UNIVERSIDADE FEDERAL DO RIO GRANDE DO SUL
DEPARTAMENTO DE FILOSOFIA E CIÊNCIAS HUMANAS
PROGRAMA DE PÓS-GRADUAÇÃO EM FILOSOFIA

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THE PRIMACY OF KNOWING-HOW: COGNITION, KNOW-HOW AND AN ENACTIVE ACTION-FIRST EPISTEMOLOGY

Porto Alegre
2023

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Tese apresentada ao Programa de Pós-graduação da Universidade Federal do Rio Grande do Sul (UFRGS) como requisito para a obtenção do Título de Doutor em Filosofia

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Diello Huffermann, Jeferson
The primacy of Knowing-how: cognition, know-how, and an enactive action-first epistemology / Jeferson Diello Huffermann. -- 2023.
208 f.
Orientador: Eros Moreia de Carvalho.

Tese (Doutorado) -- Universidade Federal do Rio Grande do Sul, Instituto de Filosofia e Ciências Humanas, Programa de Pós-Graduação em Filosofia, Porto Alegre, BR-RS, 2023.

1. Epistemology. 2. Enactivism. 3. Philosophy of Cognitive Science. 4. know-how. 5. cognition. I. Moreia de Carvalho, Eros, orient. II. Título.

Elaborada pelo Sistema de Geração Automática de Ficha Catalográfica da UFRGS com os dados fornecidos pelo(a) autor(a).

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Porto Alegre, 30 de maio de 2023

Resultado: APROVADO

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Resumo

A Abordagem Enativa (AE) é um projeto de naturalização da mente. AE deveria ser capaz de oferecer uma naturalização do conhecimento, tal naturalização subjacente é o que apresento ao leitor nesta tese. O resultado é uma epistemologia na qual o aspecto mais básico do conhecimento não é representar acuradamente. Para uma epistemologia enativa, a relação privilegiada é como conhecedores se relacionam, entram em contato ou engajam com o que é conhecido. Argumento no capítulo final que o conhecimento é uma relação perspectival, afectivamente emaranhada, historicamente situada entre conhecedor e conhecido. Conhecedor, conhecido e conhecer são caracterizados em termos liberalmente naturalistas. AE é primeiro apresentada no contexto de uma ampla tendência de estudar-se ecologicamente a cognição. O entendimento da vida no contexto do vivo me leva a argumentar que sistemas vivos e sistemas autônomos precários em geral são teleológicos e sua atividade definidora consiste em ser responsivo às fronteiras de viabilidade de sua própria existência. Sistemas cognitivos habilidosamente mudam de modos adaptativos evitando a desintegração, mesmo que as mudanças não sejam optimais. A abordagem provê uma visão relacional do comportamento adaptativo como base para o conhecimento prático [*know-how*]. A noção mais geral de conhecimento prático pode ser elaborada a partir da noção de percepção como maestria de contingências sensório-motoras. Conhecimento prático em geral é compreendido como a organização e reorganização de processos e estruturas corporais que possibilita de modo confiável a ação bem-sucedida. Conhecimento prático como as sensibilidades e capacidades corporais para o confiável sucesso da ação é uma característica de todas as formas de engajamento cognitivo. A cognição ou o sabendo-fazer do lingueajear consiste em adquirir, produzir, interpretar e modificar o conhecimento prático compartilhado entre comunidades linguísticas. Crucialmente, a influência do contexto interativo na produção de sentido de um participante de uma comunidade varia em um *contínuo de participação*. Num extremo encontra-se produção de sentido que permanece majoritariamente (mas não absolutamente individual, e no outro encontra-se atividades caracterizadas como processos conjuntos de produção de sentido. Sabendo-fazer linguagem é saber como estar em diálogo com identidades plurais e idiossincráticas enquanto se é uma você mesmo. Uma comunidade de práticas compartilhadas emerge como a base da objetividade, saber-como é um assunto comunal. Se a cognição é a adaptação habilidosa e não necessariamente optimal de uma identidade sistêmica precária em um ambiente constantemente mudando, toda cognição apoia-se em conhecimento prático. Cognição apoia-se em conhecimento prático na medida que toda cognição é entendida em termos da transição habilidosa entre estados de um sistema sob a possibilidade de desintegração Comportamento inteligente não é baseado em estruturas simbólicas e conhecimento geral, baseia-se em conhecimento prático ricamente detalhado e relevante ao contexto específico. A interação com o mundo dotada de conhecimento é a responsividade para o agora que incorpora a história que nos levou até aqui.

