding in commonsense terms. As Bell later recalled,

> In among each 400 feet of chart paper there was occasionally a quarter inch that I did not understand. What niggled me about that quarter inch was that it didn't look like a scintillating quasar, and it didn't look like interference. It was a bit of a puzzle. (Bell Burnell 2004, 1.8)

In effect, this phase of the research consisted in establishing the phenomenon empirically as an explanandum for natural science. Even Bell and Hewish's ensuing publication focused on demonstrating the existence and quantitative parameters of the phenomenon from the empirical data. It went no further in offering an understanding of the signals than a reference to a generic 'rapidly pulsating radio source', speculating as to its nature (Hewish et al. 1968).

The demand for explanation was fulfilled a few months later, when Thomas Gold (1968) sketched the mechanism accepted today: a neutron star or 'pulsar' emitting an electromagnetic beam along its magnetic axis while spinning about its rotational axis. This scientific explanation did not need to preserve elements of a pre-existing commonsense understanding in order to ensure that scientists could reindividuate the phenomenon; nor could it have done so, since there had been no such commonsense understanding.

The pulsar episode suggests that individuating a natural phenomenon does not depend on having an understanding of it in commonsense terms, any more than in terms of a scientific theory. To the contrary, it is possible to individuate a natural phenomenon in observational data, find it surprising, note that we lack an understanding of it, give it the status of explanandum, and subsequently strive to find a scientific explanation of it. This is a well-established empirical cycle in natural science.

Because individuating a natural phenomenon does not go through common sense, furthermore, a scientific explanation of the phenomenon that we subsequently formulate has no need to refer to or to incorporate a commonsense understanding of it. The scientific explanation is free to leapfrog common sense, linking instead directly to the ostension of the phenomenon in empirical data. This explains why, for example, the scientific description of Eddington's table as mostly empty space can look nothing like the commonsense description of it as solid.

By contrast, which conceptual resources are required in order to pick out phenomena in the human sciences? The roles of ostension, commonsense understanding and scientific understanding in the individuation of what Dilthey termed mental phenomena are otherwise than for natural phenomena. The meanings of a mental phenomenon are central to its identity, so we cannot individuate such a phenomenon without relying on a preliminary, commonsense understanding of it. Furthermore, the eventual scientific account of a mental phenomenon, unlike scientific accounts of natural phenomena, must preserve the commonsense understanding of it, or else subsequent researchers would not be able to reidentify the referent of the scientific account in experience. If a scientific theory of a mental phenomenon were as distant from the commonsense understanding of it as a theory of a natural phenomenon may be (for example, as Eddington's 'empty space' conception of a table is from the everyday conception of it as solid), then it would be impossible to tell what in the world the theory referred to. In Dilthey's terms, apprehending a mental phenomenon involves inner experience, drawing on intentions, affects and beliefs: outer experience alone would not be sufficient to pick it out.

This holds for the study of any behaviour in the human sciences. Take rituals: because the identity of a ritual is largely constituted by its meanings and significances, picking out a ritual as a topic of inquiry depends on a commonsense understanding of it as a rite of passage, for example, or as a pilgrimage. However much scientific theorising subsequently goes into an anthropologist's account of the ritual, reidentifying it as a phenomenon in the world will still depend on this pretheoretic understanding (Geertz 1974).

Let us focus on the ritual of gift-giving, a topic of anthropology and sociology. An object does not have any special intrinsic properties that make it a gift: what makes it a gift is the intentions and meanings that giver and receiver ascribe to it. For this reason, ostension in observational data (as used to individuate natural phenomena) is incapable of identifying instances of gift-giving or distinguishing them from other cases in which goods change hands. Instead, we need an initial commonsense understanding of the phenomenon in order to be able to individuate instances of it, before any scientific research project into the phenomenon can get under way. This commonsense understanding is based largely on our own previous experience of gift-giving and what it means for us. If we had no such understanding, we would have no insight into the world of intentions and meanings that partly constitute the phenomenon of gift-giving, and therefore we would never be able to individuate instances of the phenomenon as objects of the scientific research project. For the same reason, anthropological and sociological accounts of gift-giving, no matter how advanced, are obliged to preserve commonsense understandings of the phenomenon.

