# Representationalism and Quantum Mechanics: An Irenic-Pragmatist View

Tanner Leighton

## 1 Introduction

The pragmatist philosophy of language has undergone a significant revival in recent decades, emerging as a compelling alternative to the traditional representationalist view of language and its relation to thought and reality. Richard Rorty was instrumental in this resurgence, advancing his 'neo-pragmatism' as a radical, global anti-representationalism. Building on Rorty's work, Robert Brandom and Huw Price have each developed distinct neo-pragmatist frameworks, refining and adapting his ideas in their own analytic vocabularies and presenting them in a less confrontational, more conciliatory tone. This chapter aims to advance this conciliatory tradition by offering a new vision of neo-pragmatism as an irenic—common-ground-seeking—approach to the philosophy of language, which I term *irenic pragmatism*.

Irenic pragmatism builds upon and refines the work of Brandom and, particularly, Price within the philosophy of language. These philosophers challenge the conventional representational model, which holds that declarative sentences primarily serve to represent facts or states of affairs in the world. Often described as 'anti-representationalist', as well as 'expressivist', 'inferentialist', and 'pragmatist', their views offer a nuanced alternative to traditional representationalism. While I embrace these latter labels, I urge caution in interpreting 'anti-representationalist' too literally. Brandom and Price, I believe, offer a more sophisticated understanding that avoids the more radical commitments of their predecessor, Richard Rorty.

By contrast, Rorty was a global anti-representationalist in the literal sense, denying that declarative sentences represent facts or states of affairs. For Rorty, no assertoric sentence functions representationally. Critics of his global anti-representationalism often respond with something akin to incomprehension, treating the idea that (at least some)

assertoric language is representational as self-evident, and objecting along the following lines.

Claims such as 'The cat is on the mat' or 'Elvis Presley is alive and well and singing in Las Vegas' straightforwardly purport to represent facts or states of affairs. These sentences do not merely function to express language users' attitudes or preferences; it is either the case or not that the cat in question is located on a mat, or that Elvis Presley is alive and currently singing in Las Vegas. These facts or states of affairs obtain independently of our cognitive standpoints. Thus, denying that all uses of assertoric language function representationally seems too radical to be taken seriously as a viable perspective on thought and language.

I am sympathetic to this criticism of Rorty's neo-pragmatism. While he was influential in reigniting interest in pragmatism, his more radical views alienated much of the philosophical mainstream, reinforcing the misconception that pragmatism leads to absurd or relativistic conclusions. As a cultural agitator, Rorty sought to challenge traditional philosophical convictions, even advocating for a 'second Enlightenment' in which reason would no longer be answerable to reality—just as the first Enlightenment divorced morality from divine will. This iconoclastic approach, however, gave pragmatism a controversial reputation, overshadowing its commonsense roots.

In what follows, I articulate irenic pragmatism as a conciliatory framework for understanding language, representation, and reality from a neo-pragmatist perspective. I characterize neo-pragmatism not as a global anti-representationalist position, but as a global conciliatory perspective that foregrounds and theorizes from common-ground commitments. In contrast to Rorty's iconoclastic pragmatism, irenic pragmatism does not adopt a radical or revisionary stance on thought and language. Rather, I present it as a 'core' position, in a spirit similar to Arthur Fine's *Natural Ontological Attitude* (1986), which identifies a shared foundation between realism and anti-realism while rejecting further philosophical additions to that core.

In developing and advocating for irenic pragmatism, I build on the efforts of Price and Brandom to shift neo-pragmatism away from its more radical Rortyan phase toward a

more irenic approach. This chapter completes this transition, presenting neo-pragmatism in its least iconoclastic and most ecumenical form. I argue that irenic pragmatism serves as a core position in the philosophy of language, avoiding both Rorty's radical revisionism and the metaphysical overreach of traditional representationalism. This core adopts a quietist stance on contentious metaphysical and semantic questions, allowing both representationalist and anti-representationalist approaches to build upon it by adding their own optional and contestable commitments.

In the second half of the chapter, I apply this core pragmatist framework to the interpretation of quantum theory—an arena where debates about representation are especially contentious and in need of a conciliatory perspective. I develop and defend a position I call *irenic quantum pragmatism*, which offers a common-ground interpretation of quantum mechanics. Traditional representationalist and anti-representationalist approaches each introduce substantial ontological or semantic commitments to this framework. I argue, however, that such additions are optional and contestable rather than essential, and that the irenic pragmatist core itself constitutes a stable and viable interpretation of quantum theory. This view isolates the fundamental inferential and epistemic roles that quantum theory plays, demonstrating that these are sufficient to account for scientific practice—even in the absence of consensus about what the theory says the world is like.

The chapter proceeds as follows:

- **Sections 2–5:** I reconstruct the debate between semantic representationalists and inferentialists, offer a nuanced reading of Price's anti-representationalism, and show how it improves upon Rorty's more radical stance.
- **Sections 6–10:** I introduce the conceptual framework of irenic pragmatism, including novel distinctions between different kinds of facts and ways of conceptualizing the world—distinctions that clarify the aims of inquiry and the functions language serves across various domains. Section 10 provides a fine-grained taxonomy of representation, distinguishing between physical and symbolic modes, and further subdividing symbolic representation into linguistic, diagrammatic, and formal types. This account clarifies how representational functions operate in both

ordinary and scientific discourse, completing the general philosophical framework of irenic pragmatism.

- **Sections 11–13:** I apply this irenic framework to the interpretation of quantum theory, developing and defending irenic quantum pragmatism. I contrast this view with David Wallace's Everettian interpretation and Richard Healey's quantum pragmatism, both of which introduce substantial and contentious commitments. In contrast, the irenic approach aims to provide a stable common ground—one that avoids metaphysical overreach while still accounting for the theory's use and empirical success.

This overall trajectory—from foundational disputes in the philosophy of language to a focused application in quantum theory—allows the chapter to move from general pragmatist commitments to a concrete case study that both tests and illustrates their utility. The next section begins laying the philosophical groundwork for the subsequent development of irenic pragmatism by introducing the debate between semantic representationalism and pragmatist inferentialism.

## 2 Pragmatist Inferentialism vs. Representationalism

In developing pragmatist themes from Rorty, Wittgenstein, and Sellars, Price and Brandom have sought to construct a viable view of how language functions. They regard language as an inherently social practice, emphasizing two central features: (i) the giving and asking for reasons, and (ii) the recording of interlocutors' commitments and entitlements on what they call our *deontic scorecards*. These scorecards allow us to tacitly track and update each other's deontic statuses—our commitments and entitlements—within the broader game of giving and asking for reasons.

Brandom and Price's social perspective on language does not imply that declarative sentences do not encode information about, and at times even 'track', aspects of the external world. For Brandom, it just implies that this 'tracking' function must be viewed as downstream from, or grounded by, our core practices of inferring and giving and asking for reasons—what he calls the 'downtown' of linguistic activity. All other ('suburban')

language-games, including those involving reference, description, or observation, are derivative of these foundational practices. Price, by contrast, resists this inferentialist hierarchy, as will become clearer later in the discussion.

For both Brandom and Price, ordinary empirical discourse often aims to track features of the external world. Price in particular introduces the notion of tracking to characterize successful empirical and scientific claims. Yet he continues to describe his position as globally anti-representationalist,[1] which may initially seem at odds with his view that such claims can co-vary with features of the environment. Below, I offer a reading—and a further development—of Price's view that resolves this apparent tension.

Though once a nihilist about representation—committed to rejecting all realist views that attribute to scientific or assertoric language any mirroring or environment-tracking function—Price has gradually shifted toward a more nuanced position. He now distinguishes two clusters of representational language use: *i-representation* and *e-representation*. These concepts mark a central distinction in his mature work. I-representation captures the inferential role a claim plays within a discursive practice: its function in reasoning, justification, and the management of normative statuses.[2] E-representation, by contrast, concerns the environment-tracking role attributed to certain scientific or empirical claims, as well as to physical systems like thermometers, speedometers, or fuel gauges.[3]

Price originally followed Rorty in rejecting the idea that scientific or declarative claims participate in any word–world tracking relation. But he now grants that such claims may plausibly play both an i-representational and an e-representational role. Crucially, this

[1] Brandom, on the other hand, is more hesitant to embrace this label—though he certainly flirts with it when discussing and expressing admiration for Rorty, his dissertation supervisor. He often writes as if he agrees with nearly everything his teacher said, as though he is merely articulating a 'softer', less iconoclastic Rortyan view in his own analytic vocabulary.

[2] 'i' for *inferential* or *internalist* (Price 2013b, 36, fn. 18).

[3] 'e' for *environmental* or *externalist* (Price 2013b, 36, fn. 18).

concession does not conflict with his broader anti-representationalist framework. This is because Price targets a particular, historically dominant form of representationalism—what he calls *Big-R Representationalism*—rather than all forms of representational talk.

Big-R Representationalism is the view that language has the general function of encoding factual information about the world. Price defines it in terms of two core assumptions about how assertoric language functions (Price 2013c, 40):

1. **Content assumption**: language is a medium for encoding and passing around sentence-sized packets of factual information—the *contents* of beliefs and assertions.
2. **Correspondence assumption**: these sentence-sized packets of information are all 'about' some aspect of the external world, in much the same way.

Together, these assumptions yield a uniform view of language as a vehicle for *mirroring* or describing features of the natural environment, and for transmitting factual information (ibid., 40).

Price rejects this Representationalist view of language as problematic, especially for the sorts of non-empirical claims expressible by moral, modal, mathematical, semantic, normative, and aesthetic vocabularies. Claims made using these vocabularies are assertoric language-uses that do *not* keep track of features of the external world (Price contends), thereby invalidating Representationalism as a *global* view. Consider, e.g., the moral claim, 'Murder is wrong'. According to Price, this assertion does not mirror or represent any moral aspect of reality. For this sentence to be properly assertible, there need not be any fact or state of affairs in the world that *makes* it true. Nevertheless, Price maintains, we can understand moral expressions as functioning in an i-representational, *inferentialist*, '*internal*' sense—in contrast to an e-representational, *environment*-tracking, '*externalist*' sense. The assertion 'Murder is wrong', for instance, i-represents the action of murder as wrong, without e-representing any natural property of the action (which, some moral realists contend, would be required to make the claim properly assertible).

Denying that ethical claims function e-representationally is just to deny that these claims represent some distinctive moral feature of reality; it is not to deny that ethical claims have representational content in some *other* sense. Clearly, the claim 'Murder is wrong'

'represents' the action of murder as 'wrong' (*trivially*, this claim has representational capacity). The expressivist point is simply that it does not function to mirror or represent any queer moral property, fact, or feature of the world. One would only think that moral claims e-represent in this way, Price argues, if one were already in the grip of Representationalism—that is, committed to the idea that mirroring or tracking the world is what language is *for*. But this is precisely the view Price thinks we should reject.

Price's distinction between i-representation and e-representation offers a way to account for the representational dimensions of assertoric discourse that do not rely on static 'mirroring' or on 'tracking' dynamic features of the natural environment. The notion of i-representation gives priority to the internal functioning of an expression within a discursive practice—where, as Price puts it, 'something counts as a representation in virtue of its position or role in some cognitive or inferential architecture' (Price 2013b, 36). For Price, this inferentialist conception of i-representation captures a representational dimension intrinsic to all assertoric discourse and serves as the basis for semantic content.

This grounding of meaning in inferential practice helps explain how Price can coherently describe himself as a global anti-representationalist. For Price, meanings are never determined through e-representation—that is, by directly referring to or mirroring external facts or states of affairs. Rather, in every context, it is i-representation, rooted in the internal inferential role of expressions within discursive practices, that confers semantic content. To understand the meaning of an expression, we must attend to its use-conditions, not its referential profile or truth-conditions.

Specifically, Price follows Brandom (1994, 2000) in endorsing an inferentialist view of semantic content—*semantic inferentialism*—which I now characterize more precisely:

> **Semantic Inferentialism:** The meaning of an assertion is determined by its i-representational content or inferential profile—that is, by the way it is linked to other assertions, including its inferential antecedents, consequents, and incompatibilities.

An equivalent way to describe this view is to say that the meaning of an assertion just is its contribution to good *material* inferences. These contrast with *formal* inferences,

which are valid purely in virtue of logical form. Material inferences, by contrast, depend on the conceptual content of their non-logical terms.

