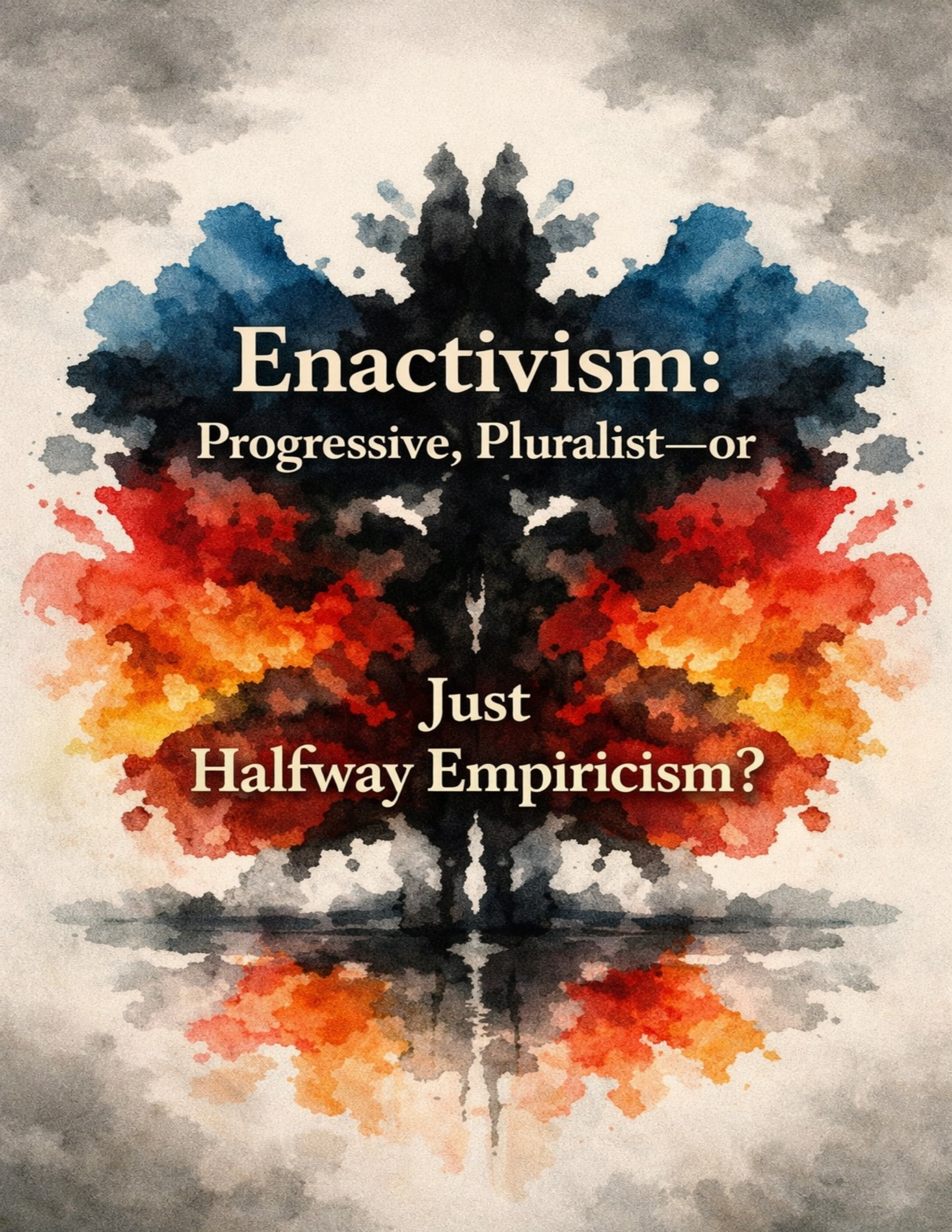

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Progressive, Pluralist—or Just Halfway Empiricism?

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Enactivism: Progressive, Pluralist—or Just Halfway Empiricism?

Matthew Crippen[1]

Abstract

Despite historical shifts, "science" has consistently meant epistemic authority, perhaps leading enactivists to cast their work accordingly. Yet enactivism sits uneasily with Popperian falsifiability, Kuhnian paradigm shifts, Hempel's standards, and other philosophy of science benchmarks, but does better under Lakatos. Lakatos's model holds that progressive science preserves a hardcore of principles by fiat, aligning with enactivism's reliance on non-negotiable grounding tenets. However, Lakatos also requires testing that generates anomalies and yields novel predictions, exemplified by the postulation and discovery of a new planet to protect Newtonian mechanics. Enactivism struggles on this second step, sometimes ignoring anomalies, as with representational additions to Brooks's robotics, or else engaging in what William James calls halfway empiricism—which definitionally pre-empts alternatives to maintain positions despite, rather than because of, evidence. James anticipates Feyerabend's pluralism and his claim that scientific ideals—unified method, neutral observation, cumulative progress, and empirical fit—rarely match practices. From this angle, enactivism might count as a science, albeit only with diluted epistemic authority. James and Feyerabend offer an additional lesson: logical consistency matters in simple cases like rejecting "square circles," but it is not obvious that the complexities of mind are explicable by a single, internally consistent theory.

Keywords

cognitive science, enactivism, Imre Lakatos, Paul Feyerabend and philosophy of science, progressive research programs, William James, radical and halfway empiricism

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Introduction

Shifting meanings of "science" complicate whether enactivism qualifies as such. The diversity of enactivist frameworks adds further uncertainty. This article assesses enactivism through various philosophy of science lenses while questioning their suitability for evaluating theories of mind.

Now, valuable perspectives need not be scientific, as with legal or moral frames. So, do enactivists have a stake in calling their work scientific? One suspects so. The term "scientist" as a designation for those who investigate material nature was coined by William Whewell at Samuel Coleridge's prompting in the 1830s. Before then, "science"—from Latin *scientia* for "knowledge"—meant "systematic and orderly thinking about a determinate subject-matter" (Collingwood, 1940, p. 4). Across eras, the word and its close cognates have identified fields of inquiry held in high esteem. For example, when Christianity became dominant, its theology became a science. Then, when systematic and experimental observation of physical nature became the preferred mode of inquiry, the approach gained status as science.

