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ORIGINAL PAPER

Ontological Breakthroughs and Individuation of Phenomena in the Natural and Human Sciences

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Abstract
A characteristic form of progress in the natural sciences consists in replacing one theory of a domain with another that posits a radically different ontology. I call such episodes "ontological breakthroughs". They are possible because many natural phenomena can be individuated and re-identified through empirical procedures, enabling reference to remain stable even when explanatory categories change. Drawing on Wilhelm Dilthey, I argue that the situation is different in the human sciences. There, phenomena are individuated interpretively, and their identification cannot be detached from the conditions under which they become intelligible. This interpretive tether, I suggest, helps explain why progress in the human sciences does not take the form of ontological breakthroughs.

Keywords Dilthey · Hermeneutics · Human sciences · Natural sciences · Ontological breakthroughs · Theory change

1 Introduction

References to "breakthroughs" are ubiquitous in science, technology, and medicine. Scientific organisations and periodicals use the label to highlight developments that they judge especially significant. Some compile annual "breakthrough of the year" lists: in 2025, for example, *Science* selected the worldwide surge in renewable energy generation, while *Physics World* chose the development of single-atom-thick metal sheets (Appenzeller 2025; Johnston 2026).

In this common usage, the term "breakthrough" functions largely as an honorific. It marks research as deserving of attention and prestige (Brown 2000; Nerlich 2009), but does not pick out any determinate kind of shift (Wuestman et al. 2020).

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There are, however, cases of scientific advance for which "breakthrough" can be read more literally. In these cases, science is portrayed as breaking through misleading surface appearances to reveal underlying structures or mechanisms. Here the term regains some of its core meaning, drawing on a familiar repertoire that portrays scientific inquiry as the breaching of barriers (Merchant 2008).

Corpuscularism, the kinetic theory of matter, relativity, quantum theory, the molecularisation of genetics, and plate tectonics are standard examples: episodes of wholesale ontological replacement in which a previously accepted description of a domain was displaced by another that bore little resemblance to it, and that purported to reach a deeper level of reality.

In what follows, I use "ontological breakthrough" for this strict sense: a transition in which one ontology is replaced by another that is not merely a refinement but is radically unlike its predecessor, while still concerning the same explananda—phenomena identified through stable observational, experimental, and measurement practices.

Some shifts labelled "breakthroughs" in a generic sense are ontological breakthroughs in my stricter sense. For example, when Joel Mokyr and Rebecca Stein (1996, p. 146) call the germ theory of disease "probably the greatest scientific breakthrough in the history of medicine", their usage can be read in these terms. The late-nineteenth-century transition from miasma theories, which attributed disease to "bad air", to germ theory, which inaugurated modern medical microbiology, was a radical ontological replacement, through which physicians continued to track broadly the same disease manifestations.

This article has two aims. First, I argue that ontological breakthroughs, although a recurrent mode of progress in the natural sciences, do not occur in the *Geisteswissenschaften* or human sciences, disciplines that study objects constituted by meanings—such as actions, practices, roles, institutions, and artefacts whose identity depends in part on participants' self-understandings and normative ascriptions. Second, I attempt to explain why.

Drawing inspiration from Wilhelm Dilthey, I argue that many natural phenomena can be individuated and re-identified through processes that are relatively independent of theory: first picked out by ostension in observation, then stabilised through experimental intervention. As a result, theoretical descriptions of natural phenomena may diverge sharply from both earlier theory and common sense without losing the ability to individuate the phenomena to which they refer. This yields what I call ontological freedom: stable empirical anchoring enables radical ontological change.

By contrast, meaning-constituted phenomena in the *Geisteswissenschaften* are individuated through interpretation within a space of reasons, norms, and self-understandings. These disciplines therefore operate under a hermeneutic tether: theoretical redescriptions that were to lose touch with recognisable meanings would thereby lose track of their objects of inquiry. Hence, I suggest, the absence of ontological breakthroughs in the human sciences. This does not imply any deficit of progress or of creativity in these disciplines. Rather, it points to a different repertoire of progress—for example, reconceptualisations within a space of meanings, richer and more reflexive self-understandings, and expansions of interpretive horizons.

The article will proceed as follows. In the next section, I distinguish my notion of ontological breakthrough from broader debates about "revolutions" in the natural and human sciences. Section 3 develops a Dilthean account of how phenomena are individuated in the two domains. Section 4 shows how stable empirical tracking enables ontological breakthroughs in the natural sciences. Section 5 argues that meaning-constituted objects in the human sciences impose a hermeneutic tether that blocks ontological replacement. Section 6 draws methodological and evaluative implications.

2 Revolutions and Other Discontinuities

The question pursued here is narrower than the long-running debate over modes of progress in the sciences, and especially whether "revolution" is an apt descriptor of change in either the natural or the human sciences.

In discussions of the natural sciences, the term "revolution" circulates in at least two senses: as a Kuhnian analytical model of crisis-driven paradigm shift, and as a broad historiographical idiom for heterogeneous episodes of change. Thomas S. Kuhn (1970) put discontinuity at the centre of twentieth-century philosophy of science, but subsequent scholarship has both redescribed many canonical revolutions and reanalysed the category of "revolution" itself.

