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F/acts

Ways of Enactive Worldmaking

Abstract: *Knowing is an activity through which agents and world produce themselves. This is often expressed by the enactive claim that agents bring forth a world. I analyse this idea for different modes of agent–environment engagement: interactional, transactional, and constitutional. Something is produced in each case. Bringing forth a world is not only an epistemic but an ontological claim. Acts in their fine structure result from a process of fact production, or f/acts. F/acts co-emerge with their 'preconditions', e.g. intentions, affordances, across the subject/object divide. F/acts define their inner temporality and affectivity, comprising both event and experience. A plurality of worlds is admitted in this enactive view, without entailing anti-realism. We cannot bring forth just any world. World resistance organizes action and experience. I touch on the implications for objectivity and free will and discuss the primordiality of activity, community, and relationality. From a notion of groundlessness in early enactive work, I suggest that a participatory universe is better conceived as a meshwork of groundless grounds.*

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1. Introduction: 'The Psyche of the Universe'

On the eve of starting his university studies, Francisco Varela was asked about his *real* interests, what he desperately wanted to understand. He answered: '*I'm interested in the psyche of the universe.*'

How should we read this? It may not be possible to describe with a single message a scientific trajectory as wide-ranging as Varela's. If asked to try, I would say his major concern was to articulate a vision of life and mind that would do full justice to the abundance, diversity, and complexity of human experience. This vision is a kind of naturalism, conceiving of a Nature accessible to human enquiry and within which we are fully included as material, sentient, caring, and precarious social beings who exist in changing relations with ourselves and with the rest of the universe.

Varela's vision is not exhausted by the shapes it has taken in the past. Nor is it today only his. It brings together many people who continue to develop his ideas as a counter-discourse that invites different ways of thinking about bodies and minds. The people working with these ideas engage with a variety of practices, from education and health sciences to the humanities and the arts. They try to do so without abandoning rigorous thinking but without arrogance either; eager to listen and learn from multiple sources and from diverse and even divergent traditions, holding in abeyance the urge to unify while at the same time attempting to build a forward-moving body of interlinked viewpoints (in this sense, the enactive project is neither strictly modernist, nor post-modernist). Varela's vision spreads beyond science into concerns for the human condition in all its messiness and difficulties as well as the condition of the planet within which we grow. These are ethical, practical, and philosophical concerns.

If further pressed to be more precise about the central message of Varela's thought, I would say it is encapsulated by the claim that living organisms *bring forth a world*. Or more evocatively in the slogan translated from a poem by Antonio Machado that reminds us that *we lay down a path in walking*. Contained in these idioms is a view of knowing as a kind of *activity*, more precisely a kind of productive activity, a poiesis as much as a praxis. Some*thing*, as well as some*one*, is brought forth; a history is laid down. What is produced is a way of being and knowing; a community of knowers and a world in

which the community exists. The dizzying circularities in such claims are hard to grasp and may even sound nonsensical.

I suggest, however, that all of the enactive approach as it stands today, and probably as it will continue to develop, can be understood just by taking this one idea seriously. My purpose in this paper is to look at it more closely: its meanings, how it is justified, what it says about how we relate to our surroundings and to our experience, and what it might hint about the kind of commitments we encounter in enactive views of Nature. I will discuss possible readings of *bringing forth a world* in relation to similar ideas coming from pragmatism and constructivism. Then I will introduce what I think is a stronger enactive reading: something *new* is produced in the activity of sense-makers. This can be shown by introducing a distinction between inter-actional, transactional, and constitutional agent–environment engagements. With these ideas, I will consider the fine structure of *acts* and the *facts* they produce. I will also indicate a few implications for an enactive ontology, but will not fully develop them here.

2. Unpacking Enaction

Of course, this 'one idea', *bringing forth a world*, is actually a series of detailed proposals that aim to capture what life and mind are about. Without getting too lost in technical aspects, a useful way to think about these proposals is expressed by Varela himself in his 1991 paper 'Organism: A Meshwork of Selfless Selves'. In it, Varela proposes a double, knotted dialectic to spell out the logic of relations of production and significance between organisms and environment:

> Organism connotes a knotty dialectic: a living system makes itself into an entity distinct from its environment through a process that brings forth, through that very process, a world proper to the organism. (Varela, 1991, p. 79)

Varela proposes to unpack this claim by studying a *dialectics of identity* and a *dialectics of knowledge* as a 'two-tier affair' (*ibid*., p. 102). Through a dialectics of identity, Varela describes how an organism posits itself as a *for-itself* through the material realization of its organization as a self-producing and self-distinguishing entity *through* ongoing exchanges with the environment. This idea derives from previous work on autopoiesis and biological autonomy. The dialectics of identity appear not only in organic metabolism but in other systems in the organism and beyond: the immune system, the nervous system, the relation between cells and extra-cellular matrix

(Varela and Frenk, 1987), social interactions, etc. In the dialectics of identity, two orders of magnitude are brought together: (1) the organized operation of component processes that give rise to an emergent unity (metabolism, neural assemblies, antibody networks, etc.) and (2) a totality formed by this unity-in-relation that engages in its own domain of interaction (in fact, it defines it) with its environment and constrains the activity of the components (organic body, perception–action loops, immune self, etc.).

The knowledge dialectics establishes a relation of significance through which the emergent entity relates to the world in non-indifferent terms. The domain of interactions, as such, emerges from the identity dialectics. These are the engagements with the environment that do not interrupt the identity process, though they may induce dynamical or structural changes (structural coupling). What happens within this domain is not indifferent to the organism. Some perturbations may push it too close to its limits of viability while others are relatively safe. These differences in the character of perturbations to the organism depend directly on its current state, they are specified by the organism's operation and in turn they induce structural drift in the organism. The environment, in this picture, is not a set of problems for the organism to solve but is co-determined (selected, modified, filtered, etc.) by organismic activity.[4]

The moments of the knowledge dialectics are (1) the perspective of significance from which the organism takes in the environment as a space of possibilities, risks, tensions, satisfactions, and (2) the interdependence of the organism and the environment as co-determined through mutual coupling. Through these two moments organisms are said to *bring forth a world*.

Weber and Varela (2002) elaborate these claims. They propose that the processes of identity are the basis for the processes of significance (back-pedalling from the subtler, knotted relation between the two dialectics in the 1991 paper). This structure/super-structure proposal leads to inconsistencies (such as the notion of graded breakdowns in autopoiesis). The proposal requires another concept, *adaptivity*, that

[4] An important shift is at play here, a common enactive move of holding together a third- and a first-person perspective and let them inform each other. The identity process and the domain of interactions are operational descriptions in the tradition of systems science. But by considering this third-person description in relation to our first-person experience we reach new insights: the domain of interactions is not neutral but value-laden. These insights then become the goal of subsequent theoretical development.

gives the system enough room to organize its activity, its changing relations to the environment, while it is still alive (Di Paolo, 2005) (and restoring, by the way, an equiprimordial relation between being and knowing). Further theoretical elaborations have refined this proposal, e.g. Giovanna Colombetti's (2014) approach to affectivity, Hanne De Jaegher's (2021) expansion of these ideas into the social domain and epistemology, and the concept of precariousness (Beer and Di Paolo, 2023).

