Phenomenology and the Cognitive Sciences
https://doi.org/10.1007/s11097-025-10079-2

Enaction as the bringing forth of worlds

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Accepted: 6 May 2025

Abstract
This paper describes Francisco Varela, Evan Thompson, and Eleanor Rosch's idea of enaction as the bringing forth of a world and compares it with Alva Noë's idea that we enact presence.

Keywords Enaction · Enactivism · World · Presence · Niche construction

In a recent paper called "The enactive approach: a briefer statement, with some remarks on 'radical enactivism'," Noë (2021) restates some of the main ideas of his version of the enactive approach and ends the first part of the paper with these words:

> A final point: experience, according to this understanding of the enactive approach, is *creative*. It is an activity of making, assembling, or putting together. Thompson and Varela (Thompson, 2007; Varela et al., 1991) would have it that it is the *world* that is brought forth through enaction. I have always resisted this. We make *experience*, not the world. But I now think that the difference between my view and theirs is not so great after all and I am inclined to agree with them, at least to this extent. Experience, as I understand it, is not something that happens inside us; it is rather something we do; indeed, it is something we do in the situations we find ourselves in, but that also, crucially, contributes to making those situations the situations they are. To enact ourselves in the world is to alter the world and so, in that sense, to make it (961).

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Published online: 15 May 2025

I'd like to take this passage as a prompt for thinking about the question of what is enacted or brought forth in enactment. Is it the world or experience or situations or ourselves or all of them together?

From my perspective, Noë's work has always been a rich source of ideas for developing and deepening our understanding of enaction as the bringing forth of a world, despite his having been reluctant to describe enaction this way. This special issue of *Phenomenology and the Cognitive Sciences* focusing on Noë's theory of sensorimotor enactivism seems like a good place to raise this question—the question of what enaction enacts—and thereby also to say why, for me, a world is brought forth through enaction (and not just experience, ourselves, and our situations).

Noë (2021) says the chief problem in the whole domain of the mind is presence. The world shows up. It is present to us, and we are present to ourselves, individually and socially, in the world. The core claim of his enactive approach, he tells us, is that we enact presence; we make it happen through our action and the skillful knowledge we exercise in action.

The problem of presence has a central place in the phenomenological tradition, and phenomenology was especially important for how Francisco Varela, Eleanor Rosch, and I formulated the enactive approach in our book *The Embodied Mind* (Varela et al., 1991), particularly for our description of enaction as the bringing forth of a world. For Husserl, the problem of presence is the problem of "constitution," where this means the bringing forth, the bringing to presence, of stable unities in experience and the manifestation of the world as a total horizon and ground of experience (Sokolowski, 1970). For Heidegger in *Being and Time*, it's the problem of "disclosure"—how the world's opening to us and our opening to the world are united in the one existential structure he calls "being-in-the-world" (Heidegger, 1962). For Merleau-Ponty in *Phenomenology of Perception*, the problem emerges in his analysis of temporality and what he calls the "unique structure" of presence from which subject and object are abstractions (Merleau-Ponty, 2012, p. 454).

Heidegger and Merleau-Ponty lay behind our formulation of the enactive approach in *The Embodied Mind* because they purposely undermine the dichotomy between subject and object or inside-mind versus outside-world. The dichotomy persists in cognitive science today. Take the faddish predictive processing model of the mind. Outside is the physical world; inside is the brain's predictive model. It's said that we can never directly experience the world; all we can ever directly experience is the content of our brain's predictive model. Although most cognitive scientists would prefer to be realists about the outside world, the predictive processing theory turns them into subjective idealists—of a strange, self-undermining sort. Our perception of the world, what we perceive as real, amounts to a "controlled hallucination" (Seth, 2021). But this viewpoint is incoherent, as I argue in my book *The Blind Spot*, written with Adam Frank and Marcelo Gleiser, because consistency requires that the physical brain, which is supposed to be objective and outside the model, be available to us only as just another hypothetical content inside the model (Frank et al., 2024). Thus, the model swallows up its own physical basis, thereby undermining itself along with the possibility of accounting for perception as an openness to the world, to say nothing of accounting for science as an epistemic activity based on perception as an openness to the world. Varela, Rosch, and I proposed the enactive approach as a way

to free ourselves from this hopeless representationalism in cognitive science (Varela et al., 1991/2017). Here is how we introduced the enactive approach: "We propose… the term *enactive* to emphasize… that cognition is not the representation of a pregiven world by a pregiven mind but is rather the enactment of a world and a mind on the basis of a history of the variety of actions that a being in the world performs" (xx). We also wrote: "What is cognition? [Answer:] Enaction: A history of structural coupling that brings forth a world" (206). For the enactive approach, world and mind form a unitary, co-constituting structure, such that enaction is as much the bringing forth of a mind as the bringing forth of a world. To borrow the words of Noë's mentor, Hilary Putnam, "The mind and the world jointly make up the mind and the world" (Putnam, 1981, xi).