One line of work has offered revisionary reconstructions of alleged revolutions in terms of gradual, continuous developments. The case of Galileo Galilei is exemplary: where Alexandre Koyré (1978) saw rupture, William A. Wallace (1984) found continuity of method and conceptual framework, documented in university curricula and textual borrowings. More recently, quantitative approaches have likewise suggested that many purported paradigm shifts exhibited patterns of cumulative advance rather than abrupt replacement (Krauss 2026, pp. 77–99).

A second line has subjected "revolution" to category critique. James A. Secord (2024) has argued that "revolution" functioned less as a stable historical kind than as a retrospective interpretive device. Normative attempts to define the term have similarly tended to broaden rather than constrain it, stretching from discipline-wide paradigm switches to circumscribed technical innovations (Casadevall and Fang 2016).

Parallel debates have unfolded in relation to the *Geisteswissenschaften* (Spacks 2006; Solleveld 2014). Kuhn's work prompted two opposite responses. One extended the vocabulary of paradigms and revolutions into the humanities, treating conceptual change in fields such as English studies as Kuhn-like (Bizzell 1979; Hairston 1982). The other emphasised disanalogy: whereas natural science was marked by sharp ruptures, humanistic inquiry was characterised by more continuous development—a view to which Kuhn (1991) himself inclined.

Recent work in history of the humanities has complicated this contrast by examining disciplinary self-narrations. Studies of philology, historiography, and similar fields have revealed depictions of these disciplines as a series of crises, turns, refoundations, and reinventions (Turner 2014; Solleveld 2016). The language of threat and turning point has become a dominant trope for thematising change in literary and cultural studies (Reitter and Wellmon 2021; Östh Gustafsson 2023).

On the other hand, such purported breaks typically coexist with continuities: core questions, scholarly canons, publication genres, and evaluative cultures often persist across proclaimed new beginnings, while renewal is frequently grafted onto existing repertoires rather than replacing them wholesale (Bachmann-Medick 2016, pp. 9–12; Aurell 2024, pp. 138–257). These findings, in turn, have fed a further worry: if new interpretations in the humanities do not eclipse older ones in the way revolutionary scientific theories are said to do, in what sense do the *Geisteswissenschaften* exhibit progress at all (Hubig 1980; Grimm et al. 2025, pp. 178–201)?

My aim in this article is more specific. I isolate one kind of discontinuity found in the natural sciences: ontological breakthroughs, in which the basic categories used to describe a domain are replaced wholesale by quite different categories. This notion is narrower than generic talk of revolution or discontinuity. It concerns not shifts of method, interpretation or emphasis, but a redefinition of what is taken to exist in the domain under study.

My claim is that these ontological breakthroughs are not a mode of progress available to disciplines whose objects are meaning-constituted and therefore individuated through interpretive mediation. On the Dilthean picture adopted here, the *Geisteswissenschaften* can certainly undergo methodological reorganisations, reconfigurations of canon and archive, and episodes aptly described as crises or refoundations. What they cannot plausibly sustain, I suggest, is a redefinition of their basic objects that severs them from the forms of understanding through which human beings make sense of themselves and their world.

3 Dilthey on the Individuation of Natural and Mental Phenomena

To clarify a central difference between the natural and the human sciences, I draw on Dilthey's epistemological framework, and particularly his account of how sciences of the two kinds access their respective domains of inquiry: natural phenomena and mental phenomena (De Mul 2004, pp. 129–140). Dilthey developed a Kantian distinction between outer experience, mediated by the senses, and inner experience, through which one is directly aware of one's own psychological life—intentions, emotions, beliefs, and the like. For Dilthey, the natural sciences proceeded on the basis of outer experience: perception and measurement delivered the phenomena that physicists, chemists, and biologists then attempted to explain.

Matters stand differently in the human sciences. Mental phenomena—acts, artworks, artefacts, institutions—are partly constituted by the meanings ascribed to them. Whereas they have physical expressions accessible to outer experience, grasping them as mental or social phenomena requires recourse to inner experience. We interpret them by drawing on forms of meaning and normative expectation that we can recognise, inhabit or imaginatively reconstruct. As Dilthey put it in *Ideen über eine beschreibende und zergliedernde Psychologie*, "Die Natur erklären wir, das Seelenleben verstehen wir" ("Nature we explain, but psychic life we understand"; Dilthey [1894] 2010, p. 119).

From this starting point, we can formulate a more explicit account of how the two kinds of sciences individuate their objects. In the natural sciences, investigators can

often identify a phenomenon while not yet possessing an explanatory framework for it. They can pick it out from third-person empirical traces in observational records, instrument readings, and experimental signatures. Explanation may come later. The natural sciences thus frequently display a two-stage dynamic: first the ostensive individuation of a phenomenon in the data—as a stable effect under particular conditions—and only later, sometimes much later, the articulation of what, in theoretical terms, it is (McAllister 2026).

Hans Christian Ørsted's 1820 report that an electric current deflected a magnetic needle illustrates this dynamic. The effect was isolated and stabilised experimentally well before there was any agreed account of its mechanism. André-Marie Ampère proposed a force-law explanation in the following decade; Michael Faraday advanced a rival construal in terms of fields in the 1840s. Only with the Maxwellian synthesis in the 1880s was Ørsted's effect fully integrated into classical electrodynamics (Darrigol 2000). Throughout these theoretical transformations, the experimentally stabilised effect remained available as the same re-identifiable phenomenon.