The claim that organisms bring forth a world deeply informed the ideas presented in *The Embodied Mind* (Varela, Thompson and Rosch, 1991). This can be appreciated by several empirical examples discussed in the book (e.g. colour vision and perceptually guided action) where the two key moments of the knowledge dialectics are at play: existence within a world of significance is manifested in lived experience and this experience is itself the ongoing embodied activity the brings forth a world of significance.

The uses of the expression *bringing forth a world* are often clearly epistemic: from the organism's perspective things are not indifferent; they have value. Events are positive or negative, they satisfy this need or induce that risk. Even value neutrality is not the same as indifference; indifference means something is not even noticeable (e.g. for our bodies, radio waves). These relations depend obviously on the organism in question, its history, its current situation. Change the organism and these relations change. So this world of significance is indeed brought forth by the organism and its history.

The epistemic sense may not be hard to accept but by no means is it philosophically uninteresting. In a weaker version, it is implicit in the acknowledgment that available experience underdetermines the knowledge we can claim to be true (in science, different theories can fit the currently available empirical data). In stronger versions, this sense informs pluralist views such as Nelson Goodman's (1978) *Ways of Worldmaking*, whereby the underdetermination of knowledge by experience cannot be entirely explicated by a relativist disentanglement of conflicting true statements, i.e. by providing the alternative contexts in which each is true, but by assuming instead that different *versions* correspond to actually different *worlds*. These worlds are not arbitrary, but remain locked within with the logic of linguistic descriptions and their coherence with experience, to the point that talk about a description-independent reality, according to Goodman and other pragmatists such as Hilary Putnam and Richard Rorty, adds little to the activity of worldmaking. The rightness of a version cannot be

tested against an undescribed reality. (But where do descriptions come from?) This is why this kind of pluralism is often construed as a form of constructivism (e.g. Boghossian, 2006).

If this pluralist epistemic sense of *bringing forth a world* provokes some uneasiness, its ontic sense hits a raw nerve. This is the sense in which the world is not simply the idiosyncratically interpreted but otherwise independent environment, i.e. the organism's *Umwelt*. Rather, alongside this epistemic sense, and maybe also because of it, there is the sense that a world is *produced* through the material consequences of meaningful engagements, the sense that something is shaped, selected, determined, brought into being though significant activity. Underlining the full embeddedness of mind within nature, epistemic activity is considered a material process whose effects, intended or not, shape the world. To see that Varela often has this meaning in mind, we only have to look at his repeated references to Richard Lewontin's (1983) view of organisms as subjects and objects of evolution (what in later years became known as niche construction or ecosystem engineering in evolutionary and ecological sciences). Not scared by this reading, younger generations of enactivists seem to embrace it (e.g. Rolla and Figueiredo, 2021).[5]

Because cognitive scientists and philosophers of mind have a tendency to herd such ontic connotations back into the epistemic corral (when not directly digging for them inside the brain), Varela and enactivists have sometimes been interpreted as intending a variant of constructivism (and sometimes flatly accused of plain idealism).[6]

5 An ontic/ontological sense of worldmaking is more readily accepted in disciplines such as anthropology and design studies, or at least seriously discussed. See Descola (2013) for a key text in the ontological turn in anthropology, Law (2015) for a perspective on reality and performativity in social and STS studies, and Willis (2006) and Escobar (2017) on ontological design.

6 The perennial complaint that the enactive approach implies some kind of idealism (e.g. Heft, 2020) ignores repeated clarifications on this topic in the enactive literature, starting with *The Embodied Mind* (Varela, Thompson and Rosch, 1991, e.g. chapter 8). Idealism, particularly in its subjectivist variant, is explicitly rejected on the grounds that the subject is itself in a process of ongoing production that results from enactive engagements. Agents and environment are co-defined and co-determined. The world produces the subject and the subject produces the world, which must be grasped not as two separate logical *statements* but as a simultaneous concrete dynamic *process*. This basic tenet of the enactive approach is hard to miss. What may trigger accusations of idealism is that the enactive approach is equally critical of naïve realism, and grasping the possibility of an alternative between these options challenges entrenched dualistic patterns of thinking present in our language, even in those who disavow dualism.

Both Maturana and Varela, as well as many constructivists, have been deeply influenced by a similar group of thinkers, e.g. key figures such as Jean Piaget in psychology and Heinz von Foerster in cybernetics. Enactivists and constructivists are explicitly critical of naïve realist positions that assume a world as given. But while Maturana seemed comfortable with his association with constructivism, as can be gathered from his regular engagement with constructivist circles until the end of his life, Varela firmly resisted the label.[7]

Without entering into a discussion about labels and positions, what Varela was keen to emphasize in his enactive thinking is that to know the world is to be active in the world, fundamentally. To know is to act. Activity does not simply *serve* knowledge; knowing *is* itself an active process. Enaction is a thoroughly *performative* approach to life and mind. Constructivism, by contrast, circles around the orbit of a mediation between knower and known, only that this mediation does not assume a world-as-it-is. Apart from this, constructivist processes of mediation (e.g. schemas, mental categories, knowledge structures) can and often do operate very much as mental representations operate in cognitivist accounts, only these epistemic structures are beholden to a condition of coherence and viability rather than being judged in terms of their fit to the world. The task of knowledge for constructivism is not to approach ever more precise degrees of accuracy measured against an inaccessible world-as-it-is, but rather to construct viable epistemic structures that satisfy the constraints of existence. There are multiple valid viable forms of knowing in this view (as in the enactive approach). Constraints on knowledge are indeed manifested through activity but for the most part activity plays only an enabling role in the (usually individual) task of constructing viable knowledge.

This is, admittedly, a quick characterization but it paints a not unfair picture of the similarities and differences between enaction and constructivism and leads into the key motivation for this paper, which is to clarify in what ways we can conceive of knowledge as *constitutively* an activity and not just as sustained by an activity. What does this imply for the agents that engage in this activity and the world in

7 'I should like to state quite clearly and unambiguously: I am not a realist, and I do not consider myself a constructivist… Classical constructivism does not at all impress me as a convincing mode of thought because it posits one side of the cognitive process as absolute: the organism forces its own logic and its own models on the world. I do not believe that to be the case at all' (Varela and Poerksen, 2006, p. 40).

which this activity takes place, since they are both inevitably changed by it?

3. Kinds of Contact between Agents and Environments

I will develop the claim that the enactive approach entails an ontic/ontological reading of the idea of bringing forth a world. The claim that something is *produced* in agent–environment engagements is easier to see if we look in some detail at different modes of engagement (in this section) and the fine structure of acts (in the next).