In his book *Action in Perception* (Noë, 2004), whose twentieth anniversary we're celebrating with this special issue, Noë did not explicitly describe enaction this way—as the interdependent enactment of worlds and minds—though I think many of the things he said can be rendered this way. For Noë, to say perception is enactive is to say, as he does on the first page of his book, that "perceiving is a way of acting. Perception is not something that happens to us, or in us. It is something we do" (1). Noë's resistance to the idea that enaction brings forth a world seems evident in this statement he makes later in the book: "It isn't that the perceptual world is *existence*-dependent on our biological natures. It is that it is only given our biological natures that this world exists for us, that we have access to the world in this mode." (156).

Noë's term "perceptual world" in these sentences admits of two readings. It could mean the world *as we perceive it*, the world in its mode of presentation to us. Or it could mean *the world itself*, which we bring to presence and thereby perceive. (Some philosophers would call these *de dicto* versus *de re* readings.) I read Noë as saying that the world, which we perceive, exists independently of us, but how it shows up for us, its mode of presentation to us, depends on us, on how we bring it to presence, on how we make its presence happen through our skillful know-how and action. I take the dependence here to be not merely causal—that our action causes the world to be present for us—but also constitutive—that how the world comes to presence for us, the mode or manner of its presence, involves our action essentially. We could say that we play an active role in the performance, given to us, of the world's presencing. Notice, however, that this way of putting things may suggest that there is a way that the world is in itself apart from us, or apart from its performance of presencing for us, or more precisely, from that of any kind of embodied or living being with its correlative mode of world presence (the world offstage, as it were). This thought in turn raises the question of how perception, ours in particular, relates to the world as it is in itself. Kant thought that perceptual appearances require things-as-they-are-in-themselves as their metaphysical ground. Something like Kant's thought may suggest itself here, too, namely, that the world in itself is the metaphysical ground of its presence to us or of our bringing it to presence. The problem with this thought, however, is that, from a Kantian perspective, the concept *world*, as we've been using it here, seems already to be on the phenomenal side of the phenomena-versus-things-as-they-are-in-themselves distinction. After all, the world we're talking about is the one comprising the situations we find ourselves in as enactive beings. It's the world Husserl called the "life-world," not the metaphysical postulate of things-as-they-are-in-themselves.

This brings us to the question of what we mean by "world" in the context of enactive thinking. I'm going to set this question aside for the moment and come back to it later. First, I would like to say why I think we can (indeed, should) render many of Noë's ideas in *Action in Perception* as supporting the idea that enaction brings forth a world.

Let me come at this point by going back, again, to how we formulated the enactive approach to cognition in *The Embodied Mind*. We described it as making two points: first, that perception consists in perceptually guided action, and second, that cognitive structures emerge from the recurrent sensorimotor patterns that enable action to be perceptually guided. Noë went further in *Action in Perception* by introducing and developing the idea that the ability to perceive is constituted by sensorimotor knowledge—by a practical grasp of how sensory stimulation varies as you move. He also used this idea, in his work with Kevin O'Regan and Susan Hurley, to explain the qualities of experience both across and within sensory modalities: what makes visual experience phenomenally different from other modalities is the particular way that sensory stimulation depends on bodily activity in vision compared with hearing or touch; and what makes visual appearances such as particular shapes, and visual qualities such as particular colours, distinct from each other are their particular sensorimotor profiles (O'Regan & Noë, 2001; Hurley & Noë, 2003).