Marcel Mauss's classic *Essai sur le don*, on gift-giving in traditional societies, provides an illustration. When delineating his topic at the beginning of the book, Mauss did not try to individuate instances of gift-giving by ostension, that is, by picking out the phenomenon from an observational record. Instead, he signalled in the book's second sentence that he would 'situate the reader directly within the atmosphere of ideas and facts through which our exposition will move' by reproducing eight stanzas of *Hávamál*, an Old Norse poem. These evoked the experiences of and meanings ascribed to gifts, friendship, generosity, hospitality and reciprocity.

From this extract, Mauss distilled the phenomenon that formed the topic of his book: 'The subject is clear [On voit le sujet]. In Scandinavian civilization, and a good number of others, exchanges and contracts are made in the form of a gift [cadeau], in theory voluntary, in reality obligatorily given and received' (Mauss [1925] 2016, 55–57). Mauss expected, in other words, that the verses of *Hávamál*, by activating his readers' commonsense understanding of meanings and intentions, would enable them to individuate definitively the phenomenon of gift-giving. No collection of observational data would have achieved this.

In the rest of his essay, Mauss presented an elaborate, general model of 'exchange in archaic societies' as a phenomenon with personal, kinship-related, social, political, practical, economic, legal, mythological, religious and magical aspects. Mauss's model had much more scientific content than his readers' commonsense understanding of gift-giving, of course. His model preserved that pre-existing understanding, however: it was obliged to do so, for it remained dependent on it in order to reindividuate instances of the phenomenon of gift-giving.

These empirical examples show the applicability of Dilthey's view of common sense to narratives of scientific discovery and interpretation. Dilthey's framework seems well placed to account for the different relations in which natural and human sciences stand to common sense.

5. Common sense in Schutz and Hempel

We have reconstructed the origins of two approaches to the relation of science and common sense: one in Continental thought with Dilthey in the 1890s and one in analytic philosophy with Whitehead and Eddington from the 1910s onwards. The Whitehead–Eddington debate yielded two intriguing explananda, as we saw, but the subsequent debate in analytic philosophy shifted to other matters. By contrast, Dilthey's approach offered an explanation of Eddington's remark that scientific conceptions of the world might differ radically from everyday conceptions, by reference to an underlying factor, namely the ways in which natural scientists individuated their phenomena. Furthermore, it provided a theoretical framework for the observation, which Whitehead made in his 1933 lecture, that the human sciences had a different and closer relation with common sense.

We now look at the way in which these two lines of thinking about common sense and its relation to scientific theorising manifested themselves in philosophy of science a few decades later. We compare two leading mid-twentieth-century philosophers of science: Alfred Schutz, of the Continental tradition of social phenomenology, and Carl G. Hempel, of the analytic school of logical empiricism. Taking one work of each of these authors as example, we will investigate how their understanding of common sense built on earlier philosophical resources.

Schutz's focus as philosopher of social science was the ways in which people used everyday interactions to construct intersubjectivity and reality (Gurwitsch 1962). We consider his 1953 article, 'Common-Sense and Scientific Interpretation of Human Action'.

Schutz opened this article by arguing that, whereas scientific constructs in all disciplines were designed to go beyond commonsense constructs, there was a difference between the natural and the social sciences in this respect. Turning first to natural sciences, Schutz discussed Whitehead's 1916 lecture, 'The Organisation of Thought', which we identified in section 2 above as an origin of the debate about how developments in early-twentieth-century physics affected our everyday view of objects. Schutz endorsed Whitehead's account of how and why theories in natural science departed from commonsense conceptions:

> For this purpose physical science (which, in this context, is alone of concern to Whitehead) has to develop devices by which the thought objects of common-sense perception are superseded by the thought objects of science. The latter, such as molecules, atoms, and electrons have shed all qualities capable of direct sense presentation in our consciousness and are known to us only by the series of events in which they are implicated, events, to be sure, which are represented in our consciousness by sense presentations. (Schutz 1953, 2)

Natural scientists were able to create and use constructs that were so far removed from common sense thanks to their capacity to individuate natural phenomena purely by discerning them in sense perception: 'The facts, data, and events with which the natural scientist has to deal are just facts, data, and events within his observational field' (Schutz 1953, 3). The situation was otherwise in the social sciences, Schutz argued:

> [T]he facts, events, and data before the social scientist are of an entirely different structure. His observational field, the social world, is not principally unstructurized. It has a particular meaning and relevance structure for the human beings living, thinking, and acting therein. They have preselected and preinterpreted this world by a series of common-sense constructs of the reality of daily life and it is these thought objects which determine their behavior, define the goal of their action, the means available for attaining them … . The thought objects constructed by the social scientists refer to and are founded upon the thought objects constructed by the common-sense thought of man living his everyday life among his fellowmen. (Schutz 1953, 3)

The social world comes structured by intentions, affects and beliefs in everyday life. In order to individuate social phenomena, therefore, the social scientist must preserve these commonsense conceptions in scientific theories.

