

# A Phenomenological 4E Eliminative Materialism: Consciousness as Neuromuscular Adaptation “In Virtue of Which” Movement Affordances are Disclosed

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## Abstract

Traditional eliminative materialism has argued that folk-psychological constructs such as belief, desire, or sensation do not correspond to scientifically-real entities. However, eliminativist writing discourse has mostly focused on a purely brain-centered model, with limited clarity on how bodily and environmental factors fit into an ontologically radical perception of the mind. This paper proposes a *phenomenological 4E eliminative materialism*, drawing on both Rowlands’ arguments for extended, embodied cognition as well as my own focus on neuromuscular adaptation as the basis of consciousness. I argue that “consciousness” should be understood not as mental content but as a fully material phenomenon, realized in the evolving, body-plus-environment synergy “in virtue of which” affordances are disclosed. This perspective dissolves the distinction between “mind” and “body” and even between “brain” and the “rest of the body,” as all cognitive processes rely on bodily structures beyond the brain. The novelty is twofold: (1) consciousness is not “that of which” we are aware, but “that in virtue of which” world-directed actions and perceptions emerge, physically constituted by new neuromuscular dispositions stemming from repeated engagement; and (2) this integrative approach fully eliminates talk of “mental states,” demonstrating that all cognition—and therefore all consciousness—extends beyond the brain. In doing so, it strengthens responses to common eliminativist objections, including self-refutation, by obviating the need for an internal “belief state” behind actions or assertions.

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## 1. Introduction

Eliminative materialism asserts that many, if not all, folk-psychological concepts—belief, desire, sensation, qualia—lack real-world correlates and will ultimately disappear from a fully mature scientific ontology of mind (Churchland, 1981; Cornman, 1968; Ramsey, 2020). According to standard formulations, mental-state discourse will be replaced by more empirically-adequate notions, often presumed to be drawn from neuroscience. Accordingly, the emphasis frequently rests on *internal* neural processes that may or may not justify folk categories (Feyerabend, 1963; Quine, 1960; Rorty, 1965).

However, in an era of so-called *4E cognition*—the view that cognition is embodied, embedded, enactive, and extended—philosophers and cognitive scientists have increasingly argued that intelligence is not confined to the brain. As Rowlands emphasizes,

“Some (not all, by any means, but some) cognitive processes are partly... made up of processes whereby an individual operates on (typically, manipulates, transforms, and/or exploits) structures in its environment” (2010, p. 2).

Going beyond mere “internal representation,” Rowlands (1995, 1999, 2006, 2010) contends that fundamental cognitive activities can incorporate bodily and external elements. This approach resonates with my own stance (Leyva, 2018a, 2018b, 2021), which frames consciousness as a physical, neuromuscular adaptation shaped by repeated contact with environmental demands. I propose that, consciousness is not an inner mental possession, but a dynamic, world-disclosing synergy of a living body adapting physically to new affordances.

The novelty lies in two key points:

1. Consciousness is not “that of which” we are aware, but “that in virtue of which” the world reveals affordances for action—a fully material process rooted in neuromuscular transformations.
2. All cognition—and indeed all consciousness—depends on bodily structures beyond the brain; there is no purely “in-the-head” mental process. Consequently, if eliminativism is correct that folk mental states do not exist, then *any* claim that inside-the-head states are “the real seat of mind” is equally mistaken.

This paper elucidates how the proposed 4E eliminative model clarifies and strengthens responses to familiar objections (like self-refutation), explains movement-based learning (as exemplified by dynamic visual acuity in baseball players), and dissolves the dualities that have long plagued mind-body debates. I draw explicitly on Rowlands’ (2010) notion of *transcendental modes of presentation* to demonstrate how consciousness is the integrated physical condition *in virtue of which* an organism’s environment appears as actionable, not a separate mental entity.

## 2. Classic Eliminative Materialism and its Limitations

Eliminative materialism emerged from mid-20th-century debates about whether standard mental concepts—belief, desire, sensation, pain—correspond to anything in the actual workings of cognition (Churchland, 1981; Feyerabend, 1963; Rorty, 1965). Advocates typically argue that (a) folk psychology constitutes a defective or false theory, and (b) future science will eliminate, rather than reduce it (Lycan and Pappas, 1972; Ramsey, 2020). The standard view is that these mental constructs have *no place* in the final account, much like how “demonic possession” has no place in medical science.