Two central tenets are implicit in the very name of the enactive approach, as I already mentioned. The first one is the claim that what we know is inseparable from what we do, that affect and cognition, however apparently passive or introvert, are *activities* that take place in the relational space between agents and world, activities that are significant for the agents and induce changes in the world. In other words, knower and known are inseparable because they are co-determined. The second tenet is that these agent–world engagements are *always* creative if we understand creation literally as the *production* of something that was not present before, in some non-trivial sense, i.e. as the actualization of newly concretized and virtual relations.[8] Creativity, in this basic sense, does not only occur in agent–world engagements, but is a feature of the interweaving mesh from which both agents and world co-emerge. This broad notion of creativity does not imply novelty with respect to a framework of expectations or radical reconfigurations of meaning spaces, as the term is more commonly used, although it is most clearly manifested in such cases.

Creativity is entailed by the claim that the world is not pregiven and that agents are not passive receivers of informational inputs, which

8 In this and the following sections I make use of terminology developed in recent enactive work (Di Paolo *et al.*, 2017; 2018; Di Paolo, 2021; Di Paolo and De Jaegher, 2022) and largely adopted from thinkers such as Gilbert Simondon, Evald Ilyenkov, and Alfred North Whitehead. Briefly, a process or an entity is said to be more *concrete* than *abstract* the more it is embedded in a set of relations with other processes or entities. A carburettor lying on a table is less concrete than the same carburettor working as part of a car engine. A passage towards increased concreteness is sometimes called *concretization*, sometimes *individuation* or *actualization*. *Virtual* relations describe as yet non-actualized *concrete* potentialities. They contrast with counterfactuals in the sense that they are adjacent or neighbouring a concrete situation (things that might be about to happen as opposed to things that are conceivable).

they then organize via some form of cognitive mediation (e.g. mental representations). Only in these mediational perspectives can change be consigned to a mere update of states internal to the agent. Nothing else needs to change and so, from such perspectives, change (learning, development, habits, environmental shaping, etc.) must be *added* as phenomena externally related to the cognitive process rather than inherent in it. Only in these mediational perspectives can we separate knowing from doing and assume change as *merely* contingent. For an enactive perspective, to know the world is always already to change it and ourselves (De Jaegher, 2021).

The two tenets have been much discussed in the enactive literature but they apply more widely to other perspectives in embodied cognitive science. To see this, it helps to roughly sort agent–world engagements into three different kinds. These are practical rather than principled distinctions. Depending on certain conditions an engagement can be classified as *interactional*, *transactional*, or *constitutional*. In all of these cases there is a *contact* between agents and environment leading to processes of mutual change, and so all of these are to be distinguished from input–output scenarios where systems are (nearly) decomposable in Simon's (1969) sense and in which neither of the two tenets hold.

We find examples of the three kinds of engagements throughout the history of psychology and often expressed in diagrammatic form (Di Paolo, 2020). All engagements entail a mutual influence between systems. The distinction is in the kind of change that takes place.

In dynamical systems terms, a system is defined by a set of variables and a rule that describes how these variables change over time. This often takes the form of a mathematically expressed law of change plus a set of parameters and constraints that fit the law to particular circumstances. Two systems are said to be coupled when the constraints and parameters affecting the flow of one system depend on the state of the other (and vice versa if the coupling is mutual).

We say that an agent–environment engagement is an *interaction* if agent and environment can be described as systems in mutual coupling and whose laws of change remain invariant. During an interaction, the two systems affect each other by mutually perturbing parameters and constraints and as a consequence the changes in the states of each vary in mutually dependent, but *not* mutually determined, ways because each system still follows its *own* invariant law. To say that these laws remain invariant means that their form doesn't change, even if parameters and other contextual conditions do change

as a result of the coupling. Even if each system 'does what it always does' during an interaction, they may still produce dynamical patterns that would not normally be possible in the absence of coupling, for instance, by reshaping the landscape of attractors.

Adapting Dewey and Bentley's (1946) terminology, we say that an agent–environment engagement is a *transaction* when, as a result of their mutual coupling, the *form* of their own laws of change also varies over time. Here we do not simply have a situation in which systems are perturbing each other and inducing changes in their states, but they are mutually changing the laws that govern them. For instance, a novel parameter may emerge as relevant that had no role before, or the effects of a particular perturbation may disappear with repetition even if other states remain the same, and so on. We associate transactions with the idea of plasticity: changes not only in states and dynamics, but in the way the systems change.

An agent–environment engagement is described as a relation of *constitution* when their status as the systems they are depends on their relation. Here the strict dynamical systems description of agents and environments *as* systems breaks down and it is not always easy to speak of laws of change, parameters, and couplings. These are all affected by the engagement in some way. For instance, what counts as the set of variables defining a system at one moment may change by incorporating processes that were external to it (as when we incorporate environmental processes into our bodies). Mutual constitution does not mean chaos. Metastable 'invariants' can emerge *through* becoming.[9] These invariants are often organizational rather than structural, i.e. they refer to general relations between changing dynamics and changing structures. A typical case of constitutional engagement is metabolism, which is defined as an ongoing exchange (matter, energy, shaping influences, etc.) between organism and environment while keeping the organism distinguished as a dynamic unity. What is invariant in metabolism is not a collection of variables (the set of variables and not just their values can change, as in the case of metamorphosis) or a law of change (metabolizing a noxious substance produces different chemical reactions, the production of

[9] Metastability in this context indicates states that are durable but not strictly stable. The system is not in full equilibrium but, relative to the scale of observation, it does not manifest strong transient behaviour either. A metastable state may be poised on the cusp of change and may move rapidly to a lower energy configuration if triggered by a perturbation or by its own dynamics.

counteracting proteins, and so on, i.e. new dynamics and not just parametric changes). What remains invariant is a concrete instance of an organizational principle; in this case, a principle of individuation through precarious self-production and self-distinction.

These kinds of agent–environment engagement vary according to the intensity of the effects they exert on the becoming of the engaged 'systems'. During interactions, each system retains its identity and its mode of operation, but their dynamics are codependent. During transactions each system retains its systemic identity, but its mode of operation changes plastically, so that both their dynamics and their structures are codependent. During situations of mutual constitution, the systems' own identity and organization are mutually defined and continuously shaped: they co-emerge, moment to moment, as metastable concretizations open to ongoing change at all levels.

As I said, these distinctions are meant to be practical. There is room for choice by adopting a particular perspective as observers; say, the choice of spatial and temporal scales, to redescribe, for instance, a transaction as an interaction. This move is valid or not depending on the question we are interested in and whether the appropriate conditions in fact obtain in the observed situation.

What we say about interaction and, to an extent, about transaction is relevant for most embodied approaches in cognitive science. Because of how agents are theorized in the enactive approach as autonomous and precarious world-involving processes of self-individuation (Di Paolo, 2018), it follows that from this perspective the default mode of engagement between organisms and environments is always constitution. It is what goes on the whole time. However, mutually constitutive processes do in fact 'settle' at least for some periods into metastable conditions. Here we may fruitfully speak of dynamically described 'systems' with certain regular patterns of operation and even patterns of expected plastic operational change, thus simplifying a situation of constitution into one of transaction or one of interaction and making the dynamical systems approach directly applicable.