This picture resonates with various strands of contemporary thinking about science. First, the practice turn in philosophy of science challenged the idea that experiment was subservient to theory, emphasising instead the relative autonomy of experimental practice. Scientists were able to constitute phenomena through laboratory manipulation that owed little to theory, and the phenomena thus stabilised could persist through later theoretical change (Hacking 1983, pp. 220–233; Bogen and Woodward 1988). The history of the electron offers a clear example: experimental practice helped to secure it as a robust object of investigation even while its theoretical interpretation remained contested and underwent significant revision (Arabatzis 2006).

Historians of "exploratory experimentation" have developed a related point. Especially in new or poorly understood domains, researchers often aim first to produce, stabilise, and characterise effects, while postponing commitment to any specific mechanism (Steinle 2016). Here too, the order of inquiry is important. Ostension, aided by intervention and manipulation, can fix a phenomenon as the object of investigation, with theory arriving only later to settle what it is (Schurz 2015).

Causal-historical accounts of reference in metaphysics and philosophy of language inspired by Hilary Putnam (1973, p. 702) and Saul A. Kripke (1980, p. 137) articulate a similar intuition. On this approach, reference to a natural kind is fixed through demonstrative contact with samples or paradigms, while elucidation of its nature is deferred to subsequent inquiry. As Jessica Brown put it, "a community can introduce a term to refer to a natural kind in advance of knowing the scientific account of that kind" (Brown 1998, p. 276). Later refinements of the causal theory of reference have complicated the simple baptismal picture, but preserved the central point: reference established through empirically situated contact with samples can remain stable through changes in theoretical understanding (Stanford and Kitcher 2000).

This does not require denying theory-ladenness of observation (Schindler 2013). My claim is not that observation is concept-free, but that the conceptual resources required to stabilise and re-identify a natural phenomenon—procedural skills, empirical tracking, standardised measurement, comparative classification—need not include a substantive explanatory account of what the phenomenon is (Votsis 2015).

Even on Kuhn's account, anomalies can precipitate crises precisely because a stable and recognisable "something" resists integration into the reigning framework (Holland and Lande 2019). A phenomenon can be singled out and tracked before it is theoretically understood.

The situation differs in the human sciences. Because meanings are constitutive of many mental and social phenomena, we cannot individuate such phenomena without situating them within a space of reasons, norms, and self-understandings. Individuation therefore depends on interpretation—either via actors' avowals and self-descriptions, or via the investigator's reconstructive grasp of the relevant normative expectations. Thus, meaning-constituted phenomena become available as objects of inquiry only under descriptions that attribute intention, belief, motive, affect, status, and obligation.

Phenomena in anthropology make this especially vivid. Consider purification rituals or rites of passage. The activities of washing, anointing, cutting hair, marking skin, and exchanging objects are underdetermined at the level of thin empirical description. They become ritual behaviour only when taken up within a meaning-laden practice that confers statuses and obligations—and only when those meanings are available in lived experience to participants and interpretively accessible to investigators who can grasp the relevant ascriptions. The phenomenon is thus fixed not by mere third-person description of bodies moving and substances changing state, but by the experienced significance through which these doings present themselves as a rite of cleansing, an initiation or a marriage (Douglas 1966; Geertz 1973, pp. 3–30).

Dilthey's epistemology thus identifies a structural difference between the natural and the human sciences in the act of individuation. Natural phenomena can often be stabilised through outer experience and experimental practice prior to, and independently of, explanatory theory. Phenomena of the human sciences, by contrast, are individuated through interpretive uptake: their availability as objects of inquiry presupposes forms of common-sense understanding expressed in intention ascriptions, normative expectations, and affective recognition.

This disparity clarifies the distinction between *Erklären* and *Verstehen*. These terms are sometimes treated as simple counterparts—interpretive understanding for the idiographic sciences, causal explanation for the nomothetic ones—but their roles are dissimilar. *Erklären* typically begins once a phenomenon has been stably individuated from perceptual and experimental data; it seeks causal accounts that may depart sharply from common sense. *Verstehen*, by contrast, is not primarily a research method in the human sciences. It is, rather, a precondition for those sciences to have objects at all. Because mental and social phenomena are constituted through attributions of intention, belief, motive, and affect, an initial understanding in common-sense terms through *Verstehen* is what makes those phenomena available for investigation in the first place (Ricœur 1979, pp. 138–143).

These contrasts in individuation constrain the possibility of ontological breakthroughs. Such breakthroughs require stable re-identification of the object of inquiry even as theoretical categories are radically transformed. In the next section, I argue that the natural sciences can secure this continuity through empirical tracking practices. In Section 5, by contrast, I argue that meaning-constituted domains typically cannot: where a phenomenon depends on interpretive embedding in shared norms,

severing that hermeneutic tether undermines the conditions for identifying the object of inquiry.

4 Ontological Breakthroughs in the Natural Sciences

The history of the natural sciences contains many episodes in which a domain of phenomena was redescribed in radically new terms, displacing both earlier theoretical categories and entrenched common-sense images. Such ontological breakthroughs are possible because natural phenomena can often be individuated and re-identified through repeatable observation and experiment—what Dilthey called "outer experience" and what we might now describe as empirical tracking. Because these practices stably pick out the target phenomenon, scientists can replace basic explanatory categories without losing their grip on what is being explained.