Which philosophy of science frameworks helpfully evaluate the status of enactivism? Hempel's (1942) deductive-nomological model is too rigid for the mind sciences, as it subsumes explanations under general laws. Another measure is uptake in the scientific community (Hull, 1988; Merton, 1957), and enactivism fares badly—unless one circularly counts its adoption by enactive cognitive scientists themselves. Setting aside, for now, debates about whether enactivism is falsifiable, Popper's (1934/1959) perspective fits poorly, given the limited empirical testing. While enactivists have aggrandized themselves as scientific revolutionaries (e.g., Hutto & Myin, 2013, 2017), Kuhn's (1962) outlook does not apply, as none have

[1]Department of Global Studies, Pusan National University, Busan, Republic of Korea

Corresponding Author:
Matthew Crippen, Department of Global Studies, Pusan National University, Busandaehag-ro 63beon-gil 2, Busan 43241, Republic of Korea.
Email: matthewjcrippen@gmail.com

instigated a paradigm shift. However, Lakatos (1978), in a posthumous volume of previously published essays, offers an intermediary position between Popper and Kuhn that might provide a defense of enactivism as science. His model may also counter an objection raised against enactivism: that it veers into what William James criticizes as halfway empiricism (Crippen, 2025a).

For James (e.g., 1897, pp. vi-viii), halfway empiricism arises when positions are upheld regardless of evidence. A neurobiologist might, for instance, definitionally equate cognition to brain-based representations, dismissing enactivist claims irrespective of data. Conversely, an enactivist might disqualify allegedly decoupled dream states as bona fide experience, preempting neurocorrelate accounts (see Noë, 2007). However, Lakatos (1978) offers a partial defense. He notes that (1) successful scientific agendas maintain a hardcore of foundational theses treated as temporarily immune to refutation and (2) that this core generates surprising predictions, leading to empirical anomalies—addressed in a more flexible outer protective belt. A program is progressive when the belt resolves anomalies through interesting, corroborated predictions—as when proposing then discovering neutrinos to preserve energy conservation (p. 82), or positing Neptune to explain orbital irregularities while retaining Newton's core principles (p. 179). By contrast, a program falls into degenerative stagnation when anomalies are met with ad hoc fixes that protect the hardcore without generating novel, science-advancing predictions.

A problem with enactivism's scientific status from this perspective is its lack of a protective belt where empirical testing occurs, leaving few anomalies, thus little opportunity to satisfy Lakatos's (1978) criteria for a progressive program. Granted, some (e.g., van Es, 2023) argue that enactivism builds on and contributes to empirical science. Yet the former does not by itself make a pursuit scientific; instances of the latter are sparse; and by either or both standards, traditions like phenomenology or pragmatism would likewise qualify.

Another issue is that enactivists cite outdated empirical work to undercut representational models, notably Brooks' decades-old research on situated robotics. This ignores Brooks' assertion that his program hit a wall as well as his teams' subsequent use of representational models (Ackerman & Guizzo, 2015; Brooks & Thompson, 2016; Lluvia et al., 2021). In other words, rather than treating such developments as anomalies demanding generative explanatory proposals, the tendency has been to sidestep them.

Does this suggest that enactivism is a static or degenerating program in Lakatos's sense? One alternative is that unificationist accounts of science (e.g., Friedman, 1974; Kitcher, 1989)—which roughly parallel Lakatos's notion of a protected hardcore—may themselves be ill-suited for studying the mind. James (e.g., 1884, 1907, 1909) argued in this direction, anticipating Feyerabend (1993, 1999), who was trained in physics and deeply versed in the history of science and philosophy. As he emphasized, scientific ideals—unified method, value-neutral observation, cumulative progress, and tight empirical fit—rarely match actual practices. From his perspective, enactivism could qualify as science. But if Feyerabend undercuts the epistemic authority of science, would there still be a stake in seeking the designation?

Regarding halfway empiricism, it is worth distinguishing definitional clarifications that allay confusions from those that pre-emptively exclude opposing positions. Where enactivism inclines toward the latter, it risks undermining the very pluralism arguably required for progress in domains as multifaceted as mind—particularly given that simpler fields, such as physics, remain far from unified. Logical consistency matters in basic cases, like rejecting "square circles," but the complexities of mind may not be explicable by any single, internally consistent theory.

Halfway Empiricism?

While Lakatos and Feyerabend offer different assessments of science, both adopt historical approaches—and before Lakatos's untimely death, they planned a joint volume, *For and Against Method*. In that spirit, this article is dialectical. It begins with a Jamesian challenge to enactivism's scientific status, reinforced by Feyerabend, then turns to a Lakatosian reply that both partially vindicates and critiques enactivism's scientific self-presentation. Finally, James's and Feyerabend's pluralism are offered as a possible response to Lakatos—one enactivists may find unsatisfying if they seek epistemic authority by calling their work "scientific."

James's views evolved over his life (1878a, 1878b, 1879a, 1879b, 1880, 1890a, 1890b, 1895, 1904, 1907, 1909), but he consistently rejected British empiricism's atomism. This was even after adopting the radical empiricist label. Though opposed to mind-matter dichotomies—and monistic in that sense—radical empiricism remains pluralistic, describing a multiverse comprised of many non-interacting and perhaps contradictory realities. The view rejects all-encompassing theoretical commitments and holds that whatever appears in experience is legitimate empirical data—that nothing should be ruled out in advance as unworthy of study. In contrast, what James castigated as halfway empiricism stipulates a position not because of evidence, but regardless of it.

James's pluralism ties to his critique of neo-Lamarckian British empiricists, who treated organisms as direct products of environmental impressions. He instead favored Darwinian indirect adaptation—variation and selection as independent processes—a view reflected in his theories of mind and knowledge. Here, a setting supplies sensory variation that selective attention subsequently sculpts. Without selection, the mind would be overwhelmed or pushed into contradiction, as in attempting to perceive both orientations of a Necker cube concurrently. Beliefs may also arise spontaneously and be retained or abandoned based on their utility in the world. James added that beliefs guide attention and action, that willingness to act measures conviction, and that action produces consequences capable of supporting, refuting, or reshaping beliefs. Absent monistic commitments, beliefs are tested piecemeal through action and its effects, yielding multiple, non-reducible paths to empirical confirmation—and thus mosaic realities marked by excess over any single theoretical or methodical ordering.