Is this a distinction simply based on timescale? No, though timescale is sometimes a good guide to differentiate these modes of engagement, with interaction corresponding to the faster and constitution to the slower ends. Constitutional engagements, however, are happening all the time in the form of reaffirmations that counteract the tendencies of precarious systems toward disorder. In some cases, these constitutional engagements can appear as a breakthrough or innovation at much faster, behavioural and experiential, scales as when an

infant suddenly integrates existing schemes for visual attention, extending the arm, and grabbing with the hand, into a novel scheme for grasping objects (Thelen, Corbetta and Spencer, 1996). This should come as no surprise if we consider organisms as existing in dense critical regimes (Longo and Montévil, 2014; Aguilera and Di Paolo, 2021) in which there can be large-scale correlations across many orders of magnitude, suggesting that the clean picture of decoupled slow and fast dynamics (e.g. a situation of a purely interactional engagement) is not the rule for organisms.

4. What is Brought Forth in Each Mode?

How are the enactive tenets manifested in each kind of engagement? What's being *produced* in each case? If constitution is the default mode of engagement, it seems as if it would be sufficient to show that an ontic reading of *bringing forth a world* applies to this case in which the inseparability of knower and known is most obvious. It is more convincing, however, to show that it applies to all cases.

If an engagement is an interaction, it might seem as if nothing new can be produced, since both agents and environment can be described as systems that do not change. However, engagement patterns can take the form of novel transients and even a convergence to a *dynamical* invariant of the sensorimotor loop that manifests experientially as a stable perception or a situation of maximal grip. A classic example is feeling the softness of a sponge by pressing it between the fingers. Softness-as-such is not a pre-existing, already concretized property of the sponge to be informationally picked up by the agent. It is not *in* the sponge in any sense (just look inside it). It is a potentiality of the engagement between sponges and certain kinds of bodies that enact specific sensorimotor patterns, such as squeezing with the fingers rather than, say, smelling. For ants, the softness of a sponge is neither a potentiality nor a possibility. Concretized in such a way out of myriad potentialities, softness is actualized, *produced* in its material and experiential aspects as something emerging out of the engagement, even if agent and sponge can be treated as structurally unchanging systems.

Interactional engagements bring forth the actualization of a particular alternative out of the concrete potentialities inherent in the situation.

Significant breakdowns in interaction lead to attempts at re-equilibration. These are transactional engagements in which both

agent and environment suffer plastic alterations and in the process new *structural* invariants can emerge, such as novel skills, habits, rearrangements in the environment, and so forth. Situations of perceptual learning are transactional; most clearly so in examples of adaptation to radical sensorimotor disruption (Kohler, 1964). The changes that emerge in such situations are historical in the sense that even if we can approximate agents and environment as well-defined systems, their structures undergo mutually triggered plastic changes during the engagement, leading either to further breaks or to a new co-adapted condition. The new situation is not necessarily a net 'gain', as with the need to find ways to cope with loss of skill (e.g. due to illness, injury, or ageing). Out of transactions, normative frames take new shape, an agent's powers and sensibilities are restructured and the environment takes the form of a niche (largely) adapted to the agents' changing way of existence and in turn enabling it. These newly produced relations do not exist before transactional activity takes place.

Transactional engagements produce a reshaping of the landscape of concrete potentialities of a situation.

In the case of constitutional engagements, both agents and environments are mutually reorganized as a result of the encounter. An agent's body may suffer alterations such as the incorporation of external processes into its identity (think of insects trapping air bubbles on the surface of their bodies that allow them to breathe underwater). Environments may be reorganized beyond co-adapted structural changes into configurations that give rise to new processes (think of cases of environmental engineering such as burrows, tunnels, nests, dams, and soil chemistry). New *forms* of engagement are made possible in this way.

Constitutional engagements bring new concrete potentialities to a changing situation, which is another way of saying that they produce new concrete possibilities.[10]

[10] A concrete possibility is not merely a logical possibility or counterfactual, i.e. anything that is not conceivably impossible. A concrete possibility is defined by the horizon of a concrete situation as that which is reachable by the actualization of a concrete potentiality. If a rabbit is falling off a cliff there is typically no concrete possibility that will prevent the expected outcome. Time-travellers materializing in its path are not a concrete possibility. If an eagle is to catch the rabbit in flight, it must already be flying around there. A *novel* concrete possibility is *adjacent* to the situation in the sense that, even if it is not an alternative in the current set of potentialities, the actualization of one of these potentialities leads to a situation in which the possibility is now reachable.

In sum, in an *ontological* sense, bringing forth a world can take the shape of an actualization of existing potentialities in the case of interaction, or the restructuring of the landscape of potentialities, in the case of transaction, or the creation of new concrete possibilities, in the case of constitution (Table 1).

Engagement	What changes	Production (ontic)	Production (ontological)
Interaction	dynamics	dynamical invariants, grip, properties	concretized potentialities
Transaction	structures	habitus, learning, settings, styles	reconfiguration of potentialities
Constitution	organizations	bodies, niches	concretized possibilities

Table 1. Summary of modes of engagement and what is brought forth in each case.

We bring forth a world in different ways in daily life, in our every contact with our surroundings and with other agents even when we are not considering the most obvious senses in which this is true, as in historical and societal change, the spread of technologies, or eco-evolutionary processes of niche construction.

5. The Myth of the Isolated Act

Of course, not everything that happens during processes of interaction, transaction, or constitution is a moment of production. Rather, it is at the phase of some adaptive resolution, at whatever scale, that the new becomes concrete, as when a percept is individuated, an act completed, or a habit settled. At earlier stages or in cases of breakdowns, this is not (yet) the case. To see this more clearly, let us look more closely at the fine structure of acts.

Laboratory studies in psychology and neuroscience isolate the phenomenon of interest as much as possible in order to say something significant about a specific hypothesis. This methodological constraint is often reasonable. But it promotes a perspective in which agents are seen as acting and perceiving the world as a chain of more or less isolated and well-distinguishable acts, with little but cumulative influences between them, each act susceptible of being explained by a similar formula of antecedent conditions, phases of the act (e.g. initiation, control, culmination) and resulting conditions leading to the

next act in the chain. This is not how activities unfold in real life, which is much messier. We are generally thrown into entangled flows of action, involving different activity genres with their own regional normativity, which occasionally overlap or contradict each other by interruptions, confusions, hesitations, and diverging goals. Relations between acts are non-linear and path-dependent.[11] Acts are hardly ever isolated in real life, but part of a web of engagements involving multiple bodily dimensions (organic, sensorimotor, socio-linguistic), often multiple agencies, and always the world. Isolated acts are a myth; more an artefact of methodological limitations than a real phenomenon.