However, many older treatments remain neurocentric, supposing that if folk mental states are eliminated, they must be replaced by discussions of “neural patterns,” “brain states,” or “functional roles” within the head (Churchland, 1981). This leaves the role of the body and environment in shaping cognition ambiguous. Furthermore, critics accuse eliminativists of overlooking lived experience or failing to clarify how consciousness could be real if mental states are illusionary (Dennett, 1978; Frankish, 2016; Rey, 1988).

4E approaches broaden the conceptual horizon, contending that cognition unfolds not just within the brain, but in concert with the body and world (Brooks, 1991; Chemero, 2009). Rowlands (1999, 2010) and others have argued for “extended mind,” “enactive perception,” or “embodied phenomenology.” However, these 4E frameworks are not always framed in explicitly eliminativist terms; some authors remain open to representational content or mental states. This gap invites an explicitly eliminativist 4E approach, which is precisely what I propose.

My stance (Leyva, 2018a, 2018b, 2021) is that the entire “mental realm,” including consciousness, can be accounted for through neuromuscular plasticity and sensorimotor coupling, thereby eliminating the notion of separate mental states. Consciousness is entirely material, a “transcendental condition” physically realized through the interplay of body and environment.

## 3. Rowlands’s Phenomenological 4E Model: Disclosure and the Transcendental Mode

Rowlands develops an argument for extended and embodied cognition grounded in the phenomenon of *intentionality*—the “aboutness” or “directedness” that characterizes mental life. Rowlands (2010, pp. 163–187) adapts a classical three-part model of intentionality (act, object, mode of presentation), highlighting an ambiguity in “mode of presentation.” It can mean either:

- Empirical mode of presentation (aspect): The features under which an object is presented (e.g., an apple’s greenness).

- Transcendental mode of presentation: “That in virtue of which” an object is presented under certain aspects in the first place—the *core* of directedness.

Rowlands argues that the *empirical mode of presentation* is itself an intentional object (like “greenness”), while the *transcendental mode* cannot be an object. Instead, it is the *disclosing activity* that makes certain aspects visible or salient to the agent. If we mistake the transcendental mode for an object, we risk an infinite regress: each aspect would require another to present it, ad infinitum.

Rowlands then asserts that this disclosing or revealing activity often involves processes outside the agent’s head, as illustrated by his example of a blind person’s cane:

“Where does this disclosing activity take place? ... [I]t straddles neural processes, extra-neural bodily processes, and things the blind person does in and to the world around him or her... so that the phenomenology of experience passes all the way through the cane to the object.” (2010, p. 70, italics removed)

Therefore, *intentional directedness* (the hallmark of “mind”) may be realized through extended bodily–environment couplings. On a narrower reading, this could be interpreted as “some but not all cognitive processes extend.” I argue (and Rowlands strongly hints) that *all or nearly all conscious processes* plausibly involve body–world interplay. If so, references to “internal mental states” become superfluous.

#### 4. My Proposal: Neuromuscular 4E Eliminative Materialism

Building on Rowlands’s distinction, I contend that consciousness is best understood as *the entire bodily–environmental synergy by which “empirical aspects” appear*. Far from being an intangible mental essence, it is a physical neuromuscular adaptation shaped by experience. In Leyva (2018a, 2018b, 2021), I highlight that repeated training—such as an athlete refining motor skills—reveals new affordances in the environment through bodily transformations, not as a result of internal beliefs or representational states.

##### 4.1 “Consciousness” as “In Virtue of Which” we Disclose Movement Affordances

A core novelty of my approach is reorienting consciousness away from the introspectively-positing “that of which I am aware.” Instead, consciousness is “that *in virtue of which* I become aware of something.” In the domain of movement:

- When a baseball player's dynamic visual acuity (DVA) improves through repeated batting practice, the world literally appears different: a 95-mph fastball is disclosed as *hittable*.
- This "hittability" is an *empirical mode* or aspect. But *in virtue of what* is it disclosed? Not by a hidden mental belief. Instead, it is disclosed by a set of new neuromuscular dispositions—improved eye-muscle responses, refined trunk rotation, and better predictive timing.
- These physical changes serve as a *transcendental mode of presentation*, the condition by virtue of which the ball's motion is seen as affording a swing.

I (Leyva, 2018a, 2018b) demonstrate how skill acquisition in sports often involves measured neuromuscular plasticity, which leads to new action possibilities. Through repetition, the athletes' structure is permanently altered, enabling them to perceive (and act upon) opportunities that non-athletes do not. This phenomenon neither references nor requires separate mental states. The plastic, body-wide adaptation *is* the relevant "consciousness."