Ontological breakthroughs in the natural sciences typically exhibit three interconnected features. (i) Radical ontological redescription: the fundamental explanatory categories are re-specified in ways that bear little resemblance to earlier conceptions. (ii) Stable empirical anchoring: phenomena are individuated and tracked through reproducible observational and experimental practices, thereby securing reference across theoretical change. (iii) Demotion of common sense to explanandum: everyday appearances are treated not as a constraint on admissible ontology but as something to be explained.

A canonical illustration is seventeenth-century corpuscularism, which combined a corpuscular-mechanical explanatory framework with a distinction between primary and secondary qualities. The common-sense world of colours, sounds, tastes, and warmth was redescribed in terms of a sparse ontology of size, shape, motion, and arrangement (Hattab 2011).

All three features are visible in this episode. (i) Bodies were reconceived as aggregates of corpuscles characterised by primary qualities, while sensible qualities were reconstrued as powers to produce sensations. (ii) Stable empirical anchoring was provided by reproducible manipulations and measurements: pneumatic experiments, chemical decompositions and recompositions, and operations such as distillation, evaporation, and crystallisation. These practices stabilised what counted as the explanandum even as theoretical vocabularies shifted. Robert Boyle's air-pump experiments in the 1650s, for example, helped isolate and stabilise pneumatic phenomena—such as the "spring" of air—as reproducible effects suitable for corpuscular explanation (Anstey 2002). (iii) Common-sense ontology was explicitly bracketed: perceptibility and qualitative richness no longer determined what was fundamental. Colour, taste, and warmth were treated as derivative effects grounded in microstructural properties.

A similar configuration appeared in the late-nineteenth-century transition from miasma theories of disease to germ theory (Worboys 2000). (i) Disease was no longer attributed to diffuse "bad air" but to specific microorganisms with determinate life cycles and pathogenic mechanisms. (ii) Yet the explananda—recurring patterns of infection, symptom clusters, transmission routes—were already stably tracked in clinical observation, hospital statistics, and laboratory practices. The new ontology

replaced earlier explanatory entities while preserving continuity of reference to the same disease manifestations. (iii) Everyday appearances—putrefaction, foul smells, visible decay—were reinterpreted as surface indicators of invisible microbial processes rather than as themselves causally fundamental. Again, stable empirical tracking underwrote ontological freedom.

This configuration recurs in other episodes of ontological breakthroughs: for example, from caloric theories of heat to kinetic accounts, and from classical to relativistic and quantum descriptions of matter. In each case, the ability to stabilise and re-identify phenomena through observation, measurement, and experiment made it possible to replace basic ontological categories while maintaining reference to the same domain.

In some respects, this picture recalls structural realism. Structural realists, whether in epistemic or ontic form, argue that what survives theory change is mathematical or relational structure rather than ontology in the sense of named entities. By locating explanatory power in abstract relational frameworks rather than in everyday ontology, structural realism reinforces element (iii): common-sense categories are displaced in favour of more abstract structures. But this displacement depends on the empirical anchoring described in element (ii): structural continuity is identifiable only where reproducible observational and experimental practices secure continuity of reference across radical redescription in ontological terms (Votsis 2011). In this respect, structural realism can be read as a philosophical codification of ontological freedom: it shows, at a higher level of abstraction, how empirical continuity can coexist with ontological replacement.

5 Impossibility of Ontological Breakthroughs in the Human Sciences

The claim defended in this section is that the specific configuration exemplified in the natural sciences in Section 4—radical ontological replacement coupled with stable reference to a persisting explanandum—is not a mode of progress available to the human sciences. The deepest changes in the *Geisteswissenschaften* more typically take one of two forms: reconceptualisation within a space of meanings, or re-individuation of the target by shifting to a different object of inquiry (often physiological, neural, computational or population-level correlates). What they do not plausibly sustain is wholesale ontological replacement about the same meaning-constituted phenomenon.

The core reason follows from the Dilthean account of individuation of phenomena developed in Section 3. In the human sciences, objects are not given independently of the interpretive practices that render them intelligible. Actions, institutions, texts, artworks, and forms of life become objects of inquiry only as they are situated within webs of meaning embedded in lived experience and shared understanding. Individuation therefore presupposes a background continuity with ordinary repertoires of agency, normativity, intention, reason, and self-understanding. Recent Dilthey scholarship has sharpened this point by emphasising the constitutive role of meaning for the "historical world" and thus the dependence of the *Geisteswissenschaften* on structures of understanding that overlap with everyday experience (Nelson 2011).

This yields a useful diagnostic criterion. A would-be ontological breakthrough in the human sciences would have to combine (i) radical redescription of the basic categories of the domain, (ii) stable re-identification criteria for the target phenomenon that do not themselves depend on ordinary meanings, and (iii) the demotion of ordinary meanings from constraints to explananda. The difficulty is that, in meaning-constituted domains, (ii) is typically supplied by the interpretive resources that the redescription envisaged in (i) proposes to supersede. In other words: where intelligibility conditions do the work of individuating phenomena, abandoning them tends to undermine reference stability.