Consider an example: the inference from 'Pennsylvania is south of New York' to 'New York is north of Pennsylvania' is *materially* valid—it relies crucially on the meanings of the terms 'north' and 'south'. For this inference to be *formally* valid, we would need to add the following (missing) premises: 'If location A is south of location B, then location B is north of location A'; 'Pennsylvania is a location'; and 'New York is a location.' With these premises added in, the inference is formally valid; with or without them, it is materially valid. So material inferences should be viewed as subsuming formal (as well as other) inferences. Healey concurs:

> Since it is not easy to say precisely what generally constitutes formal validity, it is preferable to widen the category of material inference to include formal inferences, however these may be specified. (Healey 2024 draft, 7, fn.5)

In addition to formal and inductive inferences, material inferences also include *practical inferences*—those that connect language to perception and action through what Sellars (1954) called *language-entry* and *language-exit rules*. These are rules by which events or stimuli are incorporated into discourse. For example, seeing a bus and shouting 'Look out, a bus!' prompts a fellow pedestrian to step back to safety. This shows that discursive moves can guide intentional action and are themselves shaped by perception.

It is through such transitions that semantic inferentialists can understand some assertions as *about* the world—as *e-representing* it—based on perception. Language-entry transitions involve forming claims in response to stimuli; language-exit transitions involve actions prompted by claims. These transitions enable a pragmatist to account for how linguistic practices can engage the natural world, generating e-representational claims that describe or track states of affairs.

According to inferentialism, however, e-representational content is not what determines an assertion's *meaning*. The meaning of an assertion lies in its i-representational content: how it connects to other assertions, perceptions, and actions within a normative inferential network.

This understanding of meaning theorizes from and is grounded in the *use* of expressions, which all linguistic agents straightforwardly have access to by participating in the game of giving and asking for reasons. Ordinary empirical vocabulary, ethical vocabulary, mathematical vocabularly, etc., is uncontroversially used by agents: claims are put forward, reasons are given and requested, deontic statuses (commitments and entitlements) are kept track of on the deontic scorecard. Adherring to these norms does not require or presuppose the environment-tracking notion of e-representation; i-representation and inference are the core notions at play.

In sum, for inferentialists, the meaning of expressions just is the way they are used in inferential practice—how they function in the game of giving and asking for reasons. Use determines meaning, not the other way around.

Semantic representationalists take a different perspective. Whereas i-representation is fundamental for inferentialists, e-representation is fundamental for representationalists. (For clarity, it might be preferable to refer to them as 'semantic e-representationalists', since semantic inferentialists could just as well be called 'semantic i-representationalists.' Going forward, however, I will continue using Brandom's terms, though the reader should bear this clarification in mind: *semantic representationalism = semantic e-representationalism*.)

According to semantic representationalists, declarative sentences (or thoughts) have meaning by virtue of their ability to represent facts or states of affairs in the world. In other words, the content of a statement or thought is understood in terms of its reference to or representation of something external to the language user or thinker. For example, 'The cat is on the mat' has meaning because it represents a particular configuration in the external world. To know the meaning of such a sentence is to know how the world would be if it were true; to know the meaning of a term is to know what it refers to. Terms that do not refer are often said to be 'empty' and without meaning.

But semantic representationalism, at least if understood as a uniform view of meaning, commits proponents to the existence of wordly truthmakers for all of our (true) claims; and this generates what Frank Jackson (1998) calls 'location problems' for various types of discourse.

**Location Problem:** where in the world are moral, modal, mathematical, semantic, normative, and aesthetic facts 'located'?

The problem is that it is not clear whether there *even* are such 'facts' and, if there are, what their truth-makers in a natural world could possibly be.

Semantic inferentialists, by contrast, do not commit to the existence of such truthmakers. They theorize from use-based *common-ground* facts. Meaning is not bestowed by correspondence with external states but arises from inferential position and role.

This yields a uniform account of meaning that applies to all assertions. Semantic representationalists, by contrast, cannot give such an account without committing to controversial metaphysical claims. Nor can they account for the dynamic nature of linguistic practice, since they treat content as fixed by how things are (see Brandom 2019, §3).

For these and other reasons, many pragmatists endorse inferentialism not only to explain meaning but to explain how expressions *acquire* meaning and how we *know* what those meanings are. Unlike reference relations—which are postulated, unobservable and (at least usually) epistemically inaccessible—inferential links are publicly accessible and socially trackable. (It should come as no surprise that inferentialism and other use-based approaches emerged out of the verificationist tradition.[4])

## 3 Price as a 'Global Anti-Representationalist'

Although Price self-identifies as a *global anti-representationalist*, this label is somewhat misleading. To properly make sense of his anti-representationalism, we must understand how he can accept both *e*-representation and *i*-representation while still maintaining a globally anti-representationalist stance. The apparent tension arises because, on a straightforward reading, a global anti-representationalist would seem committed to rejecting all forms of representation, including both *i*-representation and—especially—*e*-representation. However, Price does not reject these lowercase-*r* notions of representation,

[4] I follow Paul Horwich (2013, 112, fn.1) in making this assertion.

and so cannot be understood as an anti-representationalist in this strict sense. This, however, does not preclude interpreting Price as an anti-representationalist in other, more nuanced respects. Indeed, I will argue that Price is an anti-representationalist in multiple—and importantly distinct—ways.

A key dimension of Price's anti-representationalism focuses specifically on *semantics*. In particular, Price denies that meanings are ever conferred on expressions by virtue of the referential relations they purportedly bear to aspects of the external environment:

> [B]y the time we get to language there isn't any useful external notion [of representation], *of a semantic kind*—in other words, no useful, general, notion of relations that words and sentences bear to the external world, that we might identify with truth and reference. (Price 2013b, 37; italics in original)

Price's emphasis on there being no external notion of representation 'of a semantic kind' is the key to understanding one of the senses in which he is an anti-representationalist: namely, as a 'global anti-(semantic e-representationalist)'. That is, Price is a global semantic anti-representationalist about e-representation. He rejects semantic representationalism across the board as a theory of meaning.

Price is also a global anti-representationalist in a second sense. Although he is not a global anti-representationalist about (small r) representation, since e- and i-representation are species of *that* genus, Price is an anti-representationalist about (big R) Representationalism:

> When I first started talking about e- and i-representation I sometimes used to say that I had started as a nihilist about representation but become [sic] a dualist! . . . [Yet] I am still an anti-representationalist in the terms meant by most folk who call themselves representationalists. I now put that by saying that those terms involve a confusion at their core, the one I'm trying to resolve by distinguishing i- and e-representation.
>
> Here's a close analogy. Is Sellars a realist about truth? No, at least not in standard terms. He thinks that traditional realist about truth miss the distinction between his

> two notions of truth, that 'belong in different boxes'. [S]o there's a conceptual confusion at the core of their position. If you want to say he's a realist about the 'picturing' kind of truth, fine, but don't take that as a victory for the traditional realist. How could it be such a victory, when most ordinary use of 'true' don't get explained by 'picturing'? (Price 2022, email correspondence)

Most folk who call themselves representationalists are committed to what Price calls (big R) Representationalism. This recall is the view that language is a medium for i-representing and passing around the *contents* of our beliefs and assertions (the '*content* assumption'); coupled with the assumption that all of these contents *correspond* to or e-represent some aspect of the external world (the '*correspondence* assumption'). Big R Representationalists thus fail to recognize the theoretical independence of the (i-representational) content assumption and the (e-representational) correspondence assumption; and this commits them to a uniform view of language as a sort of 'mirror' of nature.

In contrast to Representationalists, Price argues that we should separate the content and correspondence assumptions, recognizing their distinct theoretical roles. The content assumption aligns with i-representation, while the correspondence assumption relates to e-representation. By making this distinction, Price rejects Representationalism as a monolithic framework while still endorsing two complementary notions of representation: i-representation and e-representation.

Unlike Representationalism, which ties representation exclusively to language, e-representation extends beyond linguistic expressions. For instance, a map of Pittsburgh plays an e-representational role, mirroring the spatial relationships of neighborhoods within the city, without being a part of natural language. A map is not a declarative sentence. This demonstrates that e-representation can occur independently of language, allowing us to have e-representation without committing to (big R) Representationalism.

This contrasts with Rorty's more radical anti-representationalism. Price would not deny that maps e-represent features of their respective territories.[5] Maps clearly serve an external, environment-tracking function. Moreover, we can turn each instance of non-linguistic e-representation into a descriptive use of language. Returning to the example of the Pittsburgh map, we might describe its e-representational function with a declarative sentence, such as:

> 'The map of Pittsburgh e-represents the relative locations of its various neighborhoods.'

Price would agree that this declarative sentence is descriptive—it states a fact about the e-representational role played by the map. However, for Price, the correspondence between the sentence and the fact it describes does not confer semantic content upon the sentence.

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[5] As a nihilist about representation, Rorty would also be suspicious of Price's internal notion of i-representation. Rorty expressed this sentiment in an unpublished communication with Price in which he was responding to an earlier version of some of the material in Price's *Descartes Lectures*. Price recounts:

> Responding to an ancestor of some of the material in [Price (2013b)], which invoked what I described as an 'internal' notion of representation, corresponding to what I later called i-representation, Rorty said the following:
>
> > [A]s you might have expected, my doubts are all about whether you are radical enough. I am not sure that it is worthwhile retaining lower-case representationalism by means of your notion of 'internal representations', just as I am unsure whether it was good strategy for Brandom to try to revivify representationalist notions within the bosom of his inferentialism. (Rorty, email communication, 19 May 2006)
>
> (As he goes on to say, 'My strategy is more slash-burn-uproot-sow-with-salt than yours.')

For Price, the sentence's content comes from its i-representational role, not its alignment with any external fact or state of affairs.

In Price's view, i-representation captures the inferential, semantic role that declarative sentences play within the 'game of giving and asking for reasons'. This role applies to all declarative sentences, whether or not they have a correspondence relation with some external fact or state of affairs. The contentfulness of declarative sentences does not depend on whether they represent an external world but on their place within inferential practices. A declarative sentence like 'The number seven is prime' is contentful because of its inferential relations, not because it corresponds to some external fact or state of affairs.

Declarative sentences, therefore, can be contentful without representing aspects of the external world.[6] Their i-representational role within a framework of reasoning suffices to account for their semantic content, according to Price. This view allows Price to decouple the semantic content of language from the traditional correspondence theory of truth, offering a nuanced account of representation that avoids the pitfalls of classical Representationalism while preserving the descriptive utility of language.

## 4 The Exact Senses in which Price is an Anti-Representationalist

In previous sections, we have established that Price is a dualist, not a nihilist, about representation. He embraces his (small-r) notions of i-representation and e-representation,

[6] On my view, it would even be problematic to say that 'e-representation is content-conferring *when the notion is applicable*', since then one would have a theory of meaning according to which *some* of the time i-representation confers content and at *other* times e-representation is content-conferring. But if global expressivism is correct, i-representation applies to all declarative sentences. Thus it would seem odd to say that even though i-representation is always at play, sometimes e-representation takes over its semantic job and confers declarative sentences their meaning. (Coming from a slightly different angle, the 'hybrid view' draws a distinction that a Pricean pragmatist has no need for and hence does not need to justify.)

yet he still identifies as a global anti-representationalist. To clarify this apparent tension, we must examine the precise senses in which Price adopts his anti-representationalist stance.

What Price most clearly denies is (big R) Representationalism as a global theory on language. This makes Price an 'anti-(global Representationalist)'. 'Anti-(global Representationalism)' is not the same as 'global anti-Representationalism'—the former is weaker than the latter. But Price is *also* a global anti-Representationalist. He rejects Representationalism as a theory on language, globally (i.e., in all contexts—ethical, scientific, etc.), since it bundles together the content and correspondence assumptions. Price argues these assumptions or intuitions need to be kept apart, since they play different theoretical roles and answer to different masters, namely, i-representation and e-representation, respectively.

Even though the content and correspondence assumptions are independent assumptions, they sometimes both apply, in the case of (successful) scientific or empirical claims. But even in this special case, these assumptions are still separate: the content of such claims comes from their i-representation role, whereas e-representation is responsible for their correspondence with, or mapping to, the world. Thus he is also a global anti-(semantic e-representationalist)—and, consequently, an anti-(global semantic e-representationalist).

In sum, Price is an anti-representationalist (AR) in multiple, interrelated senses. He is

$AR_i$: an anti-(global Representationalist),

$AR_{ii}$: a global anti-Representationalist,

$AR_{iii}$: a global anti-(semantic e-representationalist), and

$AR_{iv}$: an anti-(global semantic e-representationalist).