## 4.2 Eliminating the Inside–Outside Brain Divide

Standard 4E cognition contends that "some cognition is extended." I further claim that all conscious cognition requires bodily structures that cannot be purely "mental." We typically do not confine players' skill or consciousness to neural circuits alone: their posture, strength, stance, ocular reflexes, etc. are integral. Therefore, there is no distinct inside–outside distinction. The "brain vs. environment" split disappears because the body is wholly implicated, dissolving the premise "some processes are purely in the head." If baseball players' conscious perception of a pitch's trajectory is realized through foot positioning, shoulder rotation, and eye-muscle synergy, isolating "the mental part" from those bodily dispositions becomes impossible.

Therefore, my brand of eliminativism rejects both mental-state talk *and* the notion that cognition can be localized solely in the brain. Even classical "brain-bound" eliminativism likely preserves an inside–outside boundary at the neural/extra-neural interface. I argue that boundary cannot serve as a marker for what is or is not "cognitive." All conscious processes necessarily engage environmental interactions and bodily adaptation.

## 4.3 Why This Is Eliminative

One might ask: if my view acknowledges "experience," is it truly eliminativist? It is, because it denies the existence of folk-psychological mental states. Concepts such as *belief* or *desire* do not identify discrete entities. The body's integrated synergy with the world is not a mental

state but an extensive physical dynamic. The upshot is that we do not reduce beliefs to brain states; we disclaim them altogether. We replace them with a talk of neuromuscular transformations plus environmental couplings that yield new affordances (Leyva, 2018a, 2021).

## 5. Strengthening Eliminativist Responses to Objections

Adopting this *phenomenological 4E eliminative* approach helps clarify or strengthen standard eliminativist responses to major objections.

### 5.1 Self-Refutation Objection

Critics argue that eliminativists must “believe” their own thesis to assert it, thereby presupposing the existence of beliefs (Boghossian, 1991). However, in my approach, assertion is merely a bodily-linguistic act emerging from learned dispositions—requiring no mental state. If consciousness is always a neuromuscular adaptation, then speech or writing result from sensorimotor engagements, rather than internal beliefs. As Rowlands (2010) suggests, the ability to produce specific discourse tokens can be explained through external manipulative processes integrated with neural processes, bypassing the folk concept of “belief.”

This is arguably more persuasive than earlier versions of the response. By emphasizing that *all cognition is integrated with bodily-environment synergy*, I demonstrate that “assertion” is a form of bodily-linguistic coupling, acquired through repetition. No “belief state” is needed to account for how eliminativists articulate their thesis. Therefore, the self-refutation charge collapses.

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### 5.2 Folk Psychology’s Alleged Success

Many accuse eliminativists of overlooking how effectively we predict and explain behavior using belief-desire language. However, if, as I argue, we truly navigate by interpreting bodily dispositions, context, and prior plastic adaptations, then this success stems from overlapping bodily couplings, rather than the literal truth of statements like “He believes X” (Horgan and Woodward, 1985). I clarify that we can coordinate actions (like a baseball team planning a play) by referencing each other’s stances, eye cues, micropractices, and so on, without needing intangible mental states.

### 5.3 Consciousness: Not Eliminated but Recast

Another concern is that eliminativists occasionally “throw the baby out with the bathwater” by denying consciousness. My 4E approach does



not deny phenomena. I preserve “consciousness” as a label for the integrated act “in virtue of which” a world of affordances is disclosed. However, it is not a mental state, but a physically-realized synergy. The folk notion of introspecting intangible mental objects is abandoned, instead emphasizing the body’s continuous adaptation so that baseball players see the pitch, dancers feel the floor, or climbers sense the rock face. The phenomenon remains real, but the folk concept of “inner mental experience” is discarded as misleading.

## 6. Baseball, Dynamic Visual Acuity, and Ongoing Plasticity

To illustrate how this model works, consider my (Leyva, 2018a, 2018b, 2021) DVA analysis in professional baseball. Hitting a 95-mph fastball demands microsecond-level coordination among eye muscles, trunk posture, and motor planning. Through repeated drills, players develop improved ocular tracking, making the environment literally more “hittable,” not because they “believe they can do it,” but neuromuscular changes have reshaped the entire sensorimotor loop (Uchida et al., 2013, in certain empirical contexts).