Similar to James, Feyerabend (1999) observes that Western traditions have often privileged generalities over particulars, leading scientists to insist that things must be other than they empirically appear when in conflict with favored standpoints. This need not amount to halfway empiricism if it is acknowledged that inquiry confronts heterogeneous processes that no single theory can capture. For Feyerabend, the success of technologies such as aircrafts and smartphones does not vindicate a unified vision of nature, since each of these achievements arose from diverse models and techniques. He stresses that scientists are "embedded in constantly changing physical and social surroundings." They use "ideas," "actions," and "equipment," for example, "to manufacture, first, metaphysical atoms, then, crude physical atoms." Finally, scientists fabricate "complex systems of elementary particles out of a material that did not contain these elements but could be shaped into them," as when light appears as waves or particles depending on the experimental setup. Accordingly, "scientists are sculptors of reality," not discoverers of a ready-made world (p. 144), an idea that resonates with enactivism. Or in James (1878a, p. 17) words: "the knower is an actor" who does not encounter an "order … simply existing," but instead registers what "he helps to create." A corollary is that perceptual and cognitive apparatus serve as problem-negotiating tools, akin to instruments such as shovels or subway maps, which either do not mirror the world or are functional by virtue of not doing so in an exact way (Crippen, 2017, 2025b).

Feyerabend (1993, 1999) and (James 1879a, 1879b, 1895, 1902, 1904, 1909) converge in several further respects. Both emphasize the historical contingency and richness of explanatory narratives, and warn against the premature dismissal of alternatives—a concern central to James's critique of halfway empiricism. Both also argue that values shape facts, as when professional interests influence what counts as evidence, or when a community classifies a rampaging buffalo as dangerous (Crippen, 2023). Finally, Feyerabend (1999) and James (1878b, p. 244) explicitly declare metaphysics unavoidable but advise that it be kept within limits. For example, a metaphysics of strict causality is productive in Newtonian physics but of uncertain status in quantum mechanics. When applied rigidly or universally, however, metaphysical commitments can exclude alternatives by redefining what counts as admissible fact. Feyerabend criticizes this as methodological protectionism; James as halfway empiricism—that is, holding a position regardless of evidence rather than because of it.

Against this background, it is useful to distinguish bad from halfway empiricism, with enactivist literature supplying illustrations of the former. Noë (2004, p. 112), subscribing to the slogan "get outside the brain," repeated by Thompson (2014), minimizes neural involvement by claiming—without empirical support—that sensory substitution devices do not activate the visual cortices. Yet an endnote concedes the involvement of the occipital lobes, not noting that this area houses the visual cortices. Varela and colleagues (1991) use a kitten experiment—where some were placed in a cart pulled by others in an illuminated venue for a few hours daily—to claim that vision is learned through sensorimotor engagement. They report that those in the confined condition "behaved as if they were blind" (p. 175). Yet the original study (Held & Hein, 1963) reports no such behavior, merely documenting impaired paw placement and obstacle negotiation, with recovery after a few days of free movement in a lit setting. Rather than supporting the enactive view that vision is learned through sensorimotor engagement, the study mainly showed that motor coordination deteriorates without practice (Prinz, 2012, p. 179). These errors combine with enactive tendencies to elaborate arguments against alleged scientific foes without citations, as in Di Paolo et al.'s (2010) attack on biological pre-programming, or O'Regan & Noë's (2001a, 2001b) complaints about homuncular neuroscientists.

While bad empiricism is often obvious, halfway variants can be subtler. Consider Noë's (2007) critique of the "neural sufficiency" thesis that perceptual experience can be generated by brain activity alone, sometimes supported by dream research. Noë's main move is to stipulate that "experience is what we call … involvement with the environment" (p. 465), which one might defend as a helpful clarification. However, when the debate centers precisely on whether dreams constitute full-blown perceptual consciousness, this definition presupposes the very point at issue: that environmental coupling is necessary. Perhaps recognizing this, Noë cites a little evidence for his position, though entirely drawn from a personal communication with a psychologist. Simultaneously, he neglects the empirical literature on dreaming that might challenge his outlook (for review, see Rosen, 2018). Noë then offers a secondary argument: if dreams are full-blown experiences, they must draw on past sensorimotor couplings. This may function as another useful clarification, much as enactive reminders that seeing involves microsaccades and parallax-eliciting head movements help dispel the idea of a passive perceiver. But his claim ultimately highlights only a general constraint—that the content of experience is historically conditioned—which remains compatible with both enactivist and neural correlate accounts. This highlights potential pitfalls of precluding opposing views definitionally, which James would criticize as halfway empiricism.

The anti-representationalist stances of some enactivists can, at times, also stray towards halfway empiricism. As a preliminary caveat, not all enactivists reject representations outright, with O'Regan and Noë (2001a, p. 1017) conceding that "knowledge of the laws of sensorimotor contingency themselves must surely be represented." Additionally, enactivist critiques of representation arise in distinct explanatory contexts. A case in point is Thompson (2007, Ch. 10), whose objections emerge primarily in debates over pictorialist accounts of mental imagery, whereas Di Paolo et al.'s (2017) arguments tie to a theory of sensorimotor equilibration.

Still, a concern is that a narrow conception of representation—namely, discrete, brain-based stand-ins for external objects, computationally available for syntactic and semantic processing—sometimes gets cast as the foil in enactivist critiques (see Ward et al., 2017). By setting this arch-cognitivist—and extreme—stance as the standard, enactivists preclude a lot of representation-like phenomena from counting as such without empirical adjudication.

In this way, enactivists secure their position as non-representational largely by stipulated default, even when their own descriptive language suggests otherwise. Di Paolo et al. (2017, p. 89), for instance, describe "the presence of attractors [as being] dependent on sensory signals that correspond to events in the environment." If representations are defined as internal, discrete stand-ins that pictorially mirror the world, then Di Paolo and colleagues' formulation falls short of that status. Yet this definition departs from many historical accounts of representation. Spencer's (1855) representationalism—explicitly criticized by Di Paolo et al.—did not posit a photographic or discrete correspondence between mind and world. His cognitive model instead emphasized moving equilibrium and dynamic coordination between internal and external events across organisms, including unicellular ones. More broadly, representational theories have rarely required pictorial fidelity, which has long been attack, in any case (e.g., Dewey, 1896, 1934, p. 175). It is therefore not always clear which empirically endorsed views enactivists are targeting, whether they are fighting real or fictional enemies.

This section's sampling of halfway empiricist tendencies within the enactivist literature underscores a broader lesson—also emphasized by James and Feyerabend—about the risks of framing positions in overly exclusionary terms. Compare, for instance, anti-representational or anti-computational views with non-representational or non-computational ones. The former risk fixing the scope of inquiry and admissible evidence too narrowly, and too early, thereby overlooking the possibility that psychic systems may operate across different modes and discontinuous levels, calling for divergent theoretical explanations.

A Progressive Program?