These four notions are *not* mutually exclusive. ($AR_i$) and ($AR_{ii}$), for instance, are completely overlapping: the latter is stronger than and subsumes the former. The same relation holds between ($AR_{iv}$) and ($AR_{iii}$): the latter is stronger than and subsumes the former. ($AR_{ii}$) and ($AR_{iii}$), however, are more distinct: Price's rejection of (big R) Representationalism globally, ($AR_{ii}$), implies anti-(global semantic e-representationalism), ($AR_{iv}$), which is weaker than ($AR_{iii}$). Thus ($AR_{ii}$) and ($AR_{iii}$) jointly characterize and *exhaust* the senses in which Price is an 'anti-representationalist'.

## 5 How Price's Anti-Representationalism Improves upon Rorty's

Having offered a fine-grained taxonomy of Price's position, I hope to have improved upon his own labels—'global anti-representationalist', 'global expressivist', 'global pragmatist'—and made explicit the exact senses in which Price is an anti-representationalist. With this foundation in place, I now turn to showing how Price's view circumvents criticisms that have been leveled against Rorty's more radical and controversial form of global anti-representationalism.

Consider first an objection raised by Frank Jackson:

> Although it is obvious that much of language is representational, it is occasionally denied. I have attended conference papers attacking the representational view of language given by speakers who have in their pockets pieces of paper with writing on them that tell them where the conference dinner is and when the taxis leave for the airport. (Jackson 1997, 270)

Simon Blackburn raises a similar critique:

> [L]anguage is not there to represent things—how ridiculous! It is as if Rorty has inferred from there being no innocent eye that there is no eye at all. For after all, a wiring diagram represents how things stand inside our electric bell, our fuel gauge represents the amount of petrol left in the tank, and our physics or history tells how things stand physically or historically. (Blackburn 2005, 153)

I argue that these criticisms do not undermine Price's anti-representationalism but do challenge Rorty's more radical and iconoclastic view.

Let's focus first on Blackburn's criticism. An anti-representationalist who denies that declarative sentences represent or state facts about reality might counter Blackburn's examples by pointing out that wiring diagrams and fuel gauges do not involve representational uses of language. For instance, Blackburn's wiring diagram and fuel gauge serve e-representational roles—representing the internal state of the electric bell and the amount of fuel, respectively—without invoking linguistic representation. As with my earlier example of a map of Pittsburgh, these instances of e-representation operate independently of

language and, therefore, do not undermine anti-representationalism as a global view on assertoric language.

However, even if we interpret Rorty's anti-representationalism as language-specific, his response to Blackburn remains limited. The problem for Rorty is that instances of non-linguistic e-representation—such as the wiring diagram and fuel gauge—can be readily described in language. Analogous to the map example, we can articulate their e-representational roles with declarative sentences such as:

'The wiring diagram e-represents the internal structure of the electric bell', and

'The fuel gauge e-represents the amount of fuel remaining in the tank.'

Price's versions of anti-representationalism—($AR_{ii}$) and ($AR_{iii}$)—do not preclude him from affirming these descriptive statements. He can acknowledge that such sentences describe facts about the e-representational roles of the wiring diagram and fuel gauge without compromising his framework. In this way, Price's anti-representationalism allows him to effectively respond to Blackburn's criticism, whereas Rorty's more radical position does not. The same conclusion applies to (a) Blackburn's examples of physics and history and (b) Jackson's pocket-note example. I briefly address each in turn.

(a) Blackburn's examples of physics and history pose additional challenges to Rorty's anti-representationalism because many scientific and historical claims are naturally interpreted as descriptive statements about reality. For example, claims such as 'Helium atoms contain two protons in their nuclei' or 'George Washington was the first president of the United States' are widely understood to describe aspects of physical reality and historical events. Unlike Rorty, Price has the conceptual resources to acknowledge that successful scientific and historical claims can indeed describe such aspects of reality—or, at the very least, his framework does not preclude these acknowledgments.

(b) Jackson's pocket-note example presents a similar challenge. It can easily be reframed as a descriptive claim, such as 'The conference attendee's note describes the time and location of the dinner.' The note itself e-represents these facts, and the declarative sentence articulates this e-representational role. Price can straightforwardly accept this

descriptive function, providing a clear and effective rejoinder to Jackson's criticism—an option unavailable to Rorty's more radical anti-representationalism.

In sum, Price's dualist approach to representation allows him to accommodate the role of e-representation without embracing the stronger commitment to Representationalism that Rorty rejected. This approach provides flexibility, enabling Price to recognize descriptive uses of language while remaining outside a traditional representationalist framework.

## 6 Neo-Pragmatism as Irenic Pragmatism

If I have been successful so far, it should now be clear what Price's anti-representationalism amounts to and how it constitutes an improvement over Rorty's more radical and iconoclastic view. By adopting a dualist stance on representation rather than Rorty's sweeping rejection, Price's position has moved closer to that of his representationalist opponents. Both Price and representationalists now recognize that language sometimes functions descriptively, allowing us to state e-representational facts (i.e., 'e-facts', a term I introduce below) or to track aspects of the natural environment. The key difference lies in how they interpret this function: Price argues that e-representation is not a semantic notion (i.e., that it does not confer meaning), whereas semantic representationalists assert that it is. While still substantive, this disagreement is far narrower than that between figures like Jackson and Rorty in the 1990s. As neo-pragmatism has evolved in the hands of Price and Brandom, much of what was initially controversial in Rorty's views has been refined or softened. In this way, Price and Brandom have shifted neo-pragmatism in an irenic, or conciliatory, direction compared to Rorty's more radical stance.

My approach, which I call 'irenic pragmatism', builds on this conciliatory trend by proposing a common-ground position that transcends the core disagreement between semantic inferentialists and semantic representationalists. Drawing inspiration from Brandom's interpretation of Wittgenstein, irenic pragmatism focuses on pragmatics while purposefully refraining from theorizing about semantics. This approach enables the formulation of a genuine 'core position', consistent with the goals of irenic pragmatism, to

which both inferentialists and representationalists add additional, optional, and controversial commitments.

Brandom's reading of Wittgenstein provides a compelling foundation for this approach:

> For all that it is common to attribute to the later Wittgenstein a 'use theory of meaning,' his actual view seems to be rather that we should give up the notion of meaning in favor of that of use. He does not actually say 'Meaning is use.' What he says is things like 'Don't look to the meaning, look to the use' and 'Let the use of words teach you their meaning.' If, as I have been doing, we use 'pragmatics' in a broad sense to indicate the study of the use of expressions (Fregean 'force' [Kraft]), and 'semantics' to indicate the study of the meaning of expressions (Fregean 'content' [Inhalt]) then it is not clear that Wittgenstein regards semantics as a legitimate enterprise. He seems to think that everything philosophers need or should want in order to understand discursive intentionality is available directly at the level of pragmatics, without the need to drill down theoretically to discern a deeper semantic level of explanation. (Brandom 2019, 9-10)

Inspired by this interpretation, irenic pragmatism emphasizes pragmatics over semantics. It acknowledges that the content assumption (and therefore i-representation) applies universally to all assertions, while the correspondence assumption (and therefore e-representation) applies only to a subset of claims—specifically, successful empirical ones. However, irenic pragmatists reject the controversial claim, advanced by semantic inferentialists and semantic representationalists, that one type of representation is inherently meaning-conferring while the other is not.

In this respect, irenic pragmatists are semantic *quietists*, focusing solely on the pragmatics side of the pragmatics–semantics distinction. They introduce i-representation and e-representation to explain the roles our claims play in discourse: i-representation codifies the inferential roles played by our assertions in the game of giving and asking for reasons; and e-representation captures a further function putatively played by the empirical claims that speakers advance when intending to describe reality. The irenic pragmatist contends that

it is unnecessary to assert, as both semantic representationalists and semantic inferentialists do, that one of these 'representational' notions endows an assertion with its meaning. By remaining wholly within the realm of pragmatics, the irenic pragmatist sidesteps the debate over which, if any, representational notion is content-conferring.

Thus, irenic pragmatists focus on identifying the rules or norms governing use (pragmatics), rather than developing a theory of meaning (semantics). This enables them to avoid making claims that directly conflict with those of their representationalist 'opponents'. The question of 'what type of 'representational' content is semantic content: i-representational or e-representational?' is a false dichotomy. Semantic content is a human-introduced notion meant to explain or codify key properties of an expression's pragmatic use (Brandom 2013). But we can understand the rules governing the use of declarative sentences simply by grasping their i-representational content, which codifies the roles assertions play as premises and conclusions in material inferences, without claiming that this content constitutes the semantic content of assertoric claims. This i-representational content is what one grasps when participating in the game of giving and asking for reasons, tracking commitments and entitlements within a discursive community. Norms within a linguistic community supervene on these deontic statuses and inferential regularities.

To assert, as semantic inferentialists do, that 'the meaning of an expression arises from its use' is to make a further, controversial claim that semantic representationalists oppose—a claim that adds nothing to the understanding a competent language user already possesses in being able to appropriately use an expression or apply a claim. (Consider the difference between a competent language user and an artificial intelligence: one might argue that an AI grasps only the norms and rules for applying an expression, while sapient agents grasp something deeper—what we might call the expression's 'meaning.' Even if sapient agents do grasp something deeper than AI (a point not required for my position), my

argument is that we do not need to postulate hypothetical entities like 'meanings' to account for our discursive and communicative practices.[7])

Moreover, as Price acknowledges, some expressions function e-representationally in addition to i-representationally, meaning they have both e-representational and i-representational content. Fully understanding such assertions requires appreciating both functions. However, identifying either i-representational or e-representational content as semantic content (as semantic inferentialists and representationalists do) equates the semantic content or meaning of assertions that play dual i- and e-representational roles with something less than what is required to fully understand, grasp, or make sense of those expressions. In such cases, the most plausible approaches are either to adopt my quietist stance, Wittgenstein's nihilist stance, or to contend that both i-representation and e-representation contribute to semantic content in these instances.

Therefore, even if one believes that semantics is a legitimate philosophical enterprise, it is unclear that semantic inferentialists and representationalists succeed in fully accounting for the 'meanings' of an important subset of declarative claims, namely those empirical or scientific assertions that play dual i- and e-representational roles.

Both Rorty and Wittgenstein share my suspicion about the legitimacy and efficacy of semantics. However, they go beyond my semantic quietism by rejecting semantics as a legitimate enterprise. As Brandom summarizes, '[Rorty] recommended jettisoning not only representational semantics but semantics in general,' since he viewed it as 'a handmaiden to bad epistemology' (2013, 99) (see Rorty's magnum opus, *Philosophy and the Mirror of Nature* (1979) for his development and defense of these ideas).

Wittgenstein, like Rorty, can also be classified as a semantic nihilist. His rejection of semantics was driven by a desire to dissolve the philosophical confusion arising from the postulation of 'meanings' as hypothetical entities for explanatory purposes, similar to the way scientists postulate unobservable entities to explain observable phenomena. In the same

[7] In this regard, I follow Wittgenstein. If we are correct about this, my semantic quietism and his semantic nihilism emerge as viable alternatives to the prevailing views.

vein, semanticists postulate unobservable ‘meanings’ to explain or make sense of our observable linguistic behavior (i.e., communication practices). However, this approach assimilates semantics to natural science, endorsing a form of scientism about semantics. This is something Wittgenstein disapproves of as it leads to a distinctively philosophical kind of puzzlement (‘what kind of thing is a ‘meaning’?’), which can otherwise be avoided. His solution is to recommend shifting concern from ‘meaning’ to ‘use’. In this regard, I follow Wittgenstein and remain skeptical of the necessity of semantics, though I am not committed to rejecting it as a legitimate enterprise. (Nor do I accept semantics as a legitimate enterprise.) While semantic inferentialists assert that i-representational content = semantic content, and semantic representationalists assert that e-representational content = semantic content, irenic pragmatists, qua semantic quietists, neither reject nor affirm these claims.

There is a striking parallel here with Price’s distinction between metaphysics and linguistic anthropology. Just as the irenic pragmatist focuses entirely on the pragmatics side of the pragmatics–semantics distinction, Price’s pragmatist remains entirely on the anthropology side of the metaphysics–anthropology distinction. In particular, Price recommends that we focus solely on genealogical questions concerning how we have come to use our terms and expressions in the way we do (linguistic anthropology), rather than inquiring about the referents of our terms and expressions (metaphysics). Questions about referents and their natures are not the pragmatist’s questions. Attempting to answer such questions leads to optional and controversial commitments that both the Pricean pragmatist and my irenic pragmatist refrain from undertaking.

## 7 Two Worlds

Building on the foundation developed above, the irenic pragmatist framework extends Price’s insights further by incorporating and refining his distinction between two ‘worlds’—the *i-world* and the *e-world*—introduced in his third *Descartes Lecture* (Price 2013c). This distinction complements Price’s earlier differentiation between i-representation and e-representation. The i-world refers to the world conceived as the totality of facts as they

emerge from our inferential practices, whereas the e-world refers to the natural environment, conceived as a collection of states of affairs.