The best way to help us rethink acts in enactive terms is to criticize the classical conditions–enactment–result structure. If agents bring forth a world, not just in an epistemic but also in some of the ontic/ontological senses considered above, then the usual way of conceiving of the structure of acts is problematic.

Critics of the stimulus–response construct in psychology, such as Dewey, Erwin Straus, Merleau-Ponty, and others, emphasize the circular influence between bodily and environmental processes leading to a situation of perceptual grip in which we cannot say whether stimulus causes response or action provokes stimulus. This is what we described above as the production of a dynamical invariant in situations of plain interaction. Each act is a fluid arrangement of sensorimotor schemes, themselves a combination of patterns of agent–environment coordination (Di Paolo, Buhrmann and Barandiaran, 2017). There is no act that is not jointly enabled by body and environment. But if we admit the possibility of stronger senses of agent–environment codependence, such as transactional and constitutional engagements, the problems go beyond the need to switch from a linear to a non-linear causality perspective.

In the classical view (Figure 1), a situation leading to an act is described by a series of conditions on the agent's side and on the environmental side. An agent 'arrives' at the situation with

11 Consider complex engagements such as a doctor arriving at a diagnosis through a series of interventions intended to test and rule out alternatives. Non-linear action–decision chains like these can lead to paradoxical effects, e.g. rash actions can unlock situations in which we are stuck by overcautiousness (see Bedia and Di Paolo, 2012). Consider also placebo effects triggering reconfigurations of sense-making at the organic and (inter)personal levels, sometimes paradoxically as when placebos are explicitly described as such (open label placebos) (see Arandia and Di Paolo, 2021). For more on the question of action individuation and social interaction from an enactive perspective, see Gallagher (2020).

motivations, needs, hopes, desires, abilities, intentions, powers, sensibilities, emotions, beliefs, and so on. The environment is already present as a series of objects, affordances, opportunities, threats, obstacles, risks, etc. Out of the conjunction of these pre-existing factors, an act (somehow) takes place and results in a changed configuration of agent-side and environment-side conditions related to what the agent intended to achieve.

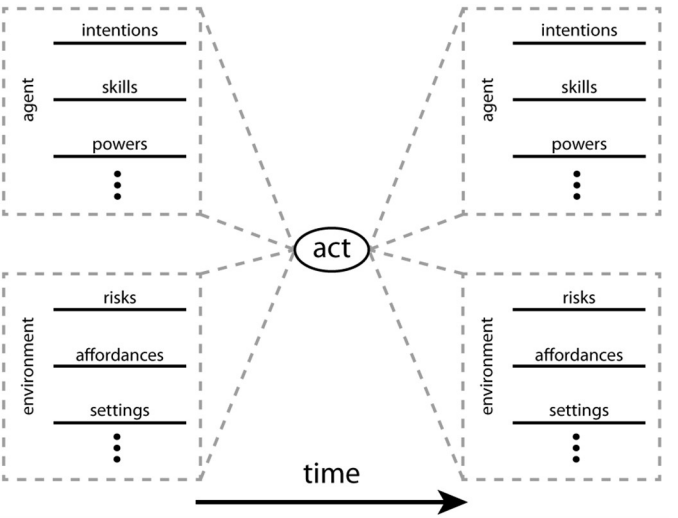

Figure 1. Classical conception of how acts are structured in terms of preconditions on the agent and the environment that give rise to an act and lead to a new set of conditions, all of it happening in externally defined time (arrow).

The problem with this picture is not that we cannot sometimes talk about conditions in the agent and in the environment using the terms listed above and others. The problem is to assume that these conditions *are already concretized* prior to the act in order to give rise to it causally and define it constitutively. The problem is to think of these conditions as concreta rather than concrescences, to put it in Whitehead's terms, i.e. exhausted processes rather than undergoing becoming *along* the activity of the act under consideration, as well as other acts that have not quite finished or fully started yet. This means that the temporality of the act is already predefined and unrelated to the act itself and its relations to other acts. In this way, we lose sight of the changing relations and processes of individuation that occur

while acts, agent, and world are brought forth. Moreover, we lose sight of the intimate relation between agents and environments by consigning conditions exclusively either to the agent or to the environment.

6. F/acts

Instead of following from conditions that are already actualized and neatly assigned either to agent or environment, an act is born out of a set of potentialities, relations, intensities, and tensions spanning bodily and environmental processes. These are not necessarily structured as concrete entities or partake of a shared simultaneity yet, e.g. as a given *affordance* or *intention*. Rather, potentialities are generally brought into concretion and take form through mutual resonance in the interlinking produced by the engagement: an *affordance-showing-up*, *an intention-in-the-making*. Activity (not just the activity involving the agent) is the driver in this picture rather than a result of putting the right factors together. It is already ongoing rather than magically propelled by a juxtaposition of inactive and heavily edited prior conditions.

Let me mention as an aside (though this would require further development) that this shift in view dissolves the classical conundrums surrounding the question of 'free will'. If an act is to emerge as a result of pregiven *concretized* conditions, it must follow those conditions as a matter of necessity. These inert conditions are given the task of sufficiently activating the act-process; they must *cause* it. But being already concretized, their causation must be linear and rule-like (this is what I mean by describing these conditions as *inert*; they operate as inputs to an external update rule). The effect of naming some of these conditions with subjective terms such as *motivations*, *intentions*, *desires*, which we (rashly) attribute entirely to the agent, is merely descriptive. If these subjective conditions are already actualized, there is no possible notion of freedom that fits this picture since we must conclude that the act *must follow from* these and the rest of its conditions. Nothing new is ever produced in these artificially clarified 'acts', nothing is created. In this picture, which is the opposite of the enactive picture, the act is simply a way of describing one more event in a closed causal domain, whose peculiarity among other events is externally ascribed.

If we assume, instead, that the 'conditions' of an act are themselves in-becoming, taking form possibly in relation to other acts, and

brought into mutual contact by the activity itself, the act does not follow from these ongoing processes as a matter of necessity. The act is rather initiated as the triggering of a particular series of events of concretization and propagation (or individuation and transduction in Simondonian terms, *cf*. Simondon, 2020) that produce and interlink flows of bodily and environmental activity. This happens in ways that are *permitted but not prescribed* by a situation that is itself evolving into new actualities.

An act actualizes what we externally designate as its own preconditions, which until that point are no more than pre-individual potential tendencies, and no less than this either, which is why they can activate and shape a once-occurrent event that we call the act. These influences coalesce into a concrete configuration by a triggering event. In this way, concrete agent and environmental conditions co-emerge and mutually actualize each other. This is why their relation is not external to each other, e.g. *the-affordance-that-shows-up-with-an-intention-in-the-making*. This is also why the supposed preconditions for an act, e.g. intentions, can in fact be brought forth retroactively, particularly in situations of social interaction (see Di Paolo, 2015). There is an 'organic' rather than a causal relation between acts, intentions, affordances, risks, and other bodily and environmental conditions (Figure 2).