This is the central disanalogy with the natural sciences. In physics, reference can often be stabilised by empirical tracking practices even when theoretical ontology changes beyond recognition. In the human sciences, by contrast, the criteria by which we identify the same phenomenon across contexts are inseparable from conditions of intelligibility that draw on the ordinary repertoire of meaning, reason, intention, normativity, and agency. One can criticise and refine ordinary self-understanding, but one cannot simply discard it while continuing to claim that one is explaining the same objects. Attempts at ontological replacement therefore tend to have one of two outcomes: either they lose their grip on the phenomenon—because they can no longer say what would count as an instance—or they reimport, often tacitly, the very common-sense categories they promised to eliminate.

Within the classical *Geisteswissenschaften*, the deepest changes are better understood as taking two forms distinct from ontological breakthroughs. The first is reconceptualisation within the space of meanings. Many influential shifts in the *Geisteswissenschaften* introduce powerful redescriptions of familiar phenomena—new interpretive schemas, diagnostic categories or accounts of constraint and possibility—without discarding the basic ontology of agents, reasons, commitments, and norms. Even programmes that declare an eliminativist ambition are commonly pulled back toward intentional and normative vocabulary in order to recover grip on their subject matter; alternatively, they are absorbed into a pluralistic toolkit as one analytic perspective among others.

The second is shift of object via re-individuation, often under the banner of naturalisation. Contemporary "scientific turns" promise a deeper ontology by relocating explanation in neural mechanisms, physiological processes, computational architectures or population-level dynamics. Such projects may be illuminating, but insofar as they re-individuate the target in non-interpretive terms, they no longer track the same phenomena as the *Geisteswissenschaften* originally did. Action-as-meaningful becomes movement-as-behavioural; belief-as-reason-responsive becomes representation-as-mechanism; institution-as-norm-governed-practice becomes network dynamics. What is preserved is not stable reference across ontological replacement, but claims about correlation, causal underpinnings, constraints or enabling conditions. What looks like ontological breakthrough is therefore, structurally, a move from meaning-constituted phenomena to naturally individuated correlates.

At this point, however, a possible objection to my taxonomy suggests itself. One might argue that the range of disciplines concerned with human affairs is wider than the classical *Geisteswissenschaften* at issue here, and that some neighbouring fields—notably economics, quantitative linguistics, experimental psychology, demography,

and survey-based sociology—plainly exhibit empirical dimensions, predictive ambitions, and techniques of quantification and statistical control. Does this not suggest that the two modes just distinguished are not exhaustive, and that inquiries into human affairs can, after all, approximate the natural-scientific pattern more closely than this account allows?

The objection deserves notice, but it does not undermine my claim. In the first place, such disciplines are not identical with the classical *Geisteswissenschaften* as understood here, whose primary objects are meaning-constituted phenomena—actions, institutions, texts, artworks, and forms of life—made available through interpretive understanding. In the second place, even where more nomothetic and quantitative inquiries bear on domains also studied by the *Geisteswissenschaften*, their greater empirical purchase does not normally consist in stable reference to the same meaning-constituted phenomenon through radical ontological replacement. Where more autonomous criteria of identification are achieved, this is typically because inquiry has shifted toward a different target—behavioural regularities, physiological processes, neural mechanisms, computational structures or population-level patterns—rather than because the same meaning-constituted object has been re-identified under a radically new ontology. What such approaches therefore illustrate, in the present terms, is not a third mode of deep change, still less an ontological breakthrough proper, but the second mode already distinguished above: shift of object via re-individuation.

This conclusion may be tested further against a series of developments in the history of the human sciences that might be thought to provide counterexamples.

Behaviourism is an instructive test case. John B. Watson (1913) proposed an explicit ontological purge: psychology should eliminate mental states and restrict itself to stimulus–response relations. If successful, this would indeed resemble ontological replacement. Yet the later reintroduction of beliefs, intentions, and representations across psychology and cognitive science is revealing. It reflects the difficulty of maintaining explanatory grip on phenomena whose individuation conditions involve intelligibility. Without intentional notions, the discipline either narrows its target—restricting itself to a limited range of learning regularities—or loses the capacity to specify what counts as the same phenomenon across contexts. Behaviourism thus illustrates what happens when the human sciences attempt wholesale ontological replacement: either the object changes, or the programme is forced back toward the meaning-laden framework required for reference stability (Chomsky 1959).

A parallel point holds for strong forms of structuralism in anthropology and literary theory. Such programmes aspire to replace intentional and experiential vocabularies with formal descriptions of underlying structures. Yet the identification of the very phenomena to be structurally analysed—rituals, myths, speech acts, systems of exchange—still relies on ordinary criteria of meaning. The rhetoric may be anti-humanist, but the practice remains tethered to interpretive individuation: without that tether, the programme cannot specify what would count as an instance of its purported object (Ricœur 1974).