Though Lakatos's philosophy of science does not resolve all the problems raised by a James-inspired critique, his framework mitigates some of them.

One point on which James (e.g., 1890b) and Lakatos (1978) agree is that scientific progress requires stubborn tenacity—even dogmatism. James (Ch. 28) argues that empirical tests of a theory often fail, and when successful, they rarely align perfectly with the hypothesis under scrutiny. He adds that good science extrapolates beyond what is directly observable. Physicists, for instance, theorize about frictionless surfaces or point-like entities—constructs never observed—yet such idealizations reveal tendencies in nature. As James puts it, many scientific conclusions are "sought under and in spite of the most rebellious appearances" (p. 636).

Feyerabend (1993) sharpens this picture. Trained in physics and versed in the history of science, he observed that scientists routinely preserve theories despite evidential violations. They modify auxiliary assumptions to protect core commitments and rely on methodological irregularities to keep research programs alive. For Feyerabend, the problem lies not in these practices but in the pretense that science is uniquely free of them and therefore entitled to special epistemic authority. Persistent conflict between theory and fact, he adds, is a defining feature of science. These conflicts take both quantitative and qualitative forms, producing what Feyerabend describes as an "ocean of anomalies" (p. 39). Historical cases illustrate: Copernican astronomy violated entrenched sensory evidence; Newtonian gravitation confronted serious anomalies early on; and Bohr's atomic model and special as well as general relativity were all retained despite substantial empirical difficulties (pp. 39–40).

Lakatos (1978) agrees that virtually every empirically tested theory would be falsified if held to Popper's standards. Compared to Feyerabend, however, he is less accepting of ad hoc workarounds and more optimistic about the epistemic authority of science, as well as the possibility of demarcation criteria for the field. This optimism takes the form of a normative distinction between progressive and degenerating research programs.

Lakatos's (1978) position is as follows: first, that historically speaking, successful scientific programs have started with a certain set of falsifiable principles; second, as the predictive value of these becomes established, the aforesaid tenets come to form the unifying hardcore of the scientific program, now held true by fiat; third, that at this point the task is to gather additional data that conforms to the hardcore, an endeavor undertaken in what Lakatos thinks of as a secondary protective belt; fourth, that testing inevitably reveals anomalies; and fifth, if answers to anomalies produce increasing numbers of novel predictions and confirmations, then the program is progressive, as in the earlier mentioned examples of the propositions of neutrinos and the planet Neptune. A stagnant or degenerating scientific program, by contrast, does not progress in this way and is instead patched up through auxiliary explanations that preserve the hardcore but do not generate new empirical predictions and confirmations.

Now, an assessment of enactivism within Lakatos's framework warrants a caveat: that enactivism encompasses several strands, with varying attitudes toward representation, computation, and explanatory pluralism. Di Paolo and colleagues (2017) state that enactivism is dialectical and evolving rather than a finished theory—a platitude that applies to virtually any ongoing research program. Nonetheless, enactive approaches share recurring commitments that plausibly function as a Lakatosian hardcore.

One such commitment is that experience is not comprised of sensory inputs, passively received and wired into an internal processor. Instead, it arises from patterns of coordination between sensory stimulation, motor activity, and environmental structure, whether physical, social, developmental, or evolutionary. Varela et al. (1991, p. 9) characterize experience as "not the representation of a pregiven world by a pregiven mind but the enactment of a world and a mind on the basis of a history of actions that a being performs." Standard examples include haptic exploration, such as fingers palpating a sponge (Di Paolo et al., 2017; Myin & Degenaar, 2014; Noë, 2004; O'Regan & Noë, 2001b). Here, perceived qualities are not solely located in objects but are brought forth through organism–environment interaction.

While central to enactivism, this sensorimotor emphasis is not unique to it. Ecological psychology likewise treats perception as emerging from active engagement with environmental structures, though with less emphasis on endogenous dynamics. James Gibson (1979, pp. 117–139) describes how chewing food or inducing motion parallax by moving one's head brings out environmental properties. Eleanor Gibson (Gibson et al., 1987) offers the same basic haptic examples as enactivists. These also appear in phenomenology and pragmatism (Merleau-Ponty, 1945/1962; Mead, 1938/1964; Dewey, 1896, 1920). From the mid-nineteenth to the early twentieth centuries, one finds many theories that were explicitly called "sensorimotor" (Crippen & Schulkin, 2020; Crippen, 2017). Accordingly, sensorimotor coordination alone does not demarcate a distinctively enactive core.

Another candidate core principle, at least for certain strands of enactivism, is autopoiesis. Originally introduced to describe living cells as self-producing systems (Maturana & Varela, 1980), autopoiesis characterizes the processes by which organisms produce and maintain their own components and boundaries. Yet this is basically to name long accepted biological commonplaces rather than presenting a uniquely new or enactive innovation (see Keller, 2009)

Closely related is the notion of operational closure. Modeled primarily on unicellular organisms, operational closure has been advanced by foundational figures in enactivism (Thompson, 2007; Varela et al., 1991) and further developed by leading proponents of autopoietic variants (e.g., Di Paolo et al., 2017). Omnidirectional rather than linear, it can be schematically expressed as follows: *A* exists only insofar as *B*, *C*, and so on sustain it, and vice versa, forming a self-generating internal network of interdependent functions that can adjust to external perturbations from the world.

Villalobos and Dewhurst (2018) illustrate operational closure using an internally regulated house-heating system that operates through a thermostatic circuit, closed on itself via the interior ambient air. Although the dwelling lacks external temperature sensors, it nonetheless exhibits intra-coordinated self-adjustment in response to outside perturbations, such as a deep freeze that accelerates interior cooling, thereby activating the furnace more frequently. Like a cell that maintains a membrane between its insides and its surroundings, the system can tolerate a cracked window but would fail if a wall collapsed. However, the components (pipes, heater, thermostat) are not generated by the system's own functioning, unlike a cell's autocreation or self-perpetuating physiology. The latter is a hallmark of autonomy for autopoietic enactivists, who describe living creatures as enclosed networks of mutually sustaining processes modulated through environmental interaction. For autopoietic enactivists, the just mentioned also meets minimal conditions for being a cognitive agent.

Contemporary biological work—including analyses of organisms without neurons—illustrates how closely related ideas are explored in empirical and theoretical contexts concerned with nutrient intake, metabolism, and self-guided behavior (e.g., Bechtel & Bich, 2024). Enactivists extend these ideas to cognition, arguing that endogenous dynamics play a constitutive role in experience while remaining modulated by sensorimotor coupling. As Thompson (2007, p. 13) puts it, the nervous system "generates and maintains its own coherent and meaningful patterns of activity" through "a circular and reentrant network of interacting neurons," such that sensorimotor coupling modulates—but does not determine—the formation of endogenous, dynamic neural patterns.