Traditionally, metaphysics has tended to conflate these notions, viewing the world simultaneously as 'everything that is the case' (as in the opening words of Wittgenstein's *Tractatus* (1922)) and as a collection of states of affairs (Armstrong 1993). For example, Armstrong states, 'My hypothesis is that the world is a world of states of affairs. I think that I am saying the same thing as those who have held that the world is a world of facts' (Armstrong 1993, 429).

Price emphasizes the importance of keeping these notions distinct by introducing the distinction between the i-world and the e-world. The i-world, corresponding to i-representation, refers—understood in a deflationary sense—to what our i-representations are *about*. As Price notes, it is a world 'only visible from *within* (i.e. to *users of*) the vocabularies in question' (Price 2013c, 55). The i-world is closely tied to inferentialist and subject naturalist perspectives, which regard facts as emerging from a web of inferences and social practices that shape our understanding. On this view, the i-world is a dynamic, continually evolving network of inferential relations, constantly negotiated and revised through social and discursive interaction. By contrast, the e-world, aligned with e-representation, reflects the object naturalist view of reality as an objective collection of states of affairs, conceptualized and described by modern science.

## 8 Two Kinds of Facts

Building on Price's 'two worlds', I propose a further distinction between two kinds of facts: *i-facts* and *e-facts*. This distinction clarifies how distinct kinds of claims relate to the i-world and e-world and enables a precise specification of the purpose of inquiry in general and scientific inquiry in particular: namely, to uncover i-facts and e-facts.

I-facts are facts situated within an i-world, capturing how an individual or community internally conceptualizes and reasons about reality. For instance, the ethical assertion 'murder is wrong' serves as a candidate i-fact, embodying a judgment embedded within an inferential reasoning system. These facts pertain to our internal frameworks for

grasping concepts like moral values and are not tethered to specific external states of affairs. Importantly, i-facts can vary between individuals or communities because they are shaped by different perspectives and inferential networks. The totality of i-facts accepted by an individual or community constitutes their i-world, and these facts are provisional—subject to change as reasoning practices and conceptual frameworks evolve.

E-facts, by contrast, characterize the natural world as we currently understand it through scientific practices. These are empirical claims—such as 'the cat is on the mat' or 'the electron passed through the left slit in a double-slit experiment'—that reflect what we take to be true about states of affairs in the e-world. Like i-facts, e-facts are provisional: our scientific vocabularies and methods shape the e-world, and e-facts may shift as knowledge advances. Because our assertions can be mistaken, e-facts do not necessarily align with ultimate empirical truths but represent our best present understanding of the natural environment.

The discovery and comprehension of these fact types lie at the heart of inquiry's purpose. From the irenic pragmatist viewpoint, inquiry broadly aims to reveal i-facts, while scientific inquiry specifically targets e-facts. Within this framework, e-facts constitute a subset of i-facts, with science functioning as a specialized approach to uncovering truths about the natural environment.

With these distinctions clarified, we can now specify that the i-world is not merely a 'world of facts' but a world of *i-facts*—the totality of all i-facts accepted by an individual or community. The e-world, by contrast, is our conceptualizations of the natural environment, understood as a world of states of affairs whose truths are captured by the e-facts uncovered by science.[8]

## 9 Idealized Versions of these Distinctions

[8] Although *facts* do not constitute the e-world in the same sense that i-facts constitute the i-world, the e-world can still be described in terms of the e-facts that characterize it.

To further refine this framework, we can introduce uppercase versions of these categories: the I-World and the E-World, representing idealized versions of the i-world and e-world; their corresponding I-Facts and E-Facts reflect what would be accepted under conditions of ideal inquiry.

I-Facts are the idealized facts that make up the I-World, agreed upon at the end of a complete and final process of rational investigation, in line with the Peircean notion of truth. Unlike i-facts, which are contingent on current inferential frameworks and subject to revision, I-Facts transcend individual or communal perspectives. They represent what all rational agents would converge upon once social and discursive negotiations are completed. In this idealized state, I-Facts are no longer provisional but reflect the objective truths of inferential reasoning—universally accepted under conditions of ideal inquiry. For instance, if the ethical claim 'murder is wrong' were universally accepted after such an inquiry, it would be an I-Fact in the I-World—representing an outcome of complete understanding and consensus.

Similarly, E-Facts capture the truths about the actual states of affairs in the E-World, the objective natural environment that exists independently of our inferential practices, scientific descriptions, or conceptual frameworks. E-Facts describe objective reality, which exists regardless of whether we have accurately described or conceptualized it. While we aim for our e-facts to align with E-Facts, the e-world remains a constructed approximation of the E-World.

However, we must be careful not to assume that the E-World came 'prepackaged' with natural kinds and inherent structure. The E-World may be more like an 'amorphous dough', shaped and structured through the conceptual schemes, categories, and scientific practices we impose upon it.

If the world is ready-made, our inquiry is a matter of uncovering a fixed, independent structure awaiting full revelation. In this case, the Peircean possibility of convergence toward a final, singular truth seems plausible. I-Facts and E-Facts would correspond to a unified truth about inferential norms and empirical reality, respectively, and

inquiry would be seen as an approximation of this ultimate reality, with our current i-facts and e-facts serving as provisional steps.

Alternatively, if the world is amorphous, the structures we identify and the facts we assert might be shaped by the conceptual frameworks we employ. In this pluralistic scenario, there may be no single, final truth but instead multiple valid ways to 'carve up' reality. Different conceptual schemes might generate different, equally valid I-Facts and E-Facts. Irenic pragmatism remains open to both of these possibilities. This openness reflects the agnostic stance of the irenic pragmatist, who does not commit to whether the world's structure is independent of or co-created by our understanding. While the Peircean possibility suggests that ideal inquiry would lead to a unified truth, the pluralistic possibility allows for multiple, equally valid sets of I-Facts and E-Facts, depending on the conceptual frameworks employed.

Thus, irenic pragmatism acknowledges both possibilities as live options without privileging one over the other. The Peircean possibility holds that all inquiry will converge toward a single, final truth, where I-Facts and E-Facts are universally recognized. The pluralistic possibility, on the other hand, suggests that there may be multiple valid ways of interpreting reality, with different sets of I-Facts and E-Facts depending on the conceptual schemes employed. Irenic pragmatism remains open to both approaches, recognizing that we cannot yet determine whether inquiry will ultimately converge on one set of truths or multiple.

## 10 Refining Price's Cluster Concept of Representation

With the distinctions between i- and e-worlds, i- and e-facts, and their idealized counterparts now clearly articulated, the irenic pragmatist framework stands on firm footing. However, to fully complete this framework, one final refinement remains: a deeper analysis of the concept of *representation* itself. In particular, we must return to—and sharpen—Price's cluster concept of representation, an idea he invokes but leaves underdeveloped. Price treats 'representation' as a cluster concept: a flexible category encompassing a variety of functions and mechanisms we associate with representation, rather than a single, unified essence.

Central to his account are two clusters: i-representation, which pertains to an expression's inferential role within a discursive practice, and e-representation, which pertains to tracking aspects of the external environment. Yet Price leaves the internal structure of these clusters largely under-theorized. While he distinguishes i-representation from e-representation and offers illustrative examples, he does not develop a systematic taxonomy or clarify their underlying unity.

In this section, I refine Price's framework by reconstructing the cluster concept in more precise terms. I propose a taxonomy of representational roles that unifies these diverse cases under the notion of counterfactual sensitivity, while distinguishing between their distinct mechanisms of success. I begin by identifying two broad categories of e-representation—physical and symbolic—and subdivide symbolic e-representation into three modes: linguistic, diagrammatic, and formal. I then argue that these symbolic e-representations are best understood as a subset of i-representations—namely, those that agents take or treat as about the natural environment—to which the tripartite subdivision also applies. This reframing preserves Price's anti-metaphysical orientation while offering greater conceptual clarity and theoretical precision.

### 10.1 Taxonomizing E-Representation: Physical and Symbolic Modes

Price introduces e-representations as systems that co-vary with environmental features, emphasizing paradigmatic cases such as the position of a needle in a fuel gauge tracking the level of fuel in a tank, or a barometer reading varying with atmospheric pressure (Price 2013c, 36). These are '*physical* e-representations', whose success depends on direct causal coupling between features of the representing system and those of the represented system. For example, a barometer's reading changes with air pressure, and the fuel gauge's needle reflects fuel levels through mechanical interaction. These systems are agent-independent: they would continue to function and vary appropriately even in a world devoid of observers.

Other familiar devices—like thermometers and speedometers—likewise fall into this category. However, Price also includes linguistic and scientific assertions within the e-representational cluster, though these are not causally coupled to environmental features in

the same way physical e-representations are. Sentences do not change physically when the environment does, and scientific models do not *mechanically* mirror the systems they describe. These require a distinct category: '*symbolic* e-representations', which co-vary with the environment only indirectly, through social practices and normative uptake. Their representational function depends not on physical responsiveness, but on our interpretive conventions and the inferential roles they play within discursive communities.

Symbolic e-representations can be further subdivided into three functional types: *linguistic* e-representations, *diagrammatic* e-representations, and *formal* e-representations, which I elaborate on below.

| **Mode** | **Agent-Dependence** | **Tracking Mechanism** | **Examples** |
|---|---|---|---|
| Physical (Causal) | No | Direct causal coupling | Thermometers, fuel gauges |
| Symbolic: Linguistic (Normative) | Yes | Normative uptake in discursive practice | 'The cat is on the mat.' |
| Symbolic: Diagrammatic (Normative) | Yes | Visual conventions + counterfactual norms | Maps, bar graphs, Feynman diagrams |
| Symbolic: Formal (Normative) | Yes | Predictive mathematical structure | Newton's Laws + Initial Conditions and Boundary Conditions |

**Figure 1.** A Taxonomy of E-Representational Modes.

1. **Physical E-Representation**: This mode refers to non-linguistic systems that causally track features of the environment through dynamic, physical co-variation. Examples

include a fuel gauge tracking gas levels or a speedometer registering a car's speed. These systems operate independently of natural language, relying on physical or mechanical processes to sustain their representational function. Their tracking is direct and causal: for instance, a speedometer's needle moves because the car's speed changes, governed by physical laws rather than social norms.

2. **Symbolic E-Representation**: This category encompasses systems that encode information counterfactually through structured, norm-governed symbolic forms, distinct from direct causal coupling. Symbolic e-representation branches into three species: linguistic, diagrammatic, and formal.

    a. **Linguistic E-Representation**: This category pertains to declarative sentences or assertions that aim to express e-facts about the e-world—empirical claims like 'The cat is on the mat' or scientific statements such as 'The electron passed through the left slit.' These are symbolic and norm-governed rather than causally coupled to their referents. Their success as e-representations depends on coherence with perceptual evidence and adherence to communal epistemic norms—justification, coherence, revisability, and accountability—within the 'game of giving and asking for reasons' (Sellars 1954; Brandom 1994). Such claims track the environment counterfactually: if the cat were in the kitchen, a different assertion—e.g., 'The cat is drinking water'—would be appropriate. This counterfactual tracking is mediated through discursive practices, not direct causal coupling. Linguistic e-representations emerge as norm-governed outcomes of rational discourse, deriving their status from their integration into inferential networks and their uptake within a community of language users. For example, the assertion 'The cat is on the mat' functions as a linguistic e-representation because it is first an i-representation—a discursive claim embedded in a web of beliefs and inferential commitments—that the community treats *takes* or *treats* as being about the e-world. Its i-representational status arises from its role within

rational discourse, while its e-representational status stems from communal uptake as expressing a lowercase *e-fact* about the environment, such as the cat's location.[9]

b. **Diagrammatic E-Representation**: This category captures symbolic systems that visually encode relational, spatial, or empirical information through structured forms such as shapes, lines, or layouts. These representations are distinct from linguistic assertions and formal mathematical models. Examples include maps (e.g., a map of Pittsburgh representing neighborhood layouts), charts (e.g., bar graphs encoding empirical data), and diagrams (e.g., flowcharts or Feynman diagrams). While such representations often take a physical form—ink on paper, marks on a board, or pixels on a screen—their representational function is symbolic rather than physical. (The medium serves merely as a vehicle for conveying information.) A map of Pittsburgh, for instance, encodes counterfactual information about spatial structure: if a