A vague discomfort, eyes tired from staring at the screen, propels me away from my desk and orients me in a direction leading out of the room. Within the general relief of relaxing my eyesight toward a far-off distance, I notice a feeling of hunger. Time for a proper pause? A vague plan takes shape to prepare something to eat; I don't know what yet. I climb down the stairs and open the fridge unsure of what I'd like to have, but I recognize what I was craving for as soon as I set my eyes on it. My intention is taking form, gaining specificity. My home environment affords these activities among so many others (placing a heavy packet on a step of the staircase, sticking decorative magnets on the fridge door) that right now are not relevant and not in the process of becoming actual, present.

Some of my intentions take shape through the flow of activity. On some occasions there is a clear motivation in view, which I then follow by an act that satisfies it. But on these occasions I have engaged in more than one act, the concretizing and becoming aware of a motivation being one, the attempt to fulfil it being the other.

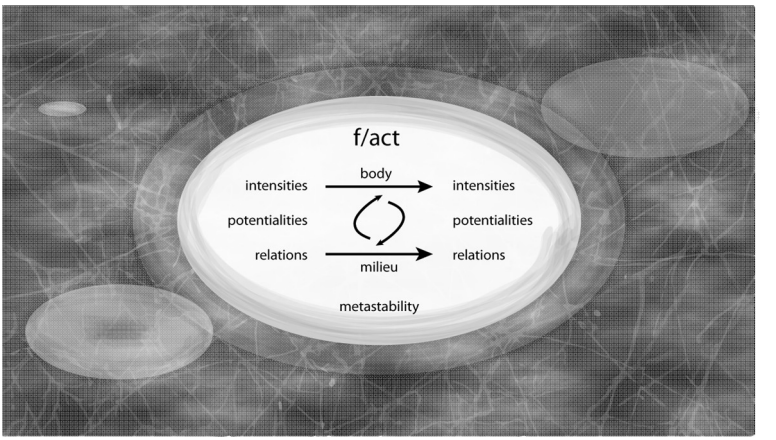

Figure 2. A f/act emerges as a metastable phase from ongoing pre-individual activity not directly attributable to agent and environment. It concretizes into codefined and time-oriented moments of body and associated milieu (arrows) and brings forth its own inner temporality and locality in the form of rhythms, durations, extension, traces, residues, and backward and forward orientation towards previous and subsequent acts (ellipses) by inducing reconfigurations in the pre-individual situation.

All of this is happening in the world. The becoming actual of an act is a creation, a becoming f/actual. Each act is thus a fact in the world, a f/act. It is both agent- and world-dependent, a co-emergence of a happening and a perspective with a shared simultaneity (Figure 2). As Christopher Caudwell puts it: 'Every quality is an event; every event a quality. Every quality of event is a relation between the subject A, and the object not-A — the rest of the Universe… Development does not take place *in* time and space. Development, becoming, and change, *secrete* time and space' (Caudwell, 1971, p. 225). A f/act is an onto/epistemic concept, an event/quality, a happening/experience. It reconfigures potentialities, relations, and intensities as part of open flows subject to constraints, resistances, and tendencies, but at a level 'below' closed causes. This is why f/acts are open and they can be taken up, resignified by other f/acts. They are concrete but they have not lost all of their potentialities for change and further becoming.

7. Who Brings it Forth? Shared F/acts, the Commons, Objectivity

Isn't the world out there? Doesn't it just show up? Some may be justifiably worried that the enactive perspective spells trouble for notions of truth or the possibility of science. To avoid misreadings, I am not claiming that the world is a construct of the agent or even of a community of agents. By activity I do not refer to processes only on the agent's side. To see this, it helps to indicate that the process by which, say, an affordance is *concretized* as a potentiality for action is also a point at which the environment 'resists' the agent-process by forcing an on-the-spot organization of alternative paths that are in tension with the emerging act. World production and world resistance are dialectically related.

World resistance is described by Max Scheler, George Mead, and Tran Duc Thao, otherwise rather different philosophers, as a sufficient reason against anti-realism. But resistance is not only manifested as reactions to my activity, as obstacles, or forces impinging on the body and potentially thwarting my engagements, providing me with direct bodily contact with otherness. It is also manifested in the organization of each act. The act is the joint result of my powers and sensibilities and the materiality of the world, which will not allow just any kind of engagement. The hammer that I'm using to repair a chair affords hammering but does not, at the moment, in the current flow, afford being used as a paperweight.[12] To use Mead's example, when I perceive a book,

> …an indefinite number of manipulatory responses are aroused, such as grasping it in a number of ways, opening, tearing its leaves, pressing upon it, rubbing it, and a host of others. One, picking up the book, is prepotent and organizes the whole act. It therefore inhibits all others… The feel of the book if one rubbed it, the contours if one passed one's hands about it, the possibility of opening the book, etc., determine the form that the grasping and lifting up of the book will take. (Mead, 1932, p. 27)

Thao expresses this relation in dialectical terms:

[12] The everyday use of the verb *to afford* points to general abstract possibilities, rather than concrete, situated potentialities, and this unfortunately can create some confusion with my usage here; what I'm trying to describe are affordances-showing-up-in-action rather than affordances in the abstract.

> [I]t is truly in its lived meaning, and not simply from an 'external' point of view, that consciousness is defined in terms of the dialectic[s] of behavior. The reactions awakened by the stimulus and arrested by the real act before they could have reached the phase of completion are integrated within the total behavior as *moments* that are *suppressed*, *preserved*, *transcended*. (Thao, 1986, p. 140)

The world admits certain combinations and sequences of sensorimotor schemes but resists others. I may hold a book, and look at its pages and indeed read the book as a synergy of simultaneous schemes, but I cannot read it while, say, flipping the pages to bring out its faint vanilla scent. My body and the world (the way the book has been *made*) resist this kind of contact. This implies that concrete affordances are only one moment of a *production/resistance dialectics* and do not exist in isolation but always as a dynamic mesh of mutually entailed invitations and oppositions.

What is brought into presence by f/acts also arises from paths not taken and from paths that become open. The relation between actualities and virtualities surrounding an act (inhibitions, priming, virtual actions, etc.) follows a topology of interlinked schemes that constitute sensorimotor agency as richly valued and affective (Di Paolo, Buhrmann and Barandiaran, 2017), a picture compatible with fine temporal structure of enaction (e.g. Varela and Depraz, 2005).

The world is 'out there' because resistance underlies worldly presence. If agents bring forth a world and world resistance organizes f/acts, we expect the world to *show up* in the experience of these agents, direct, unmediated, and valenced. This is the ubiquitous presence of the world and our presence in it. But, as Alva Noë has shown, 'presence does not come for free. It doesn't happen in us. We achieve it. Or rather, we enact it' (Noë, 2021, p. 958). The world shows up because *experiencing and worldmaking are internally linked*. Both co-emerge in the same activity of production, whether the contact is constitutional, transactional, or interactional. For this reason, the character of experience (*Erlebnis*) is worldly, and the character of the world is lived (*erlebt*).