These innovative analyses, it seems to me, are readily suited to illustrate enaction as the bringing forth of a world. One of the main ideas of the enactive approach, as Varela, Rosch, and I presented it, is that perception is not about or directed towards a pregiven world, a world whose features and contours can be specified independently of the perceiver's activity. Instead, perceiver and world are interdependently linked and mutually constitutive. Here we drew from Buddhist philosophy, specifically from the Madhyamaka (Middle Way) tradition, which maintains that objects of cognition have a threefold dependence on their causes and conditions, their constituent parts, and "mental imputation" (perceptual synthesis and conceptual construction). Noë's sensorimotor theory (developed with Kevin O'Regan) also implies that perceiver and world are co-constituting, unlike Gibson's ecological psychology, though this difference between the two theories is often missed (see Mossio & Taraborelli, 2008). For Gibson, animals pick up invariants in the ambient optic array but they do not contribute to making them. A perceptual invariant, for Gibson, is a structural arrangement of light that does not change as the animal moves, but that the animal can pick up or directly register as it moves. The invariant, though revealed through movement, is a property of the light, and registering it does not depend on whether the animal's movement is active (self-generated) or passive. Movement is instrumental for revealing invariances but does not constitute them. For the sensorimotor theory, in contrast, perceivers create perceptual invariants through their action, because the invariants are properties of the sensorimotor couplings and sensorimotor loops. For example, straight lines are characterized by the fact that sensory stimulation does not change when you move your eyes along a linear trajectory, whereas curved lines are characterized by a different set of sensorimotor dependencies. What counts as a straight or a curved line for the perceiver depends constitutively on their patterns of sensorimotor engagement. The perceptual invariants are motor-specific, constituted in part by the active body. Unlike Gibson's theory, the sensorimotor theory suggests

that actively moving as opposed to being merely passively moved in exactly the same way can make a difference to the content of what you perceive—a prediction borne out by Mark Wexler's work, which shows that perceivers judge depth and shape differently depending on whether they actively produce the transformation in the optic array through self-generated movement or just register it as they are passively moved in the same way (Wexler & van Boxtel, 2005). In short, sensorimotor invariances are brought forth through action in the strong, constitutive sense that action contributes to making them be what they are. It follows that what counts as an object in the world for perception, according to the sensorimotor theory, is actually an invariant structure of sensorimotor interaction comprising both the perceiver and the environment. Objects for perception aren't pregiven "out there" but neither are they the projected content of internal representations. Instead, as sensorimotor invariants, they are enacted or brought forth through the mutual constitution of animal-environment engagement. They are stabilized patterns of interaction comprising the animal and the environment. So what gets to be an object depends constitutively on the perceiver.

I've argued in my work that the same thing is true of colour (Thompson, 1995). Colours are relational not just in the sense that they involve interrelations between surfaces and lighting in the environment, as Noë (2004) discusses. They are also relational in being constituted by relations between sensorimotor invariants of colour perceivers and their environments. The animal's sensorimotor capacities contribute to the constitution—the bringing forth—of colour. This is evidenced by the wide range of different and incommensurable types of colour worlds and colour perception across animal species. Colour was one of our main examples of enaction as the bringing forth of worlds in *The Embodied Mind*.

Some philosophers would say that colour is a "secondary quality" (one dependent on perceivers for its manifestation) whereas shape is a "primary quality" (one that belongs to the physical world independent of perceivers). I've never accepted this division. As Varela and I argued, shape, and perceptual regions and boundaries in general, are also relational and partially constituted by sensorimotor activity (Thompson et al., 1991). What makes a shape or region or boundary in the world of the perceiver be the one that it is depends on the perceiver and how it segments the environment through its sensorimotor activity. The sensorimotor theory supports this idea because it describes how what counts as a particular shape for a perceiver depends on the perceiver's sensorimotor invariants and not just on the animal-independent layout of the environment.

Or consider space. As Poincaré (1898) suggested, sensible space arises from our implicitly learning invariants in the relations between sensory impressions and movements. Sensible space is not pregiven but has to be brought forth by sensorimotor activity, and its enactment is a necessary condition for our experience of place and for being able to create abstract representations of metric space through geometry. Husserl (1997) makes a similar kind of argument in his 1907 lectures on "Thing and Space" where he describes how different kinds of sensible and perceptual spaces are brought forth through the interwoven syntheses of perception and kinaesthesis (the experience of movement). For Husserl, visual space is constituted through the experience of eye-movements, head-movements, and whole-body movements, and the visual flow patterns they generate.

The way I've been describing Noë's sensorimotor theory aligns it closely with Husserl's idea of *constitution*. For Husserl, we constitute objects, space, time, and the world in the sense that we bring them to presence through our synthesizing activities (Sokolowski, 1970). Or rather they are brought to presence through us, because their synthesis is not just a matter of what we actively do, but also, crucially, of how we are affected and solicited by what and how we sense and feel through our living bodies. Certainly, for Husserl, it would not work to say that what we constitute or bring forth is experience and not the world, for there is no way to pry the two apart. As Merleau-Ponty (2012) wrote, discussing presence, "The world is inseparable from the subject, but from a subject who is nothing but a project of the world; and the subject is inseparable from the world, but from a world that it itself projects" (454). This passage served as a motto for the enactive approach in *The Embodied Mind*.