Now, one can grant that autopoiesis and operational closure are biologically meaningful. But from a Lakatosian perspective, the main question is whether enactive extensions of these notions have generated anomalies, novel predictions, and independent empirical confirmations. Here, the answer is unclear because there is little testing. Enactivists frequently cite computer simulations as such (e.g., Beer, 2015, 2020; Egbert & Di Paolo, 2009), and these can serve valuable exploratory and heuristic functions. Yet such models typically lack the capacity to generate anomalies and predictions for addressing them, unless embedded within a broader program involving independent empirical scrutiny of non-simulated cases.

Moreover, these simulations often take unicellular life as their paradigm case. Yet it remains unclear how well this scales to the cognitive functioning of cephalized organisms, or what empirical tests could here establish operational closure as a basis of cognition. A related consideration is that treating autopoiesis and operational closure as cognitive per se and vice versa may end up portraying cephalized organisms as aggregates of mini-minds that together comprise a bigger mind with the same basic structure as the smaller ones. In addition to its fortuitous flavor, this scenario has homuncular implications normally criticized by enactivists. However, bio-enactivists might respond by framing this implication—homuncular or otherwise—as consistent with the continuity thesis, according to which cognition and agency come in degrees across forms of life.

The Lakatosian concern, once more, is not continuity itself but whether extending organizational principles across levels yields empirically testable consequences for cognition in cephalic and non- cephalic organisms. While autopoiesis and operational closure have to some extent been operationalized, their specifically enactivist deployment has not yet generated a robust pattern of anomalies within cognitive science, a limitation that may reflect the relative immaturity of the program rather than a decisively degenerating trajectory. Whatever the case, opportunities for progressive problem shifts, in Lakatos's sense, remain limited.

A possible counterargument to the foregoing comes from van Es (2023), who argues that enactivists have grounded their views in empirical findings, generated some of their own and seen these taken up by the scientific community, producing a short list of affirming cases. Yet even if one grants van Es's demarcation criteria—and community uptake has indeed been defended by philosophers of science (Hull, 1988; Merton, 1957)—several issues remain.

First, brandishing a short list is immediately suspicious—analogous to the "Latinos for Trump" coalition emerging despite limited support from that demographic. Such signaling typically recedes when broader uptake is robust: atomic theorists and ecological psychologists do not customarily advertise catalogues of empirical studies to demonstrate their scientific status. Second, van Es's (2023) inventory is small, with details missing on the empirical attributes of the referenced studies and how they substantiate enactivist claims. Third, if occasional uptake by the scientific community were sufficient, then phenomenology, pragmatism, and much else would qualify as sciences. Indeed, my own work would count, since it draws extensively on empirical findings, sometimes includes original qualitative or quantitative data, and is cited across domains such as medicine, nuclear waste management, engineering, and economics. Yet few would regard it as science in today's sense because uptake within relevant research programs is limited.

But notice something else: even if uptake is rejected as a strict demarcation criterion, it fuels widespread testing. Hence, uptake remains a practical prerequisite for generating the accumulation of anomalies that precede novel predictions and their independent empirical confirmation.

Utopian Language Games?

In Lakatos's (1978) philosophy of science—which, in this respect, follows Popper—Marxism is cited as a degenerating research program, owing to its ad hoc assumptions and failure to empirically confirm novel, anomaly-resolving predictions. This critique is well known, and I do not dwell on it here. I note only that casual readers often conflate Marx and Marxism, taking the rejection of Marxism's scientific merits as a repudiation of Marx himself. As emphasized earlier, a body of work can retain intellectual value without being scientific—and Marx's analyses of alienation, for instance, remain incisive even if one rejects his political prescriptions. Meyer & Brancazio (2023a, p. 3) invoke Marxism in a different context, comparing certain enactive trends to the "enthusiastic yet ineffectual discourse" that Engels criticized—marked by utopianism and a neglect of practical implementation. Their claim is that some strands of enactivism may be overly intra-philosophical. In other words, many enactivist discussions appear oriented toward reaffirming foundational texts or positions. From Feyerabend's standpoint, such inward-looking theorizing risks devolving into an insider language game insulated from empirical and conceptual scrutiny. This section ponders that risk in light of the preceding analysis.

In addition to Feyerabendian protectionism, the intra-philosophical project described by Meyer & Brancazio (2022, 2023a, 2023b) may reflect Lakatosian stagnation. Enactivists, for example, often list a decades-old "greatest hits" of empirical citations to support the claim that perception is grounded in sensorimotor coordination (Crippen, 2025a). Age is not itself disqualifying, and experiments on vision-inverting glasses, sensory substitution, and motor tracking of moving balls still hold up. However, a questionable mainstay is behavior-based robotics, with enactive references typically dating to the late twentieth century or early 2000s, after which relevant research dissipated. One reason, according to Brooks—whom enactivists frequently cite without noting this point—was the failure to exceed insect-level competence (Brooks & Thompson, 2016), which remains impressive yet indicative of a scaling-up problem. Also overwhelmingly missed is that Brooks's company has long produced Roombas (robot vacuums) that store representations of static environments (Ackerman & Guizzo, 2015), precisely along the classical cognitivist lines that enactivists reject. In short, these omissions insulate enactivism from anomalies that might interestingly progress their work. The lack of critical insight becomes more puzzling given enactive objections to modeling mind after the latest technologies (e.g., Thompson, 2007; Varela et al., 1991), a practice traceable at least to the time of Descartes (Daugman, 2001, p. 24).

While omission is simpler than ad hoc revision, the result is the same: the maintenance of core enactivist commitments in a manner that exhibits features Lakatos (1978) associates with degenerating research programs. For Feyerabend (1993, p. 46), by contrast, this move is descriptively standard in the sciences but should be taken as epistemically deflationary: "The usual procedure is to forget the difficulties, never to talk about them, and to proceed as if the theory were without fault."

Feyerabend (1993, p. 30) goes further, capturing respects in which enactivism exhibits idealizing or utopian tendencies that again share features he attributes to established sciences—though not in ways that confer epistemic legitimacy. As a framework gains prominence, he writes, "debates with opponents become standardized and also quite unrealistic." Views are presented in ways that implicitly presuppose the inadequacy of what they contest: "Alternatives are still employed but they no longer contain realistic counter-proposals; they only serve as a background for the splendour of the new theory."