A further candidate is neuroreductionism, understood as a general programme to reduce experience, belief, emotion, agency, and the sense of self to neural mechanisms and dynamical or computational descriptions of brain activity. When applied to

religious experience, for example, this yields cognitive and neuroscientific projects to explain mechanisms of prayer, mystical union, conversion or the sense of presence. This programme is often taken to promise ontological replacement, since it would redescribe what the subject experiences as a religious encounter as a neural configuration with a causal history. Yet the programme's grip on "religious experience" remains tethered to the very meaning-laden criteria that it purports to supersede. In practice, such studies must first identify their explananda by relying on subjects' self-descriptions, cultural classifications, and everyday distinctions among prayer, awe, conversion, surrender, reassurance, doubt, and the like—distinctions inseparable from norms of intelligibility and background conceptions of agency. What neuroscience then delivers is not an independent re-individuation of the phenomenon under a new ontology, but correlations and mechanisms for neural and physiological profiles associated with experiences already picked out as religious. Where the approach attempts to abstract from meaning altogether, it tends to shift the object away from religious experience as such and toward more general dynamics of attention, affect, memory, and salience. The resulting work may be powerful and illuminating, but its structure is not that of stable reference through radical ontological replacement: interpretive uptake remains part of what fixes the explanandum (Taves 2009).

Psychoanalysis is another plausible counterexample, since Sigmund Freud undeniably transformed large regions of psychology and cultural interpretation. The crucial question, however, is whether the Freudian unconscious replaces commonsense psychology or extends it while remaining dependent on its core categories. The unconscious is not introduced as a new kind of entity individuated independently of ordinary mentalistic description; it is posited through phenomena already identified within that framework—conflict, repression, rationalisation, displaced desire, symbolic expression, self-deception. Psychoanalytic explanation proceeds by redescribing actions, utterances, and symptoms in terms of misrecognised or disavowed reasons, intentions, wishes, and meanings. Rather than dispensing with belief, desire, intention, and interpretation, Freud multiplied their modes (latent/manifest; conscious/unconscious; avowed/disavowed) and reorganised their relations. In that sense, psychoanalysis can be revolutionary in hermeneutic consequences—transforming self-understanding—without being a case of reference-preserving ontological replacement that could dispense with the very categories of agency and intelligibility on which it relies (Wollheim 2003).

A brief glance at methodological innovations in the writing of history makes the same point. Cliometrics, digitised archives, and computational methods have altered evidential access and scale, and have made new aggregate patterns visible. But these developments primarily transform modelling and evidence rather than reconstituting the objects of study in a way comparable to ontological replacement in the natural sciences. Where such approaches abstract away from intention or experience, they are often best understood as changing the question to one about aggregate regularities rather than redescribing the same meaning-constituted phenomena under a new ontology (Fogel and Elton 1983).

The conclusion can now be stated precisely. Ontological breakthroughs require reference stability through replacement of ontology. In the natural sciences, that stability can often be underwritten by durable tracking practices that continue to pick

out the same effects under controlled conditions even as theoretical categories change beyond recognition. In the *Geisteswissenschaften*, by contrast, objects of study are meaning-constituted and thus individuated through intelligibility conditions that presuppose continuity with ordinary forms of understanding. Attempts at radical deanchoring either lose their grip on the phenomena and are abandoned as unfruitful, or they reimport common-sense categories to do the individuating work, in which case the putative rupture is rhetorical rather than structural. What looks like "revolution" in the human sciences is therefore better characterised as refiguration and deepening within the space of meanings, or else as a shift of object to correlates no longer individuated as meaningful phenomena. The absence of ontological breakthroughs in the mould of the natural sciences is, in this respect, not a defect of the *Geisteswissenschaften* but an expression of the conditions under which their objects become available for inquiry.

6 Conclusions

The idea of ontological breakthrough is central to the self-image of the modern natural sciences. It is expressed in familiar metaphors of disclosure: breaking through the shell of appearances, retracing surface effects to underlying structures and mechanisms, unveiling what there really is (Hadot 2006). From the early modern period onward, natural philosophy has proceeded from the premise that the world as it is in itself need not coincide with the world apparent to ordinary perception. The sensible surface has accordingly been treated as a systematically unreliable guide to what exists and how it works; the intellectual task of science is to press beyond appearances towards what might be called ontological objectivity (Newell 1986).

Two snapshots capture this imagery. The first is the frequently reproduced "Flammarion engraving": a robed pilgrim who has reached the edge of the visible world thrusts his head and arm through the starry firmament. He crosses a boundary between two worlds—the familiar face of ordinary perception, and an underlying domain of hidden mechanisms of the cosmos (Flammarion 1888, p. 163; Browne 2021). The second is Arthur S. Eddington's "two tables" parable. One table is the familiar object of everyday experience—extended, solid, coloured. The other is its scientific counterpart: "mostly emptiness", with "numerous electric charges rushing about with great speed", whose "combined bulk amounts to less than a billionth of the bulk of the table itself" (Eddington 1928, p. xii). In such cases scientific progress does not merely refine common-sense description; it replaces it with a radically different ontology, treating solidity and the like not as fundamental features but as effects to be explained.

This article has argued that the natural sciences can realise that aspiration in a specific way: by radical ontological replacement that nevertheless remains anchored in a persisting explanandum through stable empirical tracking. These sciences can combine ontological freedom with an empirical discipline strong enough to keep reference steady while ontology is rewritten. In Dilthey's terms, phenomena are individuated in "outer experience" through reproducible observational and experimental

practices—practices that stabilise what is being talked about even when what is being said about it changes.