[9] Crucially, while a community may take an assertion like 'The cat is on the mat' to express a lowercase e-fact (e.g., that the cat is on the mat), the irenic pragmatist remains agnostic about its correspondence to an uppercase E-FACT, understood as an objective, mind-independent state of affairs in the traditional representationalist sense. The assertion's success as a linguistic e-representation hinges not on metaphysical mirroring but on its functional role in discourse—guiding reasoning, coordinating behavior, and answering to evidence within a shared normative framework. This agnosticism allows that such assertions might align with an uppercase E-FACT or converge toward an E-Fact—idealized facts a community would endorse at the end of inquiry under conditions of maximal epistemic virtue, such as complete evidence and rational consensus (Section 9). However, neither alignment nor convergence is intrinsic to the assertion's e-representational status. For the irenic pragmatist, representational success lies in the assertion's pragmatic utility in current discursive practices, sidestepping questions of metaphysical correspondence or the stage of inquiry.

road were rerouted, a different map would be warranted. This environmental tracking occurs through visual-symbolic means rather than causal coupling or linguistic fact-stating. Diagrammatic e-representations are governed by communal conventions—such as map legends, axes, and spatial scales—that guide interpretation. Like linguistic e-representations, they track the *e*-world counterfactually. However, they do so without relying on the assertoric or syntactic features of natural language. This category is intentionally broad, designed to encompass diverse forms of visual-symbolic representation that function informationally without fitting neatly into either linguistic or formal-mathematical modes.

c. **Formal E-Representation**: This category applies to mathematical or theoretical structures that track the environment in a predictive, formal sense rather than through causal co-variation, linguistic fact-stating, or diagrammatic convention. Unlike physical e-representation, which involves direct causal coupling (e.g., a speedometer's mechanical response), formal e-representation involves the use of abstract models that function as instruments for generating successful predictions about the environment. And unlike linguistic e-representation, which asserts *e*-facts descriptively (e.g., 'The cat is on the mat'), formal e-representations do not assert e-facts directly but constitute predictive frameworks for indicating experimental or other results. For example, consider the Schrödinger equation in quantum mechanics. The Schrödinger equation governs the evolution of a wavefunction ($\Psi$), and the Born rule translates this into a probability density $|\Psi(x,t)|^2$ over possible measurement outcomes. If the quantum system's dynamics change (e.g., if a different potential is appropriate), the equation yields different predictions, tracking the e-world counterfactually through mathematical relations. Similarly, Newton's second law ($F=ma$) in classical mechanics predicts an object's motion under given forces, tracking the e-world by forecasting trajectories without stating e-facts like 'The ball is at

position X.' Formal e-representation is abstract and predictive, grounded in the internal coherence of mathematical structures and their empirical adequacy, rather than in direct causal coupling with the environment or in compliance with the normative practices that govern linguistic assertion.

This taxonomy enhances Price's cluster concept by identifying specific internal mechanisms of success. Physical e-representations succeed causally; symbolic e-representations succeed normatively. What unites them all is their counterfactual sensitivity to the environment, but the basis for that sensitivity differs.

### 10.2 Counterfactual Co-Variation and Agent Involvement

Counterfactual co-variation might be thought of as a unifying condition for successful e-representations: if the represented feature of the world were different, a successful e-representation would be different as well. This condition is straightforward for physical e-representations, which adjust mechanically, chemically, or electrically. But symbolic e-representations—being static items like maps, models, or sentences—do not vary on their own. Their counterfactual responsiveness is realized through the agents who use and interpret them.

Consider a sentence like 'The cat is on the mat.' If the cat moves to the kitchen, the sentence does not spontaneously alter itself. Rather, what changes is the agent's use of it (or lack thereof)—as asserting it is no longer appropriate. Similarly, a static map of, say, Pittsburgh remains unchanged even if Pittsburgh's geography shifts—but agents would now judge it inaccurate and turn to a different map. Thus, the proper locus of counterfactual co-variation is the agent-representation pair. Symbolic e-representations succeed when agents, themselves causally embedded in the world, use these tools to keep track of environmental conditions, in a counterfactually responsive way.

This insight underscores a key neo-pragmatist insight: symbolic representations are *doings*: products of socially embedded activities. Physical e-representations may function independently of humans, but symbolic e-representations require agents and are maintained

within normative practices. The appearance of objectivity in linguistic or mathematical representations depends on communal uptake and justification, not directly on the 'way things are'.

### 10.3 Extending the Taxonomy to I-Representation

The tripartite structure of symbolic e-representation—linguistic, diagrammatic, and formal—maps directly onto i-representation. All symbolic e-representations are, by necessity, also i-representations: they are items embedded in inferential and discursive practices. What distinguishes an e-representational use from a purely i-representational one is the agent's intentional stance: e-representations are those i-representations that a community takes or treats as about the environment.

This use-sensitive criterion has several implications. First, it shows that symbolic representation does not bifurcate into two distinct kinds of entities—those that i-represent and those that e-represent—but rather reflects a spectrum of pragmatic uptake. The assertion 'the cat is on the mat' always plays an i-representational role insofar as it functions in inference, belief revision, and discourse. When treated as a description of an aspect of the external world, it additionally plays an e-representational role. Likewise, a Feynman diagram may serve merely as a heuristic inferential tool—functioning as a diagrammatic *i*-representation—or be interpreted more literally as representing a scattering or decay process, in which case it may also serve as a diagrammatic *e*-representation. Its representational status, whether as a purely inferential aid or as a symbolic depiction of environmental processes, depends on how it is used and interpreted by an individual or community.

Second, this framework reveals an important asymmetry: only symbolic representations can serve as i-representations. Physical e-representations—like thermometers or fuel gauges—do not engage in discursive or inferential practices. They operate outside the game of giving and asking for reasons and therefore do not carry i-representational content. This further supports the view that i-representation is a norm-

dependent, socially embedded category, whereas physical e-representation is a causal-physical phenomenon.

Recasting symbolic e-representation as a pragmatic stance toward i-representation offers a powerful, non-metaphysical account of representational pluralism. It shows that while representation takes many forms, these forms are intelligible within a unified framework that distinguishes mechanisms (causal vs. normative), modes (physical vs. symbolic), and uses (e-representational vs. i-representational). This refinement remains faithful to Price's neo-pragmatist spirit while providing the theoretical clarity and taxonomic structure that his cluster concept leaves underdeveloped.

Having now articulated the irenic pragmatist framework at a general level, we turn to its philosophical utility in a more concrete domain. Part Two of this chapter applies the distinctions and commitments developed above to a particularly contentious case: the interpretation of quantum mechanics. Nowhere are debates over representation more intense—or more in need of a conciliatory perspective—than in the foundations of quantum theory.

## 11 Irenic *Quantum* Pragmatism

With a refined taxonomy of representation now in place—distinguishing causal and symbolic forms, articulating their mechanisms of success, and clarifying their roles within inferential practices—we are ready to apply the irenic pragmatist framework to the specific challenge of interpreting quantum theory. Here, the framework can serve its intended conciliatory function: to identify a common-ground position that avoids metaphysical overreach while making sense of actual scientific practice.

Quantum mechanics, with its celebrated formalism and empirical success, poses a unique philosophical challenge. Its interpretive underdetermination invites both representationalist readings—on which quantum states (wave functions or density operators) describe physical reality—and anti-representationalist responses, which treat them as merely predictive tools devoid of descriptive content. These debates mirror the broader tensions

between semantic representationalism and inferentialism, making quantum theory an ideal context in which to explore irenic pragmatism's conciliatory potential.

In what follows, I develop and defend *irenic quantum pragmatism*: a minimalist interpretation that emphasizes the inferential role of quantum theory while suspending judgment on its metaphysical implications. On this view, quantum states function, at a minimum, as tools for generating reliable inferences about physical phenomena—from spintronics to high-energy particle collisions. Representationalists may elaborate on this core by positing ontological claims (e.g., branching worlds), while anti-representationalists restrict themselves to the theory's predictive and epistemic utility, rejecting further commitments. Irenic quantum pragmatism, by contrast, advances no metaphysical thesis of its own. Instead, it offers a stable interpretive foundation—rooted in shared scientific practices—that fosters common ground across divergent perspectives. It leaves room for continued debate, treating both the additional commitments of representationalists and the rejections of anti-representationalists as optional and contestable. I argue that this core position is robust and viable in its own right.

## 11.1 Representation in Quantum Mechanics

Irenic quantum pragmatism interprets quantum mechanics by foregrounding the inferential roles of quantum claims, treating them as tools within the scientific community's 'game of giving and asking for reasons'. Like other linguistic assertions, quantum statements carry *i*-representational content, encoding *i*-facts within an *i*-world—Price's 'world visible only from within the vocabularies in question' (Price 2013c, 55)—as shaped by the norms and practices of the physics community. This perspective commits only to quantum states as symbolic, mathematical instruments for guiding expectations and forming predictions, while remaining agnostic about whether they *e*-represent physical properties in the *e*-world. In doing so, it avoids speculative ontological commitments and situates quantum theory within a norm-governed inferential practice.

Consider an entangled electron pair assigned the singlet state:

$$\frac{1}{\sqrt{2}}(|\uparrow>_A^z |\downarrow>_B^z - |\downarrow>_A^z |\uparrow>_B^z)$$

Here, |↑⟩ and |↓⟩ denote 'spin up' and 'spin down' for particles A and B along the z-axis. This state assignment functions i-representationally, serving as a node in an inferential network. It licenses predictions, such as opposite spin outcomes with certainty when measured along the z-axis, per the Born rule, which translates quantum states into probabilities. Unlike e-representational claims like 'the electron's spin was measured up', which express e-facts about observable states, the singlet state need not describe external properties or facts. Irenic quantum pragmatism treats it primarily as a tool for licensing predictive inferences, without presuming that it functions as a depiction of physical reality.

Similarly, consider Schrödinger's cat, assigned the superposed state:

$$|\psi\rangle = \alpha|\text{alive}\rangle + \beta|\text{dead}\rangle$$

where α and β are coefficients reflecting outcome probabilities. As an i-representation, this state encodes predictive advice—e.g., equal credences for 'alive' or 'dead' if $\alpha^2 = \beta^2 = ½$—grounded in quantum norms. Irenic pragmatism does not require it to e-represent the cat as both alive and dead (or neither), which would reintroduce the measurement problem. By emphasizing i-representation, it treats the state as a guide for scientific practice, suspending judgment on its e-representational status.

This approach mirrors irenic pragmatism's handling of ethical claims, which i-represent attitudes without settling ontological disputes. In quantum mechanics, i-facts suffice for practical utility, allowing scientists to make reliable predictions without resolving whether quantum states track physical properties. By remaining agnostic about e-representation, irenic quantum pragmatism avoids metaphysical commitments, offering a minimalist yet robust interpretive core that supports scientific practice while leaving room for representationalist and anti-representationalist elaborations.

### 11.2 Theory Change and the Pessimistic Induction

From the perspective of irenic quantum pragmatism, representation in quantum mechanics is 'cheap': all assertions—including quantum claims—play i-representational roles, aiming to express i-facts within a discursive, norm-governed framework. The contentious question is whether such claims also play e-representational roles—whether they track physical properties or express genuine e-facts about the world. Irenic quantum pragmatism resists this further commitment, in part due to the lesson of the pessimistic induction: history shows that successful physical theories, once thought to reveal the world's underlying structure, are often later replaced or radically revised. From Newtonian mechanics to relativity and quantum theory, each framework has eventually shown its limitations—typically tied to specific domains or energy scales. Quantum theory, for all its empirical success, may likewise be provisional.

In light of this, the irenic pragmatist holds that we should be cautious in inferring ontological conclusions from our current best theories. Without a universal, all-encompassing, and potentially final theory of physics, we lack a secure basis for confidently identifying the true ontology of the world. Were such a theory to emerge—one whose e-representational credentials were compelling (that is, a theory exhibiting sustained predictive success across all scales and lacking serious rivals or alternatives)—it might then be reasonable to assign considerable credence to its ontological implications. If, for example, that theory supported a multiverse on representational grounds, the irenic pragmatist could acknowledge the corresponding e-fact.

At present, however, interpretations such as David Wallace's (2012) version of the Everett interpretation remain speculative. Though framed in terms of decoherence and emergent structure, Wallace's modern Everettian view still relies on a substantial ampliative inference: from the instrumental success of unitary quantum mechanics to a full-blown ontology of parallel worlds. Irenic quantum pragmatism views this inference as epistemically risky, especially in light of the historical record of theory change.

The quantum formalism applies within well-defined domains—specifically, non-gravitational regimes and energy scales for which quantum theory is empirically confirmed. In contexts such as black hole physics, by contrast, general relativity remains the most

reliable framework. Quantum theory does not currently apply where gravitational effects dominate. The need for a quantum theory of gravity arises precisely because standard quantum theory and general relativity each fail outside their respective domains (Weinberg 1995; Rovelli 2004). Yet Everettian interpretations extrapolate from the theory's success in local applications to global metaphysical conclusions—namely, that reality consists of an emergent multiverse. This move attributes to an effective, non-final theory an ontological authority that outstrips its tested domain.