O'Regan and Noë (2001b, p. 947), for example, describe a homuncular foil who holds that visual experience involves "pictures in the head" and that "to see red, there must be red neurons in the brain." This position, however, is seldom defended in contemporary cognitive science, and O'Regan and Noë provide no citations for proponents of this view. Even Descartes (1637/1971), often blamed for such thinking, cautioned against it despite occasional lapses. While not defending homuncular models and siding squarely with the embodied camp, it remains the case that surface phenomena can sometimes mirror underlying mechanisms—for example, a rotating star composed of atoms following similar trajectories. Likewise, it is logically possible for a pattern on the retina to correspond isomorphically to neural activity in the brain (Crippen, 2025a).

By framing the opposing view as implausible, O'Regan & Noë (2001b) may reduce the likelihood that evidence for homuncular aspects of mind will be taken seriously. Because rejecting homuncular models is largely uncontroversial, the stance is unlikely to be tested, thereby generating no anomalies, no novel predictions, and no path toward what Lakatos would regard as a progressive research program.

A parallel utopian tendency is the use of scientific-sounding jargon as a substitute for genuine explanation. Consider the term "neurodynamic patterns" (e.g., Di Paolo et al., 2017). It would be a mistake to dismiss such terminology as explanatorily empty merely on disciplinary grounds; interdisciplinary research routinely involves philosophers drawing on technical vocabulary from the sciences. The more relevant question is whether such terms are leveraged in ways that constrain explanation, connect to empirical modeling, or guide experimental intervention. Given that the nervous system is largely contained within the body (with limited exceptions, such as olfactory receptors), "neurodynamics" could often be replaced with "internal dynamics" without substantive loss of meaning. And given enactivism's emphasis on embodied cognition, why not speak instead of "bodily dynamics"? After all, enactivists explicitly deny that psychic life is purely a neural phenomenon. In some contexts, terms like "neurodynamics" risk functioning less as explanatory tools than as epistemically inflated "science signals," deployed by authors with limited training in the brain sciences. The nomenclature appears more programmatic than empirically discriminating, particularly when it can be substituted with minimal impact on theoretical commitments.

Ironically, the very rhetorical strategies meant to signal scientific seriousness risk reproducing the epistemic pathologies Feyerabend (1993, 1999) cautions against. On the one hand, he worries that overstating the legitimacy of established scientific models can precipitate epistemological authoritarianism. This leads him to welcome projects that—irrespective of their ultimate value—push against dominant frameworks. In this regard, he might well have applauded enactive agendas. On the other hand, Feyerabend (1993, p. 30) warns of cases where "problematic aspects which were originally introduced with the help of carefully constructed arguments now become basic principles; doubtful points turn into slogans."

Something similar occurs in enactive discourse. Frequently, certain terms—such as "representations," "information processing," and "computation"—function as negative markers. Preferred vocabulary includes "dynamic," "co-constructed," "co-constituted," and "structural coupling" alongside words like "emergent," "sense-making," "autonomous," and "precarious." The situation mirrors the use of labels such as "communism" and "freedom" in rightwing rhetoric, where nomenclature can replace arguments to signal what is suspect or noble.

Enactive language can also give the impression of greater explanatory depth than is present. An example comes from de Figueiredo et al's (2025) article "Participatory sense-making and knowing-in-connection in VR." Their opening gloss on enactivism states that "living beings exist in precarious conditions" and that "life is precisely the co-emergence of both significance for a certain organization and its self-individuation which is the dynamic process of a network of relations of producing and maintaining itself" (p. 2). Within enactive frameworks oriented toward life–mind continuity, such claims indicate commitment to principles of biological self-organization, sense-making, and autonomy, and the cited piece offers insights. Nevertheless, the quoted passage largely amounts to the commonplace that organisms remain alive and individuated by continually sustaining themselves through interactions. While not entirely beyond empirical debate, such near-truisms are unlikely to be disconfirmed in ways that would generate the anomalies central to Lakatos's account of progressive research programs.

A second issue is the tendency to exaggerate the views of opponents. Consider here the enactive slogan that "you are not your brain." Noë (2009) has made this a book title. Thompson (2014) similarly notes that cognition is no more in the brain than flight is in a bird's wing, since both arise through body–world interactions. Obviously, enactivism does not reduce to these statements, and each appropriately targets narrow—and arguably halfway empiricist—conceptions that definitionally locate cognition in the neural substrate alone. Still, when applied to tasks such as talking or algebra, it is doubtful that even enactivism's critics would dispute the involvement of organism–world interaction. The problem, then, is not the idea itself, but enactive tendencies to cast it as radically opposed to the mainstream. In Feyerabend's (1993, 1999) sense, this kind of sloganeering serves as a consolidating idiom against partly fictional enemies, contributing to insular protectionism, which we will see can devolve into halfway empiricism.

A third concern is the generally mocking tone adopted by some enactivists. Notable for his antagonism toward notions such as emergence and autopoiesis, Hutto (2019, p. 835) advances an enactive account of mathematics that recommends:

> Subtract any residual commitment to mental representation, information-processing stories and neuro-fetishism. … Subtract any residual constructivism, anti-realism and idealistic elements from the account. Finally, subtract any lingering psychologism about mathematics and its content.

Hutto's normative exhortation here aligns with the utopian project described by Meyer & Brancazio (2023a), which resonates with Feyerabend's (1993, 1999) deflationary account of idealized science. Characteristic of a style that runs throughout Hutto and Myin's (2013, 2017) work—which presents itself as scientifically revolutionary—the passage's mocking tone favors rhetorical closure over testable commitments. As Barthes (1957/1991) and Marcuse (1964) each warn, reducing opponents to caricatures fosters one-dimensional thought. Marcuse makes this point in relation to analytic philosophical traditions of the sort to which Hutto belongs, noting that such reductions discourage engagement with alternative perspectives, whether empirical or conceptual.

False Antagonisms and Desirable Conflicts?

A concern is that enactivism's argumentative substructures prematurely foreclose reconciliation with adjacent approaches. Frequently, claims are not merely about how the mind works, but also negative pronouncements about why alternative positions are misguided or incoherent. Such exclusions can amount to halfway empiricism. From a Feyerabendian perspective, these declarations risk mistaking local explanatory success for global sufficiency. At the same time, Feyerabend's (1993, 1999) pluralism does not oppose conflict as such, and in fact values it insofar as it weakens the authority of ruling orthodoxies—a function poorly served, however, when criticisms caricaturize adversaries or frame even non-opposing views as antagonistic. This section accordingly expands on cases in which purported clashes between enactivists and their foils appear overstated.