Most of the time we flow spontaneously, mastering our relation with the resistances of the world. The world shows up in its everydayness. Worldmaking is ongoing, but probably in situations that can be safely described as interactions or as transactions when we must overcome some breakdown. When our sense-making is confronted with unexpected or previously unencountered resistances, we may experi-

ence what Noë (2023) describes as the *aesthetic blind*, moments of perplexity, invitations to make sense and conceptualize, and at the same time no obvious direction in which to turn to do so. Art excels at producing such experiences. Bodies and world shift at such moments from tensions to possibly new adjustments (and possibly new tensions) by the production of f/acts that change both bodies and world. We may find ourselves abiding in dislocation, both baffled and attracted by an experience or an artefact difficult to assimilate. Creative production is at the most obvious in such cases because the act of production (of original meanings, new spaces, witty remarks, cool gestures, imaginative rhymes, fetching dance moves, revolutionary gadgets, revived cityscapes, unheard-of rhythms, and so on) is *itself* present as such; we *witness* the new.[13] But production, as I have claimed, also goes on when we don't notice it.

I have delineated this view for the situation of a single act, which I described as mythical. But I have also suggested how this description fits the more concrete view of acts as emerging from a history of interweaving activity, some of it being other acts by myself and others, some of it other forms of activity.

Even though f/acts are agent-dependent, *bringing for a world* does not all lie upon an agent's shoulders, nor can the world be just turned into anything the agent needs or desires. The world resists and socio-material situations organize the possibility, the concretization, the normativity, and even the fine structure of action. F/acts belong in meshes of activity, propagating through world and bodily changes to other f/acts involving other agents. In this sense, any situation is always-already a world-brought-forth, a past sedimentation. But situations are always active, i.e. not just settled facts, but *f/acts* in various stages of becoming, as well as un-concretized interweaving pre-individuality. A situation *embodies* its past. As situations change, so can the sedimented structures with their remaining potentialities change. A past that does not change is not the real past.

It is in this sense that life is always-already engaged in *co*-productive activity, sympoiesis or *making-with*, Donna Haraway's elaboration of the idea of autopoiesis (after Dempster, 2000) as a play of 'foregrounding and backgrounding different aspects of systemic

13 There is an inherent contradiction in such aesthetic experiences. Eventually, they may become voided and degrade into the production of spectacle demanding novel disruptions (Debord, 1994).

complexity' in generative friction (Haraway, 2016, p. 61). Sympoiesis is at play in all forms of collective individuation but is particularly obvious in cases of symbiosis where codependent autonomous entities mutually produce each other. In human cases, making-with is the unceasing historical activity of communities, non-human agencies, and active environments.

What does it all mean for the question of sharing a common world? As individuals we engage in the creative activity we have described in the previous sections, but only as the dialectical flipside of historically co-produced sedimentation which organizes world resistances. In concrete places and temporalities, agents and non-agents locally bring forth a world creating habitats, landscapes, zones, rhythms, exchanges, needs and values, norms and meanings. This is their *commons*, whether the agents acknowledge it as a shared creation that it is and gives them life, or not.

The commons is the ground and the atmosphere we inhabit, the ecological system shaped by a sedimented history of engagements, by paths laid down by other walkers (human and non-human) and linking to our own.[14] In its openness, the commons is never entirely compelling nor uniform. It presents us with resources, traditions, opportunities, and warnings, but it is also malleable to transgression and can be reshaped by tensions and struggle. The commons underlies the more mundane meaning of the world, what shows up. But it is not always directly visible. It is not identical with pseudoconcrete presence (Kosík, 1976). Via processes of concealment and reification (Lukács, 1972), the world-that-shows-up hides lines of tension.[15] These undercurrents can manifest as dissonances, discomfort, disquiet, and disease. Worlds can become oppressive, barren, or highly skewed in possibilities of becoming. That is, until f/acts of collective consciousness raising — worldmaking interventions *par excellence* —

[14] Included in the idea of the commons are the traditional meanings of uncommodified resources, spaces, languages, opportunities, traditions, etc. But in the current context all of these should be seen as ongoing processes of becoming. To emphasize this point, David Harvey (2012, p. 73) speaks of the malleable social practice of producing commons as *commoning*.

[15] Should we be surprised that a way of thinking in good part inspired by Lewontin's view of the organism as the subject and object of evolution should lead to something like Lukács view of the working class as subject–object of history? A common ancestor further up the lineage tells us that human beings 'make their own history, but they do not make it just as they please in circumstances they choose for themselves; rather they make it in present circumstances, given and inherited' (Marx, 1996, p. 32).

disclose the mismatch between the commons and the consciously manifest, revealing hidden flows, biases, and configurations of power as targets for social change. To critically raise consciousness of our place, to take a standpoint rooted in the commons is to invite ethical and hopeful collective action.

The commons from which we grow as agents is both a world-in-the-making and a world of *shared* f/acts. This means the possibility of truth-processes such as science, the arts, and political action. But if knowing changes the world and changes us, then how do we agree on what we know? The answer is we can agree but we don't always do. Agreements are not givens, but f/acts themselves. Enactive epistemology admits more than one valid perspective. Perspectives are world-processes, as is truth, and nothing compels agents to undergo knowing engagements that will lead them to the same place. The possibility of a shared perspective relies on agreements being ontic as well as epistemic. They must be *achieved*. We agree on facts about the world by participating in f/act-making together (e.g. a team working on an experimental set-up, checking results, following a tradition, etc.), not as a matter of abstract, universal, and uninvolved 'observation' and rationalization. Agreements are acts of participatory sense-making that do not necessitate to appeal to the arbitration of pregiven 'objective' conditions. They can be self-grounding, pragmatically framed, tested by time and practice, and bringing into relative coordination a variety of factors, from the personal and the linguistic to the scientific and the political. Objectivity in this sense is perfectly compatible with the enactive view. It *co-emerges* with agreement processes. It is an historically situated epistemic virtue, among many others valuable for scientific and other practices. Objectivity can change according to changing standards and technologies (Daston and Galison, 2007). It is not, however, about the absence of observer participation. It is a way of regulating this participation through negotiated and revisable standards, protocols, and techniques, a joint process of f/act making.

When histories of f/act making diverge, so do the worlds enacted. Other worlds will differ from our own. Nothing in the creative materiality of existence compels agreement, nor is agreement necessarily impossible or even unusual. Yet diversity is constitutive of linguistic bodies (Di Paolo, Cuffari and De Jaegher, 2018) and participation always involves some degree of interacting across difference (Di Paolo and De Jaegher, 2022). Any difference is a combination of shared and unshared history. In some cases, inter-world difference may be bridgeable by 'making a journey' from one world to another

(Lugones, 1987), changing ourselves as a result. Inter-world translation is a journey of transformation through f/acts, failed and successful. By 'laying down a path' that links to others in their own world, we may grasp why it is different from ours. We may learn to inhabit this world but we may never do this 'perfectly'. The task is never finished and sometimes it is just not possible to achieve a meaningful connection from our current departure point; the concrete possibilities may be absent and must be produced first. Failures accumulate but each attempt is also a change. What was not concretely possible before the failed attempt might become reachable as a result, and eventually vindicate past efforts.