This line of reasoning led Schutz to propose what he called a 'postulate of adequacy' to govern theorising in social science. In it, he elevated to a methodological principle the demand that the constructs of the social scientist be consistent with commonsense conceptions, to the extent that they had to be comprehensible to the actors whose behaviour was studied:

> Each term in a scientific model of human action must be constructed in such a way that a human act performed within the life world by an individual actor in the way indicated by the typical construct would be understandable for the actor himself as well as for his fellow-men in terms of common-sense interpretation of everyday life. Compliance with this postulate warrants the consistency

> of the constructs of the social scientist with the constructs of common-sense experience of the social reality. (Schutz 1953, 34)

The demand that advanced sociological theories maintain consistency with commonsense conceptions would be preposterous if extended to the natural sciences. It highlights the methodological difference between the two families of sciences on the phenomenological view, as well as the distance between phenomenological and positivist conceptions of sociology (McLain 1981).

Schutz did not draw on 'pioneers of the *Geisteswissenschaften*' such as Dilthey in his works (Wagner 1983, 122): he took Husserl instead as his main theoretical reference. As we see from this summary, nevertheless, the theory of social science that Schutz developed in his 1953 article was also consistent with Dilthey's account of the difference between natural and human sciences and the relations in which they stood to commonsense conceptions.

Let us now turn to Hempel and his book, *Philosophy of Natural Science*, which appeared in the following decade. An important theme of this book was the relation between empirical data, commonsense views of phenomena, and theoretical explanation. While it remained within the analytic paradigm, this book is in many ways also an exemplification of Dilthey's account of the ways in which natural scientists individuate natural phenomena and of their freedom, in consequence, to depart from commonsense understanding in their explanations of them.

From the opening pages, Hempel endorsed the idea that individuating a physical phenomenon and finding an explanation of it were distinct stages, and that it was possible to accomplish the former while having no preliminary understanding of the phenomenon. He cited a case in which the distinction came across clearly: 'a simple suction pump, which draws water from a well by means of a piston that can be raised in the pump barrel, will lift water no higher than about 34 feet above the surface of the well' (Hempel 1966, 9). Artisans had individuated this phenomenon by ostension long before Evangelista Torricelli in the 1640s suggested an explanation, which was that the weight of a column of water of this height exactly counterbalanced the 'sea of air' pressing on the surface of the water in the well. Like the pulsar discovery discussed in section 4 above, this instance shows that natural scientists can individuate a phenomenon from empirical data well before they achieve an understanding of it.

Indeed, Hempel's deductive-nomological model of explanation was based on this duality and diachronicity: it assumed that the discovery of a phenomenon and the achievement of an explanation of it were distinct acts, separated in time by a perhaps lengthy interval. The characteristic outcome of a deductive-nomological explanation is retrospective understanding of a previously observed effect: 'That explains it – the phenomenon in question was indeed to be expected under the circumstances!' (Hempel 1966, 48).

In the next chapter, Hempel laid out his view of the relation between science and common sense. He did this in the form of a response to Eddington's 'two tables' parable, which, as we saw in section 2, has been an almost mandatory reference in analytic discussions of this topic. Hempel disagreed with Eddington: scientific theorising did not aim to explain away everyday appearances. Instead, Hempel argued, it assumed those appearances and accounted for them in terms of microstructures:

> [T]he atomic theory of matter does not show that a table is not a substantial, solid, hard object; it takes these things for granted and seeks to show in virtue of what aspects of the underlying microprocesses a table displays those macroscopic characteristics. (Hempel 1966, 78)

It was still open to a scientific theory, however, to show that our commonsense notions of objects were mistaken. As Hempel wrote, 'science will not hesitate to explain even the familiar by reduction to the unfamiliar, by means of concepts and principles of novel kinds that may at first be repugnant to our intuition' (Hempel 1966, 83). He cited relativity theory and quantum mechanics as cases in which this had occurred.