The human sciences differ. Their basic materials are not hidden mechanisms behind appearances, but meaning-saturated forms of life already disclosed in ordinary participation: action and expression, institutions and norms, artworks and practices, conflict and self-understanding. Of course the *Geisteswissenschaften* can bring neglected objects into view, reconfigure salience, and introduce powerful new conceptualisations. But these advances do not have the structure suggested by the breakthrough imagery. They do not consist in meaning-independent discoveries of underlying ontological kinds masked by the sensory surface. Rather, novelty in the human sciences characteristically consists in redescribing formations within a space of meanings—roles, practices, classificatory schemes, and self-understandings—whose conditions of intelligibility remain internal to that space.

This is why the *Geisteswissenschaften* operate under what I have called a hermeneutic tether: their objects are constituted, at least in part, by the meanings within which agents understand themselves and one another. That tether limits ontological freedom in a distinctive way. It does not block conceptual innovation; it constrains the possibility of reference-preserving ontological replacement. The characteristic labour of the human sciences lies in making intelligible what was already there in lived life—but not yet adequately seen, articulated, contextualised or contested.

One immediate consequence concerns familiar debates about reductionism and naturalism in the human sciences. If ontological breakthroughs of the strict kind isolated here are structurally unavailable under the hermeneutic tether, then some reductionist ambitions are best understood not as bold research programmes but as category mistakes about what success would look like. This does not settle every question about explanation across the sciences, and it certainly does not rule out fruitful borrowings of methods, models, and causal analysis where appropriate. But it tells against a crude picture in which the human sciences are simply waiting for their "Eddington moment"—the decisive replacement of the everyday ontology of persons, reasons, and meanings by a deeper scientific one.

The argument also has methodological and institutional implications. If one wants to understand how the *Geisteswissenschaften* produce knowledge, it may be more revealing to analyse the disciplined labour of interpretive work—its standards of evidence, practices of contextualisation, forms of argument, and modes of critique—than to hunt for spurious "revolutions" modelled on the natural sciences. And it bears, indirectly, on science policy. In assessment and funding contexts there is a temptation to treat "breakthrough" rhetoric as a generic marker of excellence. In the humanities this can mischaracterise what success looks like under the hermeneutic tether. It pressures scholars to promise ontological ruptures that they cannot—and need not—deliver, and it risks undervaluing the patient, conceptually exacting, historically informed, and normatively alert work that constitutes these disciplines at their best.

Ontological breakthroughs may be central to the self-conception of the natural sciences, but it is a mistake to treat them as the universal template for intellectual progress. The human sciences are not failed natural sciences. They are disciplines with different objects, different constraints, and different possibilities for conceptual

and critical achievement. Seeing that difference clearly is not an exercise in resignation; it is a precondition for describing, defending, and cultivating what they can do.

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Declarations

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References

Anstey PR (2002) Robert Boyle and the heuristic value of mechanism. Stud Hist Philos Sci 33:157–170
Appenzeller T (2025) Good morning, sunshine. Science 390:1208–1209
Arabatzis T (2006) Representing electrons: A biographical approach to theoretical entities. University of Chicago Press, Chicago, IL
Aurell J (2024) What is a classic in history? The making of a historical canon. Cambridge University Press, Cambridge
Bachmann-Medick D (2016) Cultural turns: New orientations in the study of culture. Blauhut A (trans). De Gruyter, Berlin
Bizzell P (1979) Thomas Kuhn, scientism, and English studies. Coll Engl 40:764–771
Bogen J, Woodward J (1988) Saving the phenomena. Philos Rev 97:303–352
Brown J (1998) Natural kind terms and recognitional capacities. Mind 107:275–303
Brown N (2000) Organising/disorganising the breakthrough motif: Dolly the cloned ewe meets Astrid the hybrid pig. In: Brown N, Rappert B, Webster A (eds) Contested futures: A sociology of prospective techno-science. Ashgate, Aldershot, pp 87–108
Browne L (2021) The Flammarion engraving and its symbolic potential. Psychol Perspect 64:562–580
Casadevall A, Fang FC (2016) Revolutionary science. mBio 7:e00158
Chomsky N (1959) Review of B. F. Skinner, Verbal behavior. Language 35:26–58
Darrigol O (2000) Electrodynamics from Ampère to Einstein. Oxford University Press, Oxford
De Mul J (2004) The tragedy of finitude: Dilthey's hermeneutics of life. Yale University Press, New Haven, CT
Dilthey W ([1894] 2010) Ideas for a descriptive and analytic psychology. In: Makkreel RA, Rodi F (eds) Wilhelm Dilthey: Selected works, vol 2. Princeton University Press, Princeton, NJ, pp 115–210