Here, “consciousness” is the real-time synergy—emerging from months or years of training—that reveals the incoming pitch as “affording a well-timed swing.” This synergy encompasses the arms, eyes, stance, environmental cues, and the neuronal architecture that coordinates them. If folk psychology suggests, “He sees the ball and decides to swing,” it may be heuristically convenient but ontologically misleading. My approach eliminates references to “decision,” “belief,” or “desire.” The relevant phenomenon is purely physical: an integrated system shaped by repeated practice, where the ball is disclosed as “swingable.”

### 6.1 Ongoing Plasticity and Extended Consciousness

Each time the player trains, bodily dispositions evolve, fostering new ways of perceiving further nuances—e.g., the pitch’s spin, the pitcher’s release angle. In each case, the environment is re-disclosed as offering new micro-affordances. The “consciousness” of the play deepens, but only in the sense that the integrated body perceives new aspects. There is no “internal content” derived from a mental state. The synergy is wholly external+internal, inseparably.

Therefore, every “conscious” moment is the real-time manifestation of a larger, extended plastic system. This highlights the second novelty of my argument: not only that *some* cognition extends beyond the brain (Rowlands, 2010), but that *all conscious processes involve body and environment* in a non-optional sense. We never encounter purely intracranial consciousness, if we define consciousness as the condition “in virtue of which” the environment is revealed for action.

## 7. Evolutionary and Pragmatic Merits: Survival, Reproduction, Well-Being

The final perspective concerns evolutionary advantage. If consciousness is a body–environment synergy that reveals crucial affordances—such as food sources, predators, mates, social cues—then its existence can be explained by the adaptive value of flexible neuromuscular plasticity. Over evolutionary time, organisms that effectively remodel their bodily structures in response to environmental challenges survive and reproduce more successfully (Churchland, 1993; Leyva, 2018a). No ephemeral mental states are required. The entire “mental dimension” transforms into a physical dimension of plastic responsiveness.

From a well-being perspective, as an agent refines these couplings, it experiences fewer “failures to act appropriately,” thus reducing stress, injury, or confusion. This can be understood as a thorough integration of “consciousness” with a physically-realized sense of skillful coping—similar to Merleau-Ponty’s notion of the body’s “maximum grip” on the environment, except that it is now embedded in an eliminativist framework that denies separate mental entities.

## 8. Concluding Synthesis

Eliminative materialism traditionally contends that discussions of mental states is scientifically suspect. Phenomenological 4E cognition, as exemplified by Rowlands, emphasizes that cognitive processes often extend beyond the brain into bodily–environment actions. I combine these two lines of thought with my own accounts of neuromuscular adaptation (Leyva, 2018a, 2018b, 2021) to articulate a phenomenological 4E eliminativism that perceives consciousness as the physically-realized, body-wide synergy “in virtue of which” the environment is disclosed as affording action.

The upshot includes:

1. Consciousness is not “that of which we are aware” but rather “that in virtue of which” we become aware of movement possibilities (affordances).
2. This “in virtue of which” refers to new bodily–behavioral dispositions, systematically ingrained through repeated interactions with the environment. The baseball player’s improved dynamic visual acuity is an iconic example.
3. The entire phenomenon is purely physical because these bodily transformations extend beyond the brain and cannot be classified as “mental states.”
4. Consequently, folk–psychological mental-state talk can be discarded altogether. Our notion of the “mind” dissolves into integrative neuromuscular–environment couplings.



This stance effectively addresses the challenges faced by eliminative materialism. It demonstrates how the self-refutation objection misfires since no “belief” is needed to assert eliminativism. It also elucidates “success” in predicting others’ behaviors through shared bodily–environment couplings, rather than through literal mental-state attributions. Furthermore, it redefines “consciousness” so that it is not eliminated as a phenomenon, but is reinterpreted in fully physical terms, aligning with Rowlands’s transcendental/empirical distinction.

The biggest novelty, then, is that the 4E idea that some cognitive processes occur in body/world structures is upgraded to a total claim: *all* conscious processes incorporate bodily structures beyond the brain, so there is no inside–outside boundary line for the mind. This yields a thoroughgoing eliminativism: if the mind is not in the head, and talk of intangible mental states is unfounded, “mental states” can be eliminated from ontology. In its place, a material unity of brain, body, and environment remains, revealing movement affordances.

Essentially, consciousness—once the “holy grail” for mind–body debates—transforms into an emergent function of extended plastic engagement. “Phenomenological 4E eliminative materialism” can be perceived as a coherent and empirically grounded perspective that overcomes the dualities embedded in older mind–body conceptions. No leftover mental residue remains. The entire conceptual framework for cognition is replaced by a model where the dynamically-adapting body discloses the world.

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