While Hempel differed from Eddington on details, these passages show that he remained well within the analytic framework that Eddington had laid out. In particular, it is notable that Hempel did not seem to regard the ability of natural scientists to individuate phenomena independently of attempts to explain or understand them, which lies at the root of the tendency of natural science to depart from commonsense conceptions, as deserving comment or elucidation. These were for him self-evident facts about science, it seems.

What about mental phenomena? In *Philosophy of Natural Science*, Hempel (1966, 2) suggested that there was little methodological difference between social and natural sciences. He had been more forthright a few years earlier:

> What the preceding considerations … suggest is … that the nature of understanding, in the sense in which explanation is meant to give us an understanding of empirical phenomena, is basically the same in all areas of scientific inquiry; and that the deductive and the probabilistic model of nomological explanation accommodate vastly more than just the explanatory arguments of, say, classical mechanics: in particular, they accord well also with the character of explanations that deal with the influence of rational deliberation, of conscious and subconscious motives, and of ideas and ideals on the shaping of historical events. In so doing, our schemata exhibit, I think, one important aspect of the methodological unity of all empirical science. (Hempel 1962, 31–32)

Hempel's confidence that the deductive-nomological model of explanation was applicable in the social and human sciences presupposed that mental phenomena, like natural phenomena, could be individuated in a way that did not depend on intuitive understanding, and that they could therefore be displayed as explananda awaiting theoretical explanation at a later stage. This is a form of positivism that has led to interesting debates about reductionism in the human sciences, as we shall see next.

6. Reductionism about mental phenomena

Of course, the thesis that the study of mental phenomena requires a specific method, which Dilthey and Schulz advanced, is contentious. Many have sided instead with Hempel in believing that methods of the natural sciences generally applied to mental phenomena too. This view has gained in popularity: much teaching in philosophy of social science in recent decades, for example, has given less prominence to methodological differences between social and natural sciences (Cartwright and Montuschi 2014, 1–2).

One of the foci of the debate on the autonomy of the social and human sciences has been the possibility of reduction to neuroscience. The reductionist project aims to replace the understanding of mental phenomena in the commonsense terms of intentions, motives, beliefs and feelings with causal explanations in terms of neurobiological mechanisms. Francis Crick gave a particularly trenchant formulation: the proposal 'is that "You", your joys and your sorrows, your memories and your ambitions, your sense of personal identity and free will, are in fact no more than the behavior of a vast assembly of nerve cells and their associated molecules' (Crick 1994, 3). Such a radical break with commonsense ontology – the equivalent of Eddington's reducing solid tables to particles in a mostly empty space – might ensue if the study of mental phenomena followed the model of natural sciences.

Discussion about the prospects of reducing mental phenomena to natural phenomena was already under way in Dilthey's time, mainly within a controversy between two possible ways of practicing the science of psychology (Dilthey [1894] 2010, 133–143). Dilthey's own proposal was for what he called a descriptive and analytical psychology, formulated as a *Geisteswissenschaft* in the sense that we discussed above. The alternative was an *erklärende Psychologie* or 'explanative psychology', which included projects such as Gustav Fechner's psychophysics and Hermann von Helmholtz's experimental investigation of perception. Explanative psychology, Dilthey said, was founded on 'the hypothesis of the parallelism of physiological and psychical events', or 'the postulate that no psychic phenomenon exists without an accompanying physical one' (Dilthey [1894] 2010, 140).

Dilthey believed that explanative psychology could not succeed, because psychophysical parallelism did not hold in general between natural phenomena individuated in outer experience and mental phenomena apprehended in inner experience. Dilthey approvingly quoted some words of Wilhelm Wundt, a former exponent of explanative psychology who had disavowed the project for this reason:

> [P]sychophysical parallelism is a principle whose application extends only to the elementary mental processes, … not to the more complicated products of our mental life, the sensible material of which has been formed and shaped in consciousness, nor to the general intellectual powers which are the necessary presuppositions of these products. (Dilthey [1894] 2010, 141–142)

Whereas Dilthey's critique of explanative psychology is not entirely explicit, his epistemological framework provides the resources to argue as follows.