8. Nature: A Meshwork of Groundless Grounds

I have examined the meaning of the claim that agents bring forth a world. I have shown it to entail an ontology of production, which is manifested in all kinds of creative agent–environment contact, not just at scales of historical change or in the manifestation of novelty where it is most obvious. To read this claim in purely epistemic terms is to discard key developments in enactive theory, risking incoherence. As Rolla and Figueiredo (2021) convincingly put it, embodied agents bring forth a world, *literally*. I have shown the different ways in which this happens. Production of the new takes place in all the modes of agent–environment engagement, though in different ways. I have also considered the fine structure of acts bringing to the surface both the conditions of possibility and the consequences of an ontology of production. The analysis shows that agents and world are co-produced through meshes of interlinked creative concretizations, f/acts, that world-resistance organizes action and lived experience, and that a perspective that admits a plurality of worlds does not eschew ideas of truth-making or objectivity.

I have by no means exhausted the implications of the enactive idea that agents bring forth a world. Several questions remain open. I will only briefly comment on them in the rest of this section, though they deserve separate treatment.

Varela's thinking is an invitation to make a journey to a different way of seeing. If we accept the invitation, we begin to discover that this way of seeing was already latent in the work of past thinkers, or at least in some of aspects of their work. True to its claims, and in a somewhat Borgesian fashion, enaction produces its own precursors by

highlighting resonances with traditions that might not have seemed to resemble each other before its interventions.[16]

I have focused on the *bringing forth* part but less on the *world* part. What makes it a world rather than a collection of contingently related productive activities? Here we need to appeal to the interlinking of f/acts and processes of sedimentation, but this may not be sufficient. A world is internally resonant, even if not entirely coherent, and this must be accounted for. Heidegger (1995) proposes to conceive the world as the manifestness of beings *as a whole* and he is particularly focused not only on direct and pre-reflective presence, which animals share with us, but also on the reflective and linguistic presence of the world and its horizons.

For Nishida (2012), by contrast, this view does not quite capture the self-making essence of the world as the ongoing passage from the *made* to the *making*, which he conceived dialectically as the creative moving ground of human reason and freedom. These do not result from transcendental subjectivity, but rather 'historical, social, creative activity becomes the center… we make things' (p. 182) and things made by us make us move in turn. We find reason 'where, from seeing the thing we act… (on the basis of acting, we reflect the thing; on the basis of reflecting the thing, we act)' (p. 175).

Such reflexivity is part of the internal resonance of worldmaking activities, which takes the shape of what Charles Taylor (2016) refers to as the issue of 'sensitivity to rightness'. For Taylor, this is a sensitivity 'from the inside' (p. 257), an historically situated *logos* that tracks the world's becoming. This sensitivity, like all reflexivity, is constitutively social. From a linguistic bodies perspective, the inter-subjective processes that constitute a shared normative horizon (the way communities make meaning together through co-regulated repertoires of social acts) are the conditions of possibility for a 'sensitivity to rightness' and hence for an historically situated rationality.

This suggests that the relation between language and world is in need of further enactive investigation. This relation is not 'cashed out in terms of denotations or connotations whereby language articulates forms of meaning in which the world is objectivized. In fact, language is first responsible for enhancing a relation of participation in the world, and of speaking to the world, and listening to it' (Di Paolo, Cuffari and De Jaegher, 2018, p. 135). Language makes us engage the

16 See Borges' (1952) essay on 'Kafka y sus precursores'.

world existentially, which in some cultures adopts a second-personal framing, as in the world-as-Thou.

I have touched, obliquely, on questions of enactive ontology without giving an adequate account of what it entails. This work also needs to be done, even though what I say here already points in the direction of relational and process ontologies in which activity and becoming are primordial. An ontology of production entails the deep relationality of f/acts. Objects and their properties emerge relationally — as the softness of the sponge — but in a sense which is different from seeing them as 'mind-dependent', i.e. merely epistemically. For Varela, Thompson and Rosch (1991, p. 233), this only tells half the story if we don't simultaneously challenge the lack of ultimate foundations for concepts, languages, and interpretations of the world. Varela and colleagues refer to this lack of ultimate foundations using the term *groundlessness*, engaging in particular the Madhyamaka Buddhist tradition according to which nothing is unconditioned and all things are empty of intrinsic essence. Such a philosophy lends coherence to the claim that a plurality of viable worlds can be brought forth. Since it also affirms the primordiality of everyday practices of living, the idea of groundlessness is compatible with the ontology of production. However, since the term is often understood in Western languages in the negative (*lack* of foundations), the word itself doesn't sufficiently emphasize the creativity of worldmaking. The open-endedness required for bringing forth worlds speaks of an inexhaustible richness, a foamy, shimmering abundance that the English term *groundlessness* ill describes. We can at the same time defend the idea, argued for in this paper, that produced grounds *are* grounds in the full sense of the word even if none of them is ultimate. This can help us make sense of the Mahayana teaching that freedom consists not in escaping but in inhabiting the everyday world. Moreover, grounds interlink by inter-world path-making. Nature is a meshwork of groundless grounds.

The other ontological hint that needs further elaboration is contained in the idea of activity, and in particular the idea of production, broadly understood as encompassing both poiesis and praxis. The universe is active and makes itself, and we as observers participate in that process bringing to it our own worldmaking activity.

A participatory universe is not a foreign idea in science. In an interesting case of intellectual convergence, several physicists who have pondered about the foundations of their discipline are increasingly driven to the conclusion that our acts of observation are creative, literally. As we enquire into it, the universe changes as a result. Not in

an unruly manner but in ways that cannot be fully accounted for before the act of participation takes place.

John Wheeler (1990), a pivotal figure in many of the key developments in twentieth-century physics, explained the idea of the participatory universe with an analogy that could hardly be more enactive. Consider a game of 20 questions where you enter a room with other players who have agreed to think of a person or an object and can only provide yes/no responses to your queries. Eventually, if you ask your questions cleverly, you may guess the correct answer. Wheeler, who often referred in his own writings to Machado's image of *laying down the path in walking*, asks us to imagine a variant of this game (Wheeler, 1978). Imagine there is *no* pregiven answer. As you start asking questions, the other players respond yes or no at will, with the only constraint that each response should be consistent with the previous ones. This variant of the game can still converge to a 'right' answer, only its rightness is internal to the process of enquiry itself, a process of f/act making. The answer did not exist before the questions were posed; it was brought forth by the questioning.

Perhaps Varela would have remarked, with satisfaction, that such acts of creative participation are clear manifestations of the psyche of the universe.

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