This brings us back to the very idea of a world. In Noë's paper from which I quoted at the beginning, he says: "Presence… implies a world, that is, it implies not only that things *show up*, but that they show up as residing within a skein of meaningful relations, some foregrounded, others in the background" (964). "World" here clearly does not mean nature or the universe as the physicist conceives of it. After all, there is no foreground-background structure in the physicist's nature or universe; that structure is perceptual. To think that nature as physics describes it is the world is a case of what Husserl (1970) called "surreptitious substitution," the covert replacement of concrete, lived reality with the abstract and idealized product of an objectifying, mathematical method. Nature, to the extent that science discloses it, including with mathematical physics, is always found within the world. Although we can and should say that nature, the cosmos, contains our world, we also can and should say that the intelligibility or presence or manifestation of nature as such resides within our world. (These ideas are themes of my co-authored book *The Blind Spot* [Frank et al., 2024].) Speaking with Husserl we can say that the world is the horizon of every possible horizon of meaning or intelligibility, including the intelligibility of nature for science. Or speaking with Heidegger we can say that the world is the manifestness of beings as such. A world is "cast-forth" with our being, Heidegger (1988) says.

Heidegger (1996) notoriously also says that whereas we human beings are "world forming," animals are "world poor." Animals, he thinks, are instinctually driven and captivated by their surroundings, and are incapable of relating to presence or manifestness as such. Although animals have a kind of behavioural openness, and so aren't completely "worldless" the way a stone is, they nonetheless do not cast forth a world. So being "world poor" for the animal ultimately amounts to its not really having a world at all. But Heidegger is wrong for both philosophical and empirical reasons. It is a philosophical mistake to analyze animality or biological life privatively, as Heidegger does, by abstracting from what is specific to us and then equating what is left with animality or life. Even when Heidegger moves away from a strictly privative analysis and tries to analyze animal life on its own terms, he continues to use *Dasein* (our human mode of being) as his reference point. But animals, as well as very young children for that matter, engage presence or manifestness in their own unique ways different from that of the mature human adult, which always remains Heidegger's paradigm. Animal life is also not reducible to being instinctually driven and captivated by the environment. Thus, Heidegger's ethology is outdated.

Noë (2021), in contrast, thinks animals do have worlds. Worlds show up for them, he says, which is to say they enact the kinds of presence keyed to their forms of life and agency. I would say that animals are world-enacting, and that this formulation offers an alternative to Heidegger's categories of world-forming versus world-poor. Niche construction theory in biology gives biological content to this idea, and it's therefore encouraging to see a new generation of enactive thinkers use niche construction theory to articulate enaction as the bringing forth of worlds (Werner, 2020; Rolla & Figueiredo, 2023; von Es, 2024). Niche construction is the process whereby organisms actively modify their own and each other's local environments on both developmental and evolutionary time scales. Examples including building artifacts like nests and dams, creating trails, altering physical and chemical conditions on land and in the ocean and atmosphere, creating shade, influencing wind speed, changing nutrient cycles in plants, and many other processes and activities. Niche construction happens at metabolic, cognitive, social, and cultural levels, depending on the organism. It is creative because it makes, assembles, or puts together something new; it doesn't simply rearrange pregiven or pre-existent materials. Werner (2020), in an important paper on niche construction drawing on earlier philosophical work by Barry Smith and Achille Varzi (1999), shows that if we define a niche in terms of its part-whole structure, boundary, and location (using mereology, topology, and the ontology of location respectively), then niches are clearly not pregiven but are rather brought forth, because the parts, boundaries, and locations that define them depend constitutively on the activities of organisms. In another paper appropriately titled "Bringing forth a world, literally," Giovanni Rolla and Nara Figueiredo (2023) also argue that niche construction is the bringing forth of a world constituted mutually by the organism and the environment. As Di Paolo (2023) notes with reference to this work, "the world is not simply the idiosyncratically interpreted but otherwise independent environment, i.e. the organism's *Umwelt*. Rather… a world is *produced* through the material consequences of meaningful engagements… something is shaped, selected, determined, brought forth into being through significant activity" (164). Here we rejoin Noë's (2021) statement I quoted at the outset: "To enact ourselves in the world is to alter the world and so, in that sense, to make it" (961).