Both psychophysical parallelism in Dilthey's age and neurobiological reductionism in our time rest on a particular assumption. This is that it is possible to individuate a given mental phenomenon in two independent ways: once by means of what Dilthey called inner experience, by reference to the meanings, values and feelings that people ascribe to the mental phenomenon, and once in outer experience, i.e. picking out the phenomenon from observational data. The individuation of the phenomenon from the observational record will form the basis of a causal explanation of it by means of *erklären*, just as in the case of natural phenomena; we will then have the assurance that this explanation applies to the same mental phenomenon that we have individuated by means of inner experience.

Take neuroscientific accounts of religion as an example. These attempts to redescribe and explain religious experiences in neurobiological terms (Schjoedt 2009). Researchers proceed by attempting to individuate a religious experience in two ways. First, they identify an experience, such as reading a particular text, as religious by reference to the specific values and meanings that the subject ascribes to it. This procedure parallels the way in which scholars in human science apprehend a mental phenomenon – for example, as Mauss identified the phenomenon of gift-giving. Separately, researchers pick out the experience neurobiologically, for example by monitoring blood flow in the subject's brain during a reading of the text in question. If a distinctive blood flow pattern emerges, we might claim to have individuated the neurobiological correlate of that religious experience. Once this phenomenon has been established as explanandum, finally, researchers can produce causal explanations of it in neurobiological terms. This operation parallels the discovery process of pulsars: having scanned the sky, Bell and Hewish individuated a phenomenon from scruff in their detector output, for which Gold later provided a causal explanation.

Now, Dilthey's critique of *erklärende Psychologie* suggests the following objection. The procedure sketched above rests on the possibility of individuating a given mental phenomenon through both inner and outer experience. The operation using inner experience does not merely individuate a mental phenomenon, however: it partly constitutes that mental phenomenon. This is because the values and meanings ascribed in inner experience form part of the mental phenomenon – they are not contingent attributes of a phenomenon that is given in empirical data. Whatever structure the scientist individuates by means of outer experience, therefore, is not identical to the mental phenomenon that is apprehended in inner experience. It must be counted as a distinct natural phenomenon.

To return to the example sketched above, the experience of reading a particular text is made into a mental and religious phenomenon by the subject's ascription of meanings and values to it. Registering patterns in blood flow measurements performed while the subject reads that text individuates a natural phenomenon, of course, but that natural phenomenon does not coincide with the mental phenomenon apprehended through inner experience: it is shorn of the meanings and values that partly constitute the mental phenomenon. This objection derives from the point made in section 3 above about the difference between *erklären* and *verstehen*: the latter is not a scientific method that represents a counterpart to *erklären* for mental phenomena, but rather an operation that partly constitutes mental phenomena.

If we follow this argument inspired by Dilthey, then natural and human sciences remain separate domains even in cases of attempted naturalistic reduction. Natural science may, of course, construct causal explanations of phenomena individuated from the observational record. These explanations will not apply, however, to the mental phenomena apprehended through what Dilthey called inner experience, because those mental phenomena are not identical to the natural phenomena to which the causal explanations apply: mental phenomena are constituted partly by values and meanings that natural phenomena do not exhibit.

7. Conclusions

Analytic philosophy from the 1910s onwards captured two conspicuous elements of the relation between common sense and science: the tendency of the natural sciences to repudiate commonsense conceptions of the world in the pursuit of deeper causal explanations of phenomena, and the greater closeness of the human sciences to common sense. However, while leading the discussion in other interesting directions, the analytic tradition did not take up the task of accounting for these explananda: it did not delve into the epistemological conditions that made repudiation of common sense possible, and it tended to assume that the human and social sciences operated in this respect like natural sciences.

Continental philosophy has added important reflections. The interpretative framework sketched by Dilthey both suggested a way of understanding the ability of the natural sciences to depart radically from commonsense conceptions of the world, and accounted on the same basis for the difference in stance of the human and social sciences. The key for Dilthey was the way in which a science individuated its phenomena. Natural scientists were able to pick out their phenomena from empirical data, according to this viewpoint; this did not work for mental phenomena, however, because of the contribution of meaning attributions to constituting their identity.

Integrating these perspectives yields, I argue, a robust and convincing view that provides an understanding of the relation between science and common sense, differentiates between sciences of different kinds, and connects to broader methodological debates about science.

Acknowledgements

I thank the editors and two unnamed referees of *Inquiry* for perceptive criticism, which resulted in improvements and clarifications.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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