## 12 Comparison with Healey's View

Irenic quantum pragmatism stands to Healey's approach as irenic pragmatism stands to Price's framework. By examining this analogy, we can better understand how my view of quantum theory both parallels and diverges from Healey's—just as irenic pragmatism draws from and refines Price's position.

Healey (2017) contends that quantum theory is prescriptive rather than descriptive: it does not describe or e-represent the properties of quantum systems, but instead serves as a normative guide, directing users in how to assign rational degrees of belief to various magnitude claims. What makes quantum theory revolutionary, on Healey's view, is its capacity to enhance our e-representation of the world indirectly—not by representing physical systems itself, but by guiding how we distribute credence across claims that do. Although Healey does not explicitly invoke Price's i/e-representation distinction, his position fits naturally within that framework.

To illustrate Healey's approach, consider a particle confined to a region R, such as an electron in a box, with the wave function $\psi(\vec{x}, t)$. On his view, the wave function does not describe the electron's position. Instead, it serves as part of a normative framework that advises agents on how to distribute credence across magnitude claims about the system. For instance, consider the claim: 'The electron is in region r ⊂ R'. Given sufficient environmental decoherence, the Born rule provides a well-confirmed method for apportioning credence. The appropriate degree of belief an agent should assign to the electron being in region r is given by:

$$\int_{region\ r} |\psi(\vec{x}, t)|^2 d^3x \,.$$

Thus, quantum theory—according to Healey—enables agents to form rational partial beliefs about magnitude claims without describing or representing the systems themselves. These magnitude claims may e-represent quantum systems, but quantum theory itself does not. Instead, it offers guidance for how to assign credences to such claims.

Healey 2017 thus frames quantum theory as a purely prescriptive instrument. The theory itself does not e-represent anything, even if the magnitude claims it advises about (e.g. 'the electron is in region r') may be taken to e-represent aspects of the world.

The irenic quantum pragmatist, by contrast, adopts a quieter stance. While acknowledging that quantum theory prescribes how agents should manage their beliefs about physical systems, the irenic view does not rule out the possibility that it also describes or represents those systems. It remains agnostic about whether quantum state ascriptions—such as wave functions or density operators—play an e-representational role in tracking features of physical systems. These state ascriptions are granted only an i-representational role: they function as symbolic tools embedded within a larger inferential and normative framework.

What distinguishes Healey's current position (2022) from both his earlier view and irenic quantum pragmatism is that he now claims quantum states are extrinsically physical properties of quantum systems. While he still denies that these states are 'beables' in the traditional sense (i.e. intrinsic, directly real properties), his view now includes a limited descriptive component: quantum theory represents at least one physical property previously unknown to classical physics. This marks a departure from the purely prescriptive stance of Healey (2017) and introduces an ontological commitment that the irenic quantum pragmatist deliberately avoids—or more precisely, suspends judgment about.

This development mirrors the familiar contrast between irenic pragmatism and Price's anti-representationalism in ethics. Irenic pragmatism holds that moral claims i-represent attitudes (such as approval or disapproval), while remaining agnostic on whether they e-represent natural or non-natural moral properties. Price, by contrast, denies any such

e-representational role. Similarly, irenic quantum pragmatism remains open to the possibility that quantum states e-represent features of physical systems, whereas Healey, like Price, draws a firmer line—although his 2022 view partially walks back the purer anti-representationalism of his earlier work.

In sum, irenic quantum pragmatism articulates a common-ground view: it commits only to quantum theory's prescriptive function—its role in guiding rational credence—and remains agnostic about whether wave functions and density operators describe or represent physical reality. Healey's more recent position adds on to this core by asserting that quantum states are extrinsically physical properties. Moreover, he maintains that wave functions and density operators do not themselves represent *intrinsic* physical properties of systems. Both of these claims—Healey's ontological posit and his restriction on what quantum models can represent—are commitments that the irenic view neither affirms nor denies. They are, in the irenic framework, optional and controversial additions rather than part of the shared, irenic core.

### 12.1 Avoiding the Measurement Problem

Healey avoids the quantum measurement problem by denying that quantum models represent the intrinsic physical properties of quantum systems—such as the spin of entangled electrons or, in Schrödinger's cat thought experiment, the cat's state of being both alive and dead. According to the standard representationalist view of quantum theory, a state like:

$$\alpha|\text{alive}\rangle+\beta|\text{dead}\rangle$$

e-represents the state of Schrödinger's cat. Taken literally, this state assignment implies that the cat is both alive and dead—or perhaps neither, depending on interpretation. These conclusions are rather extravagant, as all observations of cats reveal them to be either alive or dead, but not both (or neither).

Healey reinterprets quantum state assignments as tools for encoding advice about expected experimental outcomes, rather than as descriptions of spin values or macroscopic

properties like a cat's state. Irenic quantum pragmatism adopts this advice-based interpretation but remains agnostic about whether quantum theory also plays a descriptive or e-representational role—beyond guiding the credences we assign to possible outcomes. On this view, the state

$$|\psi\rangle=\alpha|\text{alive}\rangle+\beta|\text{dead}\rangle$$

i-represents the quantum system: it encodes inferential guidance about what an observer can expect to find upon measurement, without asserting that it e-represents any intrinsic physical properties of the system. This emphasis on the state's i-representational function within normative inferential practices allows irenic quantum pragmatism, like Healey's interpretation, to sidestep the measurement problem by refraining from treating quantum state assignments as direct descriptions of reality.[10]

### 12.2 The Descriptive Nature of Confirmation

A challenge to Healey's prescriptive approach—and by extension, to irenic quantum pragmatism—arises from the apparently descriptive nature of confirmation in quantum theory. Critics argue that since quantum mechanics makes empirical predictions, and these predictions appear to describe what will be observed, any account of quantum theory must acknowledge at least a limited e-representational role. An anonymous referee captures this

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[10] Specifically, irenic quantum pragmatism does not assert, and Healey explicitly rejects, premise 1.A of Maudlin's trilemma formulation of the measurement problem (1995, 7):

> 1.A The wave-function of a system is *complete*, i.e. the wave-function specifies (directly or indirectly) all of the physical properties of a system.
>
> 1.B The wave-function always evolves in accord with a linear dynamical equation (e.g. the Schrödinger equation).
>
> 1.C Measurements of, e.g., the spin of an electron always (or at least usually) have determinate outcomes, i.e., at the end of the measurement the measuring device is either in a state which indicates spin up (and not down) or spin down (and not up).

worry succinctly: ‘Every theory, even for a die-hard instrumentalist, has a representational sub-structure. At minimum, the observables (or empirical predictions) of the theory are representations of what will be observed.’

Tushar Menon (forthcoming), attributing the argument to Peter Lewis (2020), formulates the challenge in the following way:

> Our scientific discursive practice of using QM, at least some of the time, includes predictive claims. That’s how we know that QM is a good theory. But predictions of experimental outcomes are descriptions of possible (changes in the properties of) experimental apparatuses. So any account of a physical theory needs to account, at the very least, for the descriptive nature of confirmation; call this the descriptivist challenge.

If this critique succeeds, Healey’s anti-representationalist stance may appear to conflict with standard scientific practice. Likewise, irenic quantum pragmatism—with its minimal commitment to i-representation and agnosticism about e-representation—faces a parallel test: can it accommodate the apparently descriptive character of confirmation without compromising its core commitments?

In response, I argue that irenic pragmatism can accommodate this criticism by recognizing a limited descriptive role in confirmation while maintaining that this role does *not* imply that quantum theory e-represents properties of physical systems. On this view, confirmation is descriptive only in a modest sense, one that does not conflict with the theory’s prescriptive core. By carefully distinguishing between different senses of ‘description’, the irenic pragmatist avoids the inference that confirmation requires quantum theory to serve an e-representational function, thereby preserving its immunity to the measurement problem.

From the irenic pragmatist perspective, quantum theory primarily functions as a guide to expectations rather than a description of the world. Its predictions tell us how to allocate credence across different possible observations, offering advice about what experimental outcomes we should expect.

At the same time, quantum predictions can be descriptive in a limited sense. They indicate which e-representations of experimental outcomes we should expect. For instance, when quantum mechanics predicts an interference pattern in a double-slit experiment, it doesn't describe the particle's path or state but prescribes probabilities for what we'll see on the detection screen.

However, it is crucial to emphasize that these predictions do not describe the intrinsic properties of physical systems—such as a particle's position or spin—prior to measurement. Instead, they simply indicate the anticipated outputs of experimental setups, like the emergence of interference patterns on a detection screen. This separation enables the irenic pragmatist to recognize a limited descriptiveness in confirmation while steering clear of any commitment to quantum theory e-representing physical reality.

Thus, quantum theory is both prescriptive and descriptive, but not in a way that contradicts irenic quantum pragmatism. The descriptive nature of confirmation is not a matter of quantum theory describing the world, but rather of our descriptions being constrained by the guidance quantum theory provides.

Suppose a Stern–Gerlach experiment is designed to measure the spin of an electron along a particular axis—say, the z-axis. In this context, the quantum formalism need not be interpreted as describing the electron's spin state; rather, it assigns probabilities to the possible outcomes of the measurement. Within the theory, spin is formally *i*-represented by the operator vector $\vec{S} = (S_x, S_y, S_z)$. Because these operators do not commute, quantum theory does not treat the spin components as jointly well-defined or simultaneously measurable. The magnitude claim that 'the spin is up along the z-axis' (or 'down') is the descriptive element—it states an outcome and may *e*-represent a feature of the system. Quantum theory itself, by contrast, does not assert that any particular outcome will occur; instead, it prescribes how credence should be distributed across possible magnitude claims. On this view, the descriptive work in confirmation is performed by the magnitude claims themselves, not by quantum theory per se. Confirmation thus has a descriptive face, but the mechanism guiding our expectations remains fundamentally prescriptive.

So, the irenic pragmatist can reject the descriptivist challenge by maintaining that:

- Quantum theory does not e-represent empirical outcomes—it only prescribes probabilities over descriptive magnitude claims.
- Descriptive magnitude claims do the actual describing (in the e-representational sense), meaning that e-representation does occur in scientific practice, but it is not a function of quantum theory itself.

The descriptivist challenge assumes that confirmation requires quantum theory to describe empirical outcomes. However, the irenic pragmatist can reject this assumption by distinguishing between the probabilities quantum theory generates and the descriptive magnitude claims they are assigned to. This distinction allows the irenic pragmatist to reject the claim that quantum theory must play a descriptive (e-representational) role in confirmation while preserving the undeniable fact that scientific theories guide empirical expectations.

## 13 The Nature of Quantum States

The previous sections have emphasized the normative, inferential role that quantum theory plays within scientific practice—especially when contrasted with more metaphysically robust interpretations. Yet further clarity is needed regarding one of the central elements of quantum theory: the notion of a quantum state. Physicists rely on wave functions and density operators to predict experimental outcomes, but they often use varied and philosophically loaded language to describe what these mathematical tools *are* or *represent*. This raises a key question: What, if anything, do quantum states represent—and how should we understand their role in the practice of physics? This section addresses that question directly by offering a comparative analysis of three major perspectives: the minimalist, pragmatic view advanced here; Richard Healey's relational ontology of quantum states; and David Wallace's Everettian representationalism.

Physicists often speak of wave functions as 'representing' quantum systems, 'describing' particles, or even 'being' the quantum state. Such language invites philosophical scrutiny. Do wave functions describe objective reality? Are quantum states ontological entities, abstract tools, or representational devices? From the standpoint of irenic

quantum pragmatism, these questions are best approached by distinguishing the normative role quantum theory plays in scientific practice from optional metaphysical interpretations. My view grants quantum state ascriptions an i-representational role within the inferential and predictive practices of physics, while remaining agnostic about whether they also play an e-representational role that tracks physical features of the world.

This irenic stance diverges sharply from Richard Healey's 2022 view, which offers one of the most carefully developed middle-ground positions in the literature. While Healey formerly advocated a purely prescriptive pragmatist interpretation—denying that quantum states are real, descriptive, or representational—his more recent view grants them objective reality as extrinsically physical properties of quantum systems. Though he resists wave function realism and denies that quantum states are physical magnitudes or intrinsic properties, Healey now holds that quantum states are ontic, truth-apt, and representational in a qualified, relational sense.

Let's first clarify Healey's mature position before contrasting it with the irenic alternative.