To start, consider enactive discussions of mathematics, particularly appeals to gestural accounts. One representative case is Baggio (2025), who conceives gesture broadly as bodily movement and treats it as foundational to spatial—and by extension, mathematical—understanding. At the outset, gesture is defined so expansively that it excludes relatively little. Baggio's article is careful, well researched, and informative; the narrower contention is simply that the explanatory resources it mobilizes are not, on their own, distinctively enactive. The point is illustrated when Baggio's discussion turns to Goldin-Meadow's well-known findings that gesturing improves mathematical performance (Goldin-Meadow, 2004; Goldin-Meadow et al., 1999, 2001). This is even though such gestures require no distinctively enactive machinery, as they are readily interpretable as instructional scaffolds within mainstream cognitivism. As Baggio himself notes, these results show that gesture conserves cognitive resources during instruction and reallocates them toward memory—effects that do not warrant enactivism's explanatory commitments. What enters at this juncture is a familiar theoretical move: gesture is redescribed as embodiment; embodiment is taken to underwrite anti-representationalism; and a pedagogical aid is thereby elevated into a principled exclusion of representational explanation.

A structurally similar exclusionary move appears when enactivists position their outlook against ecological psychology. Enactivism's originators (Varela et al., 1991) explicitly adopt a constructivist stance. This is expressed in their view that agents do not encounter a pre-existing world, but rather one that they help bring forth, or in more specific claims such as the following: "the properties that specify what colors are simply have no non-experiential, physical counterparts" (p. 166). While this commitment aligns with their broader philosophical orientation, constructivism here also functions as a boundary-drawing device. That is, it is used to demarcate the enactive position from ecological psychology, particularly that of Gibson (1966, 1979), who identifies as a realist in two principal senses. Epistemologically, he defends a form of direct realism according to which environmental information is available without mediating interpretation; ontologically, he holds that while affordances or action possibilities are relative to what an organism can do, they nonetheless exist in the environment independently of any particular creature. The last clause is defended on the grounds that the properties that make paths walkable or chairs sittable persist even when no one is present to exploit them.

This framing of constructivism versus realism underwrites a recurring line of criticism. Enactivists suggest that Gibson's realism treats the environment as overly passive or pregiven, rendering it available for information pickup in a way that downplays organismic contribution (Di Paolo et al., 2017; Hutto & Myin, 2017; Varela et al., 1991). Plainly, however, realism need not preclude constructivism when changes are enacted primarily in the world (Crippen, 2020, 2025a). An illustration is provided by *Physarum polycephalum*, a slime mold that forages by depositing slime trails and subsequently avoiding them. In such cases, environmental modification and sensorimotor activity are inseparable: the organism navigates a self-structured, affordance-rich landscape that exists independently while retaining material traces of prior action. These actions reconstruct the environment as real, persisting features (Crippen, 2020).

Gibson himself supplies rebuttals to enactive criticisms that he treats perception as passive information pickup. Whether intended or not, he also shows that his realism need not violate constructivism. Gibson (1979) argues that actions bring environmental properties into relief (pp. 117–139) and that perception is multimodal, arising when a totality of bodily capacities synchronize around encountered objects (pp. 210–211). Gibson (1966, 1979) emphasizes that affordances are values rather than neutral properties, and his account implies that organisms have a role in enacting them—a position enactivists endorse (e.g., Colombetti, 2014; Thompson & Stapleton 2009). Food affordances, which Gibson discusses, show how endogenous conditions can transform environmental possibilities, as when a new peanut allergy makes previously benign snacks negatively affordant (Crippen, 2025a, 2025c).

What can we therefore conclude about the earlier-cited objections of Varela et al. (1991), Di Paolo et al. (2017), and Hutto and Myin (2017)? Charitably, they are overstated, with some enactivists stressing the approach's compatibility with ecological psychology (e.g., Stapleton 2016) and few rejecting the latter outright. Less charitably, the dispute may be driven by deep similarities and a protectionist desire to carve out a distinct intellectual space for enactivism (Crippen, 2020).

Let us turn to a tougher case: functionalist and computational views, which are widely—though misleadingly—regarded as necessarily hostile to enactivism. Thompson's critique of the extended mind thesis (Thompson 2007; Thompson & Stapleton, 2009) provides an illustration. Although the thesis was originally introduced by Clark and Chalmers (1998), Thompson focuses primarily on Clark's later work. He frames the extended mind view as functionalist and raises two central objections: its reliance on computationalism and its claim that computations can be realized across different physical substrates. The latter, as Thompson (2007, p. 5) maintains, renders "the embodiment of the organism essentially irrelevant to the nature of the mind."

While this critique may apply to certain interpretations of the extended mind, it relies on a narrow notion of computation and multiple realizability. Bio-inspired robotics offers counterexamples. Long (2011), for instance, describes an evolutionary game with aquatic robots. They competed for light—their energy source or "food"—with variations from the more successful incorporated into the next generation. As Long explains, much of the relevant computation for this task is offloaded to the robot's body itself:

> The body of Tadro3 "computes" everything that the micro-controller running the Interactive C program doesn't: all the difficult physics. By virtue of being in the real world, interacting with real water, Tadro3 automatically solves the intensely complex dynamics of a flexible propeller transducing an oscillating uniaxial bending couple into a propagating bending moment that flexes the tail, which, in turn, is also loaded hydromechanically in a time-varying manner as its relative motion in the water changes. In response to the tail's coupled internal and external force computations, the body, to which the tail is attached, undergoes the yaw wobbles—recoil and turning maneuvers (p. 104).

As Long summarizes, "our population of Tadro3s became smarter … by evolving their bodies, not their brains" (p. 95), here equivalent to CPUs and internal programming.

Enactivists might object that Long (2011) merely substitutes the term computation for dynamic interaction. However, this objection overlooks several points. First, Long does more than relabel dynamics; he shows how bodily dynamics and computational processes can be functionally equivalent. Given that enactivists often seek to scale sensorimotor frameworks into explanations of language and mathematics (Baggio, 2025; Di Paolo et al., 2018; Hutto, 2019), they should welcome Long's move. Second, rejecting such cases by narrowing the definition of computation to exclude Long's assessment risks foreclosing inquiry independently of evidence, edging toward halfway empiricism and a degenerating research strategy.