Douglas M (1966) Purity and danger: An analysis of concepts of pollution and taboo. Routledge & Kegan Paul, London
Eddington AS (1928) The nature of the physical world. Cambridge University Press, Cambridge
Flammarion C (1888) L'atmosphère. Météorologie populaire. Hachette, Paris
Fogel RW, Elton GR (1983) Which road to the past? Two views of history. Yale University Press, New Haven, CT
Geertz C (1973) The interpretation of cultures. Basic Books, New York
Grimm SR, Peels R, van Woudenberg R (2025) A philosophy of the humanities. Oxford University Press, New York
Hacking I (1983) Representing and intervening: Introductory topics in the philosophy of natural science. Cambridge University Press, Cambridge
Hadot P (2006) The veil of Isis: An essay on the history of the idea of nature. Chase M (trans). Harvard University Press, Cambridge, MA
Hairston M (1982) The winds of change: Thomas Kuhn and the revolution in the teaching of writing. Coll Compos Commun 33:76–88
Hattab H (2011) The mechanical philosophy. In: Clarke DM, Wilson C (eds) The Oxford handbook of philosophy in early modern Europe. Oxford University Press, Oxford, pp 71–95
Holland J, Lande JB (2019) On the paradigmatic force of anomaly. MLN 134:527–533
Hubig C (1980) Gibt es einen Fortschritt in den Geisteswissenschaften? Z Philos Forsch 34:191–209
Johnston H (2026) Top 10 breakthroughs revealed. Phys World 39(1):9–10
Koyré A (1978) Galileo studies. Mepham J (trans). Harvester, Hassocks
Krauss A (2026) The engine of scientific discovery: How new methods and tools spark major breakthroughs. Oxford University Press, New York
Kripke SA (1980) Naming and necessity. Blackwell, Oxford
Kuhn TS (1970) The structure of scientific revolutions, 2nd edn. University of Chicago Press, Chicago, IL
Kuhn TS (1991) The natural and the human sciences. In: Hiley D, Bohman J, Shusterman R (eds) The interpretive turn: Philosophy, science, culture. Cornell University Press, Ithaca, NY, pp 17–24
McAllister JW (2026) Common sense and the difference between natural and human sciences. Inquiry 69:937–962
Merchant C (2008) The violence of impediments: Francis Bacon and the origins of experimentation. Isis 99:731–7
Mokyr J, Stein R (1996) Science, health, and household technology: The effect of the Pasteur revolution on consumer demand. In: Bresnahan TF, Gordon RJ (eds) The economics of new goods. University of Chicago Press, Chicago, IL, pp 143–206
Nelson ES (2011) Self-reflection, interpretation, and historical life in Dilthey. In: Lessing H-U, Makkreel RA, Pozzo R (eds) Recent contributions to Dilthey's philosophy of the human sciences. Frommann-Holzboog, Stuttgart, pp 105–134
Nerlich B (2009) Breakthroughs and disasters: The (ethical) use of future-oriented metaphors in science communication. In: Nerlich B, Elliott R, Larson B (eds) Communicating biological sciences: Ethical and metaphorical dimensions. Ashgate, Farnham, pp 201–218
Newell RW (1986) Objectivity, empiricism and truth. Routledge & Kegan Paul, London
Östh Gustafsson H (2023) The humanities in crisis: Comparative perspectives on a recurring motif. In: Paul H (ed) Writing the history of the humanities: Questions, themes, and approaches. Bloomsbury, London, pp 65–83
Putnam H (1973) Meaning and reference. J Philos 70:699–711
Reitter P, Wellmon C (2021) Permanent crisis: The humanities in a disenchanted age. University of Chicago Press, Chicago, IL
Ricœur P (1974) Structure and hermeneutics. In: Ihde D (ed) The conflict of interpretations: Essays in hermeneutics. Northwestern University Press, Evanston, IL, pp 27–61
Ricœur P (1979) Main trends in philosophy. Holmes & Meier, New York
Schindler S (2013) Observation and theory-ladenness. In: Kaldis B (ed) Encyclopedia of philosophy and the social sciences. Sage, Los Angeles, CA, pp 694–697
Schurz G (2015) Ostensive learnability as a test criterion for theory-neutral observation concepts. J Gen Philos Sci 46:139–153
Secord JA (2024) Against revolutions. BJHS Themes 9:17–38
Solleveld F (2014) Conceptual change in the history of the humanities. Studium 7:223–239
Solleveld F (2016) How to make a revolution: Revolutionary rhetoric in the European humanities around 1800. Hist Humanit 1:277–301

Spacks PM (2006) Revolution in the humanities. Daedalus 135(2):11–14
Stanford PK, Kitcher P (2000) Refining the causal theory of reference for natural kind terms. Philos Stud 97:97–127
Steinle F (2016) Exploratory experiments: Ampère, Faraday, and the origins of electrodynamics. Levine A (trans). University of Pittsburgh, Pittsburgh, PA
Taves A (2009) Religious experience reconsidered: A building-block approach to the study of religion and other special things. Princeton University Press, Princeton, NJ
Turner J (2014) Philology: The forgotten origins of the modern humanities. Princeton University Press, Princeton, NJ
Votsis I (2011) Structural realism: Continuity and its limits. In: Bokulich P, Bokulich A (eds) Scientific structuralism. Springer, Dordrecht, pp 105–117
Votsis I (2015) Perception and observation unladened. Philos Stud 172:563–585
Wallace WA (1984) Galileo and his sources: The heritage of the Collegio Romano in Galileo's science. Princeton University Press, Princeton, NJ
Watson JB (1913) Psychology as the behaviorist views it. Psychol Rev 20:158–177
Wollheim R (2003) On the Freudian unconscious. Proc Address Am Philos Assoc 77(2):23–35
Worboys M (2000) Spreading germs: Disease theories and medical practice in Britain, 1865–1900. Cambridge University Press, Cambridge
Wuestman M, Hoekman J, Frenken K (2020) A typology of scientific breakthroughs. Quant Sci Stud 1:1203–1222

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