To summarize: "bringing forth a world" can be given both ontological and ontic readings (Di Paolo, 2023). Enaction is the bringing forth of a world understood as presence or manifestness with open horizons of potentialities and possibilities, which become actualized and concretized, thereby generating new horizons of potentialities and possibilities. Without enaction there is no world in the sense of horizonally structured presence and absence. This is the ontological reading. Enaction is also the bringing forth of a world understood as co-determining bodies, habits, and niches. This is the ontic reading.

Noë's work since *Action in Perception*, in particular his books *Strange Tools* (Noë, 2015) and *The Entanglement* (Noë, 2023), can be read as studies of how, in enacting ourselves through art and technology, we bring forth the world by altering it. In *Strange Tools*, Noë introduces the concept of an *organized activity* and argues that it is a pervasive feature of human life and much animal life. His examples of organized activities are social: breast feeding and conversation; we should add play and religious rituals. Such activities are organized in the sense that they are basic (they

are natural, rooted in our biology), they are skillful, they have temporal structure, they aren't directed by any one individual participant, they have functions, and they can be sources of pleasure. We can also say, using the language of Varela's enactive approach, that organized activities exhibit a kind of autonomy. An autonomous system, according to Varela, is one that has "organizational closure," where this means that every process or activity in the system enables and is enabled by another process in the system—think of metabolic processes in a cell (Varela 1979/2025). (Think of metabolic processes in a cell.) Ezequiel Di Paolo adds that autonomous systems are also "precarious:" they must continually produce and maintain themselves in challenging conditions otherwise they will fragment or run down, and the processes that make them up would themselves otherwise run down if they were not caught up in the system (Di Paolo & Thompson, 2024). Autonomous systems, in Varela's language, are "sense-making" systems: they enact or bring forth meaning and significance in their interactions. Living is sense-making in precarious conditions (Thompson, 2011). This is also part of what it means to bring forth a world.

Varela's paradigm of a minimal autonomous and world-enacting, niche-constructing system was a living cell. "Autopoiesis" was his and Humberto Maturana's name for this kind of basic biological autonomy—the molecular self-production of a bounded, self-maintaining individual that also brings forth its own "cognitive domain" (Maturana & Varela, 1980). Varela also described autonomous systems in the social domain, using the example of a conversation—one of Noë's main examples of an organized activity—as a guiding idea. In the Preface to *Principles of Biological Autonomy*, Varela's landmark 1979 book, he wrote: "The fundamental paradigm of our interaction with an autonomous system is a conversation and its unsatisfactory results breaches of understanding" (Varela, 1979/2025, xxix). Further on in the book, when discussing the co-constituting structure of a conversation and its participants, he adds: "I am using here 'conversation' in a general and loose sense. Species interaction achieving a stable ecosystem can be thought of as the biological paradigm for a conversational domain. But human interactions can be similarly treated, as participants engaged in dialogue, whether with each other, with the environment, or with ourselves. This is the process underlying the conversational patterns that constitute the autonomous unity to which we belong and which we construct" (226).

Hanne De Jaegher and Ezequiel Di Paolo (2007) have extended these ideas further in the human, social domain with their idea of "participatory sense-making." When individuals coordinate their utterances and movements in an interaction, such as a conversation or a dance, the interaction process itself can take on a form of autonomy. "Participatory sense-making" refers to how meaning is generated and transformed in the interplay between the individuals and their unfolding interaction. Social worlds are brought forth by participatory sense-making, and social worlds make participatory sense-making possible (Di Paolo et al., 2018). Cognition and world are co-constituting.

One of the central ideas of Noë's recent work is that human sense-making, especially participatory sense-making, has always been constituted by art. Art has always already been reorganizing and remaking our organized activities as human beings (and, we could add, our organized ways of interacting with animals: think of the hunt and Upper Paleolithic cave paintings). Artistic practices and art works loop into the

organized activities of our lives and reorganize them, making them something new. This is what it means, in general terms, to say that art and life are "entangled" (Noë, 2023). Entanglement is a kind of enaction. It means that art has always already been playing a role in how we bring forth our world.

Much more can and should be said about Noë's rich idea of entanglement and his recent work in the philosophy of art, but I cannot do so here. What I have tried to do is to trace a path from Noë's *Action in Perception* to his *Strange Tools* and *The Entanglement* by emphasizing their important contributions to our understanding of how enaction brings forth a world. To bring forth a world is to enact oneself, and to bring forth oneself is to enact a world. Enaction, being, and worlds are entangled.

Author contributions Sole author.

Funding NA.

Data availability NA.

Declarations

Ethical approval NA.

Informed consent NA.

Statement regarding research involving human participants and/or animals NA.

Competing interests NA.

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