Comparable considerations apply in more familiar settings. A Roomba's spherical chassis "computes" spatial relations by rolling into and along obstacles to follow contours. Such embodied computation can be understood as transferable across certain substrates: replacing a plastic shell with aluminum preserves functionality. The objection that this is not a case of multiple realizability because the shapes are the same misses the functional point. Shapes themselves can render different substrates interchangeable with respect to computational roles, such that organic and prosthetic limbs can occupy similar functions in this respect. Hippocampal prosthetics are also under development

(Hampson et al., 2012; Roeder et al., 2024), and whether intracranial or external, they could plausibly extend cognition in Clark's dual sense of outsourcing cognitive processes and coupling them with artificial systems (Crippen, 2025a; Crippen & Rolla, 2022). Related arguments are developed by Villalobos and Dewhurst (2018), who suggest that disputes over extension hinge less on extension itself than on how autonomy and organizational closure are defined.

Whether or not enactivists agree with this account, it should not be dismissed as an ad hoc response to anomalies. Rather, it constitutes a theoretical expansion that accommodates anomalous data in ways that progress the research program. While dissolving false antagonisms is valuable, genuine contradictions may be productive—or at least not deeply problematic. Even physics remains theoretically fragmented, and organisms, nervous systems, and minds are arguably far more complex. In this light, enactivism may benefit from engaging more constructively with opposing views. Historically, major scientific figures have accommodated competing theories. An example is Darwin increasingly making room for Lamarckian ideas with each edition of *On the Origin of Species* (Crippen, 2010). Although Lamarckism ultimately lacked empirical support, this outcome was not easily foreseeable at the time, and Darwin's openness to rival perspectives did not hinder the development of a progressive research program.

The same lesson applies to the cognitive sciences. As Meyer & Brancazio (2023a) note, it is unclear why empirical psychology should fully embrace enactivism rather than selectively integrating its concepts where they increase explanatory success. Given the complexity of mind, the insistence by some enactivists (e.g., Di Paolo et al., 2010, p. 33) on avoiding "contradictory hybrids" is puzzling. While logical consistency matters in simple cases—such as rejecting the notion of a "square circle"—it is far from obvious why a phenomenon as multifaceted as the mind should be explicable by a single, internally consistent theory.

A final irony follows from these considerations. While philosophy of science offers evaluative tools, its tendency toward unificationist assumptions—Feyerabend (1993, 1999) being a notable exception—may be less defensible in the context of the mind sciences, where explanatory plurality may be epistemically advantageous. In this respect, Feyerabend's position converges with that of James (eg., 1884, 1897, 1907, 1909), albeit not without tension. His defense of theoretical and methodological pluralism was not a call for peaceful coexistence, but for sustained opposition to dominant modes of explanation. Competing perspectives, on this view, should challenge prevailing frameworks, since intellectual dominance tends to suppress alternatives prematurely and inhibit discovery. From this standpoint, enactivism can be credited with disrupting entrenched representationalist and computational orthodoxies and reopening foundational questions concerning embodiment, action, and world-involvement. At the same time, Feyerabend's pluralism applies symmetrically: enactivism itself should remain open to challenges, internal tension, revision, and eventual historical dissolution or amalgamation with alternative framings, as has been the fate of many once-dominant research programs. An alternative, also in Feyerabend's and James's vein, is that a thoroughgoing mind science may progress only by accepting a form of epistemological anarchism, in which even contradictory modes of explanation are mobilized to account for different—or perhaps even the same—aspects of psychic existence.

Conclusion

Enactivism was originally introduced as a scientifically oriented alternative to computational orthodoxy, yet much of its subsequent development has remained programmatic rather than empirically generative. This does not diminish its historical or critical significance. Like ecological psychology and earlier pragmatist and phenomenological traditions, enactivism has helped expose limitations in dominant models of cognition by focusing on embodiment, action, and organism–environment coupling. These interventions have been productive. The difficulty arises when critical disruption is mistaken for scientific consolidation.

Viewed through Lakatos's framework, enactivism has not yet matured into a progressive research program. Its core commitments have rarely been subjected to systematic anomaly-driven refinement, and its empirical engagements have not produced a sustained pattern of risky predictions and independent confirmations. Instead, foundational claims are often defended by definitional narrowing or by casting rival approaches as foolish. When exclusions of this sort are treated as principled rather than provisional, they resemble what James described as halfway empiricism: positions maintained regardless of how the evidence might otherwise develop.

At the same time, the limitations of enactivism do not license a simple return to unificationist ideals. Lakatos's model, like other unificationist approaches in the philosophy of science, presupposes that progress ultimately consists in convergence on a single explanatory framework. The mind sciences provide little reason to accept this assumption. Even in physics, theoretical fragmentation persists. In psychology and cognitive science, where phenomena span neural, bodily, social, cultural, and historical levels, explanatory plurality may be a permanent feature rather than a temporary shortcoming.

This tension helps clarify what is at stake in assessing enactivism's scientific status. If science is understood, in Feyerabend's sense, as an irreducibly plural practice shaped by historical contingencies and methodological heterogeneity, then enactivism already belongs within it. Yet this concession comes at a cost, for Feyerabend's pluralism dissolves the special epistemic authority often associated with scientific designation.

The future of enactivism, then, likely does not lie in displacing alternative paradigms, nor in defending its identity through exclusion. Its more durable contribution may be to function as a catalytic framework that sharpens questions, exposes neglected assumptions, and participates in hybrid research trajectories capable of generating testable consequences. Whether enactivism remains primarily a philosophical intervention, evolves into a progressive research program, or moves in a more Feyerabendian vein remains an open question. What will settle the matter is not the refinement of slogans, but the willingness to expose its core commitments to sustained empirical and conceptual risk.

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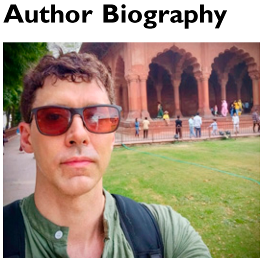
Author Biography



Awarded for excellence, **Matthew Crippen** has held academic positions on four continents. His research—often informed by his own qualitative or quantitative data—focuses on cognitive science, politics, history, art, technology, design ethics, Indigenous traditions, and environmental philosophy. He has approximately 70 publications, mostly solo-authored, and has visited around 70 countries, sometimes fore field research. Outside the academy, he has held various jobs, ranging from hard manual labor to working as a musician, a mandolin and guitar instructor, and a gymnastics coach.