### 13.1 Healey's View: Quantum States as Extrinsically Physical Properties

Healey (2022) explicitly rejects the idea that quantum states are either physical entities (like particles or fields) or physical magnitudes (like mass or temperature). Instead, he proposes that they are extrinsically physical properties—relational properties a system has relative to a physical situation, not to an agent's beliefs or knowledge. In his words:

> A quantum state is an objective relational property of a physical system that describes neither its intrinsic physical properties nor anyone's epistemic state... A system has a quantum state only relative to something physical. (2022, 307)

The quantum state, for Healey, supervenes on *backing conditions*—that is, physical features of the environment and the system's preparation history—and functions to encode objective probabilities for magnitude claims, to which the Born rule assigns credences. These probabilities are modal: they concern possibilities and guide agents in uncertain circumstances, even when frequency data is lacking.

Healey frames this view as a kind of naturalistic pragmatism, influenced by Price's subject naturalism, which begins not with metaphysical posits about the world but with our epistemic and physical limitations as agents. He insists that quantum states are ontic—independent of any agent's beliefs—but are relational to physical situations that constrain what information an agent can access.

This leads Healey to affirm that statements like 'system $S$ is in quantum state $\psi$' are truth-apt and sometimes true, thereby grounding the representational status of quantum state assignments in a minimal sense. They are not descriptive of intrinsic properties, but they are objective, truth-apt, and modal, representing probability structures relative to environmental constraints.

### 13.2 The Irenic Contrast: Quietism and Normative Function

By contrast, the irenic quantum pragmatist does not affirm that quantum states are objective properties—intrinsic or extrinsic. Nor does it assert that they are ontic, relational, or modal in the representational sense. Rather, the irenic view suspends judgment on these metaphysical and semantic commitments, focusing instead on the uncontroversial fact that quantum states play an inferential, predictive, and prescriptive role within scientific discourse. Whereas Healey holds that quantum states are real, extrinsically physical properties, my irenic view refrains from attributing any metaphysical status to them. I acknowledge that scientists often treat quantum state ascriptions as if they represent features of the world, and that certain statements involving quantum systems may be truth-apt. But I decline to elevate this pragmatic success into an ontological thesis. Accordingly, I reject the claim that quantum states—merely by virtue of their association with probabilities—must exist in the e-world as entities or properties, or represent anything in it.

The irenic view therefore resists Healey's 2022 elaborations beyond his earlier 2017 stance. It does not endorse Healey's claim that quantum states represent 'objective probabilistic relations' between backing and advice conditions, nor does it assert that such representation makes them modal or ontic. On the irenic view, all that is required for successful scientific practice is the coherent use of quantum state ascriptions within a

normative framework that guides prediction and belief revision. Whether these state ascriptions track features of physical systems is a further question—one the irenic pragmatist leaves open as optional and contestable.

In conclusion, Healey's view adds a specific metaphysical and representational thesis to what I consider the irenic core of quantum pragmatism. This core—shared by both views—acknowledges the prescriptive, inferential, and predictive utility of quantum theory without requiring that quantum state ascriptions describe or mirror reality. Irenic quantum pragmatism carves out a space for scientific pluralism: one may adopt Healey's further commitments or not, but doing so is optional. The core pragmatist view remains neutral, tolerant, and functionally sufficient.

### 13.3 Wallace's View: Robust E-Representationalism

David Wallace (2012) offers a third, metaphysically committed alternative. As a leading defender of the Everett interpretation, Wallace advances a robust e-representationalist account of quantum theory. On this view, wave functions, state vectors, and density operators are identical with quantum states, which in turn are taken to describe—or e-represent—physical systems. Quantum states are not merely mathematical tools for prediction or inference; they are the fundamental physical reality described by quantum theory.

According to Wallace, quantum mechanics—understood through unitary dynamics and decoherence—describes a branching multiverse, where each term in a superposition corresponds to a distinct outcome in a continually splitting reality. The quantum state evolves unitarily in Hilbert space and thereby tracks the objective structure of this multiverse. Wave functions express quantum states in a strong sense, akin to how a sentence expresses a proposition: they reveal what the world is like. For Wallace, then, the quantum state is not a tool for regulating belief but a mirror of physical structure—it directly represents the E-world, the external natural environment.

This sharply contrasts with the irenic quantum pragmatist view, which declines to identify wave functions with quantum states, denies that quantum states must describe

reality, and avoids the metaphysical extravagance associated with a branching ontology. On the irenic account, wave functions *denote* quantum states—that is, they designate them without presuming that they either represent or express them. Quantum states are understood as abstract tools that play a normative, i-representational role: they guide rational credences and facilitate prediction. Crucially, this account does not commit to the view that quantum states represent or express the true structure of the world.

Whereas Wallace treats the quantum state as constitutively descriptive, the irenic view treats it as functionally prescriptive. For Wallace, quantum theory's success demands that quantum states e-represent physical systems—because only this, he argues, can explain how quantum theory introduces novel magnitudes, entities, and ontological commitments (a challenge taken up in the next section). For the irenic pragmatist, by contrast, the success of quantum theory can be understood entirely within a normative and inferential framework: quantum states are introduced because they license reliable predictions and guide expectation, not because they reveal the fundamental structure of the universe.

Wallace's insistence on e-representation carries significant epistemic risk. To endorse the Everettian picture is to commit to a highly speculative metaphysics—a universe of countless branching worlds that are, in principle, unobservable. The irenic pragmatist remains deliberately agnostic on such matters. From the irenic standpoint, one can respect the empirical adequacy of quantum theory without affirming Wallace's metaphysical commitments. The role of quantum states in practice—as part of a successful predictive apparatus—does not require that they be interpreted as real physical structures. If they function well as normative tools for guiding expectation, that alone suffices for their legitimacy within science.

In summary, Wallace's view adds a strong metaphysical thesis to the functional role of quantum theory: quantum states are real, intrinsic features of a branching multiverse. The irenic view rejects this thesis, arguing instead for a quietist minimalism that preserves the inferential, predictive, and epistemic utility of quantum states without taking a stand on their ultimate ontological status. As with Healey, Wallace's interpretation represents a

philosophically loaded elaboration beyond the common-ground core of irenic quantum pragmatism.

Wallace is explicit that denying this descriptive role to quantum states threatens our ability to account for the success of quantum theory. In particular, he argues that quantum states are indispensable in explaining the introduction of new physical magnitudes and theoretical entities that emerged during the development of quantum mechanics. Only by treating quantum states as genuinely representational, in a strong ontological sense, can we understand how quantum theory has extended the boundaries of our physical ontology.

This objection poses a serious challenge to pragmatist interpretations and is taken up directly in the next section.

| **Feature** | **Wallace (2012)** | **Healey (2022)** | **Irenic Quantum Pragmatism** |
|---|---|---|---|
| Ontology of Quantum States | Intrinsic physical properties (beables) | Extrinsically physical, ontic properties | No ontological commitment |
| Relationship to Formalism | Wave functions are quantum states | Quantum states may be represented by various mathematical objects | Wave functions denote quantum states (non-committal between expressing and representing them) |
| Representation | E-representational: quantum states describe physical reality | Representational in a modal, relational sense; not descriptive | i-representational only; semantic quietism on e-representation |
| Truth-Aptness | Yes, quantum states correspond to objective facts | Yes, state ascriptions are truth-apt relative to physical situations | No assertion; truth-aptness is optional and contestable |
| Function of Theory | Predictive and descriptive (e-representational) | Predictive with a limited role e-representational role | Normative and inferential; prescriptive and i-representational |
| Epistemic Risk | High: robust metaphysical commitments | Moderate: objective but relational | Low: no metaphysical risk; open-ended and pluralist |

**Figure 2.** Comparison of Views on the Nature of Quantum States

## 14 Wallace's Criticisms

This chapter concludes by addressing another important challenge for irenic quantum pragmatism—one that comes from David Wallace (2020), who contends that Healey's (2017) pragmatist approach—and, more broadly, all anti-representationalist interpretations of quantum theory—fail to adequately account for the introduction of novel scientific language and theoretical entities that emerged with the development of quantum mechanics.

In Chapter 1 of this dissertation, I began addressing Wallace's critique by distinguishing five possible sources for introducing new entities and magnitudes into scientific discourse. Of these, an irenic pragmatist can legitimately appeal to only three:

- **S1**: Observation or experiment unmediated by physical theory.
- **S2**: Observation or experiment mediated solely by classical theories.
- **S3**: Observation or experiment mediated by physical theories, including quantum theory.
- **S4**: Classical theories, from which entities and magnitudes—understood as beables—might be 'read off.'
- **S5**: Quantum theories, from which entities and magnitudes—understood as beables—might be 'read off.'

Irenic pragmatists accept S1, S2, and S4 as legitimate sources but refrain from invoking S3 and S5, which would require treating quantum theory as a basis for ontological commitment. Within these constraints, I examined a range of historically significant terms—such as *superconductivity*, *color charge*, *strangeness*, *quantum fields*, and the *Higgs field* in particular—and showed how each can be introduced in ways consistent with a pragmatist framework. These examples directly challenge Wallace's assertion that anti-representationalist accounts lack the conceptual resources to accommodate such language.

Nevertheless, a natural question arises: why assume that S1, S2, and S4 suffice to explain all cases of novel entities, properties, or phenomena? A representationalist might

argue that certain distinctively quantum phenomena—if such exist—can only be introduced through an S3- or S5-type pathway, in which quantum theory plays a direct representational and ontological role. If so, the irenic pragmatist may be unable to account for such phenomena without abandoning their agnostic stance.

A strong candidate for a 'distinctively quantum-mechanical phenomenon' is quark confinement. Unlike many quantum concepts that have classical analogs, quark confinement arises uniquely in quantum chromodynamics (QCD). In the corresponding classical Yang-Mills-Wong theory of strong interactions, the condition of color neutrality does not hold. This means that pragmatists cannot rely on classical theories (S4) to introduce the concept.

Could a pragmatist instead appeal to an experiment-based introduction story (S1 or S2) in such cases? The concern is that this may not always be possible. Yet, as it turns out, quark confinement can be handled in this way. As Thomson (2013, 248) notes:

> There is a wealth of experimental evidence for the existence of quarks. However, despite many experimental attempts to detect free quarks, which would be observed as fractionally charged particles, they have never been seen directly. The non-observation of free quarks is explained by the hypothesis of color confinement.

This hypothesis was introduced on the experimental basis of repeated failures to observe free quarks, particularly in deep inelastic scattering experiments, which warranted understanding protons as composite rather than fundamental particles. This suggests that we do not need a representationalist reading of quantum theory to account for the introduction of quarks or quark confinement.

Even if there were cases where only an S3- or S5-based introduction story were possible, a pragmatist need not be cornered. In instances of controversial reification, a pragmatist might invoke an error theory, according to which certain entities, magnitudes, or phenomena that some physicists attempt to refer to do not, in fact, correspond to real physical things. The core idea is straightforward:

- When a scientific community is divided over the ontological status of a given entity, some physicists must be mistaken ('in error').

- In cases of controversial ontological commitment—e.g., regarding the reality of the wave function or the many 'worlds' or 'minds' posited by Everettian interpretations—there is no consensus.
- Since physicists themselves disagree, it is reasonable for a pragmatist to remain noncommittal and appeal to an error theory.

However, a pragmatist cannot indiscriminately apply the error theory to *every* case of S3- or S5-based reification. Doing so would render the view unfalsifiable, insulating it from critique and thereby stalling philosophical progress.

A key question is how much disagreement among physicists suffices to justify invoking an error theory. A single dissenter in the physics community is not enough. By 'controversial', I mean cases where there is substantial disagreement among physicists about whether a given entity or property is real. While I cannot offer a sharp criterion for sufficiency, some cases are clear:

- The ontological status of the wave function remains controversial, warranting an error-theoretic approach.
- The ontological status of electrons and quarks, however, is not disputed in the same way—these concepts, understood as representing real entities, must be accounted for by the pragmatist rather than explained away.

Thus, when there is sufficient scientific controversy, an error-theoretic response remains a viable option for the pragmatist, since when there is controversy, at least once party has to be wrong, so alleging that the quantum representationalist is, seems reasonable.

The challenge for representationalists, then, is to identify an entity, magnitude, or process that (i) enjoys near-universal acceptance within the physics community as an element of physical reality (aside from a few fringe dissenters) and (ii) lacks any plausible S1-, S2-, or S4-based introduction story. If such a case could be established, it would provide a genuine obstacle to pragmatist readings of quantum theory which do not grant the theory an e-representational role in describing the physical systems to which it is applied.

In the next sections, I consider two potential counterexamples that might be raised against pragmatist accounts of quantum theory, in accordance with the above challenge.

## 13.1 Anticipating Potential Counterexamples

### 13.1.1 Quantum States

Consider claims about wave functions representing properties of physical systems, such as $\psi_1(\vec{x}, t)$ describing the location of a particle in a box, or $|\psi_2> = \frac{1}{\sqrt{2}}(|\uparrow>_z + |\downarrow>_z)$ representing the spin of a beam of electrons en route to a Stern-Gerlach apparatus. Physicists routinely say things like '$\psi_1$ represents the quantum state of the particle confined to a box' or '$\psi_2$ is the spin quantum state of the electrons'. Taken at face value, such statements seem to support the view that quantum theory introduces a new kind of entity—quantum states—that must be treated as physical properties or constituents of the world.

On this interpretation, the irenic quantum pragmatist appears to face a dilemma: either abandon their minimalist view or adopt an error theory about the language and practice of working physicists.

The irenic response is to treat quantum states as abstract mathematical objects—entities denoted by symbols such as $\psi_1$ and $\psi_2$—which function as normative tools within inferential practice. The irenic pragmatist can say quantum states are either (i) *expressed* or alternatively (ii) *represented* in an abstract, formal sense—what we might call '$\text{represent}_\text{a}$'[11]—by wave functions. However, the irenic pragmatist does not commit to quantum states being e-represented in a physical or ontological sense that would treat them as properties of physical systems or as entities located in, or constituting, the empirical world. On this front, the irenic pragmatist remains agnostic.

There is, then, a representational choice point. Multiple senses of 'representation' are clearly at play—semantic, physical, abstract (and, indeed, multiple variants within each of

[11] I include the subscipt 'a' on '$\text{represent}_\text{a}$' to differentiate this kind of representation, of *abstract* entities, from the kind of representation that pragmatists are committed to rejecting in the quantum case (i.e. mathematical representations of *physical* systems and their properties).

these categories)—and the irenic pragmatist must remain quietist about all but those variants compatible with their inferentialist and minimalist commitments. But does treating quantum states as abstract mathematical objects—while remaining agnostic about their physical status—put the irenic pragmatist at odds with the physics community, which frequently treats such states as if they refer to, or track, physical features of the world?

Some critics think so. They argue that treating quantum states as mere abstracta misrepresents the experimental practice and ontological assumptions of physicists. One critic frames the objection as follows:

> There is no problem taking the Greek letter psi to represent an abstract mathematical object (what Einstein called the psi-function). The problem arises if one goes on to take the psi-function to represent an abstract quantum state. Physicists say they prepare quantum states by carrying out physical operations. An abstract object like a psi-function is not susceptible to manipulation by any physical operation. Entangled states are not abstract objects but a valuable physical resource, and their production and control are significant experimental achievements. Mathematicians did not create irrational or transcendental numbers by physical means: they either discovered or created such abstract objects by their purely mental efforts.[12]

It is, I take it, uncontroversial that (i) physicists prepare physical systems via physical operations; (ii) these systems are assigned quantum states; (iii) certain systems are entangled, meaning they exhibit non-classical correlations across spacetime; and (iv) the entangled systems themselves are not abstract objects. However, the contradiction highlighted in the objection does not follow from these premises and therefore does not preclude understanding quantum states as abstract objects.

In preparing a physical system, the correct quantum state to be assigned is determined by which physical operations are used during the preparation procedure: if different physical operations were employed, a different quantum state would (in general) be appropriately assigned. By keeping the mathematical domain separate from the physical

[12] I thank an anonymous referee for raising this objection.

domain, it is possible to keep quantum states solely in the mathematical realm, from which different mathematical functions or operators are assigned to physical systems prepared differently.

The objector collapses the distinction between the mathematical and physical realms when asserting that physicists 'prepare quantum states by carrying out physical operations'. This claim equates the target physical system with the quantum state that is (correctly) assigned to it—relative to the situation of the assigning agent (see Healey 2022)—and thereby suggests that quantum states themselves are altered by physical interventions. But abstract objects, by definition, cannot be manipulated by physical means. If quantum states are abstracta, and yet subject to physical manipulation, we face a contradiction. This contradiction, however, is not forced upon us; it can be avoided if we (i) preserve the distinction between the mathematical and physical domains, and (ii) remain clear that what is actually prepared by physicists are physical systems (e.g., electrons with definite momenta or spin components along a given axis). Once prepared, these systems are then assigned a quantum state—a mathematical object selected in light of the preparation context.

The confusion arises when one assumes that the quantum state fully describes or represents the physical system itself, making it all too easy to slide—perhaps unwittingly—between mathematical and physical categories. But making this slide—asserting that physicists literally prepare quantum states—presupposes the very representationalist assumption at issue between representationalists and anti-representationalists in the interpretation of quantum theory. Worse still, it commits a category error by conflating *representings* with *representeds* (Brandom 1994, 2000), thus eroding the crucial distinction between the formal tools used in theory and the physical systems they are used to describe, model or predict.

### 13.1.2 The Higgs Boson

Consider next claims about Higgs bosons—for instance, that they are 'excitations' of the Higgs field or that they have a mass of about 125.35 GeV. As argued in Chapter 1, pragmatists can make sense of claims about Higgs (and other quantum) *fields* based on their

acquaintance with classical gauge theories. One option is to understand the Higgs field as a classical field, and 'quantization' as a mere mathematical process useful for arriving at a better instrument for prediction, or advice-generation. Alternatively, a pragmatist could try regarding quantum fields wholly instrumentally. But what about Higgs *bosons*? These cannot be understood as 'excitations' of quantum fields understood *instrumentally*, since mathematical instruments cannot 'give rise to' particles (though they may be used to make predictions about those particles if we antecedently have reason for accepting them into our ontologies). The case for understanding Higgs fields as classical fields would not seem to fare much better, since it is never (so far as I am aware) claimed that certain particles are 'excitations' of *classical* fields (S4). So it seems that the best bet for a pragmatist is to try to construct an introduction-story for Higgs bosons by analyzing the experimental particle physics tradition at the Large Hadron Collider at CERN which led to the announcement of the discovery of the Higgs boson in 2012, and seeing if it is plausible to account for its discovery in purely *non-quantum* terms (S1, S2).

A potential problem for pragmatists about quantum theory when it comes to introducing the Higgs boson is that when Higgs particles are created, they usually subsequently decay too quickly for decoherence to occur, and thus for magnitude claims about the Higgs boson to even count as meaningful on a pragmatist view. This is because, at least on Healey's account, magnitude claims about a target system only count as significant when sufficient environment-induced decoherence has occurred rendering the density operator assigned to the system approximately diagonal when written in a preferred basis. Consequently, quantum theory (on the pragmatist perspective) would not seem to have the resources to grant significance to magnitude claims about Higgs boson decay processes that occur more rapidly than the decoherence time scale. A Healey-type pragmatist might seem to have to say that experimentalists making claims about these processes are 'in error' when making such claims, since quantum theory *à la* Healey does not license them. But this would be an unreasonable application of the error theory and would cast pragmatism in serious doubt.

Yet a pragmatist need not appeal to the error theory here. For the experimental particle physics tradition at the Large Hadron Collider *does* entitle us to make claims about the Higgs boson and its various decay modes, and so a pragmatist can appeal to *that* tradition in accounting for such claims. More specifically, a pragmatist could appeal, for instance, to an analysis such as Khachatryan et al. 2015 (CMS Collaboration) in giving an introduction-story for the Higgs boson. Working in the experimental tradition at CERN, this collaboration set limits on the Higgs boson lifetime and width from its decay into four charged leptons. Their whole discussion seems to presuppose that a Higgs particle was produced in a localized event and that it maintained its identity while following a short trajectory before decaying into four charged leptons. At no point does the collaboration appeal to representational elements of models of quantum theory to warrant their claims about the *detected* Higgs boson's lifetime and flight distance inside the CMS detector. And so, in order to comprehend their paper and claims about the Higgs boson in particular, one need not embrace a representationalist semantics. The field theory involved in their analysis is simply field theory *itself*, not field theory *as-interpreted* by Wallace (who endorses semantic representationalism) or Healey (who endorses semantic inferentialism). Both pragmatists and representationalists alike can comprehend the claims made by experimental collaborations such as CMS and ATLAS at CERN—they just construe these claims via different semantic theories. It is emphatically *not* the case that pragmatists must express puzzlement every time the term 'Higgs boson' is uttered.

The experimental traditions at CERN should be understood as alternative modelling traditions which *warrant* claims about Higgs bosons and their decay processes, including those that occur more rapidly than the decoherence time scale. For these cases, quantum theory (understood from the pragmatist perspective) should be understood as 'silent', not as issuing conflicting claims with the experimental tradition. That is, for Higgs boson decay processes that occur too quickly for sufficient environment-based decoherence to occur, a pragmatist should understand quantum theory not as telling us that magnitude claims about the Higgs in these cases are meaningless, just that applying quantum theory in these cases to generate Born probabilities (expectation values, etc.) is not warranted. So, one can accept

quantum theory *and* the claims made by experimental particle physicists at the Large Hadron Collider, for they are not making contradictory claims.

Ultimately, what we want to account for is our most up-to-date understanding of the physical world. To do so a pragmatist must recognize distinct and at least partially independent traditions, namely theoretical quantum physics, which deploys quantum theory to entitle various claims and explain various phenomena, and the experimental traditions in physics, such as those at the Large Hadron Collider at CERN, which entitle other claims. These alternative modelling traditions' results often reinforce those coming from the theoretical tradition; but their results, at other times, should be viewed as standing on their own feet—and not ultimately grounded in or explainable by quantum theory. When integrated together, these traditions give the full story of our current understanding of the physical world.

I further contend that this *patchwork-style* narrative is precisely the type of story we should expect, given the current state of progress in physics. The pragmatist-friendly patchwork view outlined above provides exactly what we seek: a coherent account of our most up-to-date physical knowledge. To insist that all physical knowledge must be grounded in, reducible to, or explicable by quantum theory alone would be to treat quantum theory as if it were a fundamental, candidate *final* theory. However, this demand is unreasonable, since we know that quantum theory is not an all-encompassing, fundamental theory. For example, it is well established that quantum theory does not account for gravitational effects—for these, we must turn to General Relativity, which must also be included in the patchwork of our current understanding of the universe.

What we seek, as philosophers of science, is an account that does justice to the full tradition of successful quantum physics—not necessarily one that renders this tradition recoverable, reducible, or explainable in terms of quantum theory alone. To require that an interpretation of quantum theory be able to warrant knowledge generated from all domains of physics, across all modeling traditions—both theoretical and experimental—is neither necessary nor reasonable.

## 14 Conclusion

This chapter has developed and defended irenic pragmatism as a conciliatory framework for understanding language, representation, and reality from a neo-pragmatist perspective. Building on the insights of Price and Brandom while avoiding the radicalism of Rorty, I have sought to articulate a common-ground position that accommodates both inferentialist and representationalist perspectives without committing to the controversial assumptions of either. By building on and elaborating Price's distinctions between i-representation and e-representation, the i-world and e-world, and introducing novel distinctions between i-facts and e-facts—along with the uppercase counterparts of these distinctions—I have constructed a pragmatist framework that clarifies the roles our linguistic practices play while maintaining a quietist stance on the nature of semantic content and other contentious metaphysical issues.

Applying this framework to quantum mechanics yields an interpretation—irenic *quantum* pragmatism—that navigates between representationalist and anti-representationalist approaches to the theory. It recognizes the i-representational function of quantum state assignments while remaining agnostic about their e-representational role. This stance offers a response to the measurement problem while avoiding ontological commitments that extend beyond the empirical and predictive success of the theory. By distinguishing between the prescriptive and descriptive aspects of confirmation, it provides a way of understanding how quantum theory informs belief without presupposing that it e-represents physical reality.

Building on previous work, I further demonstrated how a pragmatist can account for novel scientific language—quarks and quark confinement, quantum states, and the Higgs boson—without treating quantum theory e-representationally. This challenges the assumption that theoretical innovations in physics require semantic representationalism, instead showing how they can be understood through a minimal pragmatist inferentialism developed above.

In sum, irenic pragmatism offers a middle path that respects the pragmatic dimensions of scientific inquiry while remaining open to multiple interpretative possibilities.

By remaining neutral on deep ontological commitments, it provides a philosophical framework that is both rigorous and adaptable—capable of accommodating scientific progress without prematurely endorsing speculative metaphysical assumptions, whether those of Everettian interpretations, Bohmian mechanics, or spontaneous-collapse theories, or the anti-metaphysical rejections typical of anti-representationalist approaches such as Healey's.

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