Palavras-chave: Abordagem Enativa, enativismo, conhecimento prático, sabendo-fazer, cognição.

Abstract

The Enactive Approach (EA) is a project of naturalization of the mind. EA should be able to offer a naturalization of knowledge, such underlying naturalization is what is found in this dissertation. The result is an epistemology where the most basal aspect of knowledge is not to accurately represent. For an enactive epistemology, the primary relation is how knowers relate, contact or engage with what is known. I argue in the final chapter that knowing is a perspectival, affectively entangled, historically situated relation between knower and known. Knower, known and knowing are characterized in broad naturalistic terms. EA is first presented in the context of a larger trend of studying cognition in an ecological way. The understanding of mind in the context of the living leads me to argue that living systems and precarious autonomous systems in general are intrinsically teleological systems whose defining activity consists in being responsive to the viability boundaries or conditions of their own existence. Cognitive systems skillfully change in adaptive manners to not disintegrate, even if their changes are not optimal. The account provides a relational account of adaptive behavior as the basis for an account of know-how. The more general notion of know-how can be articulated from the notion of perception as mastery of sensorimotor contingencies. Know-how in general is understood as the organization and reorganization of bodily processes and structures that enables reliable successful action. Know-how as the bodily sensitivities and capabilities relative to the cognitive domain that reliably result in the success of action is a feature of all forms of cognitive engagement. The cognition or knowing-how of languaging consists in acquiring, producing, interpreting and modifying the know-how shared within linguistic communities. Crucially, the influence of the interactive context in a participant's sense-making varies in a *continuum of participation*. In one end of the spectrum one finds sense-making that remains largely (but not absolutely) individual and in the other end where what characterizes the activity is a joint process of sense-making. Knowing-how to language is knowing-how to be in dialogue with plural and idiosyncratic identities while being both yourself. A shared community of practices emerges as the basis of objectivity; knowing-how is a communal affair. If cognition is the skillful and not necessarily optimal adaptation of a precarious systemic identity to an always changing environment, all cognition rests on know-how. Cognition rests on know-how in the sense that all cognition is understood in terms of skillful transition between states of a system struggling with possible disintegration. Intelligent behavior is not based on symbolic structures and context-free knowledge, it is based on richly detailed, context-specific know-how. The knowledgeable interaction with the world is the responsiveness to the now that incorporates the history leading up to it.

Key-words: Enactive Approach, enactivism, know-how, knowing-how, cognition.

APOIO DE FINANCIAMENTO CAPES

This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – Brasil (CAPES) – Finance Code 001

Contents

1. Introduction: Enactivism, knowing-how and a nautical metaphor

We want to understand the form and function of our continuous contact with the world. Minds do not just represent the world, they live in and are part of physical reality, a reality of the embodied self and the material world [...] Perception, action, and cognition are thus assembled under a single dynamic ...
Thelen and Smith, 1994

Autopoietic Enactivism[1], Autonomist Enactivism[2] or more accurately the Enactive Approach to Cognitive Sciences (*EA*[3] for short) is an ongoing project of naturalization of the mind. Knowledge — in all its forms — is mind-dependent. *A fortiori*, at least tacitly, EA offers a naturalization of knowledge. The underlying naturalization of epistemology is what I am after. The naturalized epistemology arrived at is one where the most basal aspect of knowledge is how knowers relate, contact or engage with what is known. Knowing is a perspectival, affectively entangled, historically situated relation between knower and known. Knower, known and knowing are characterized in broad naturalistic terms. The idea of a naturalization has a strong specific sense here, due to the major cornerstone of the EA — the deep continuity between life and mind — the topic of the next chapter. In it, I elucidate the enactive characterization of cognition as sense-making in a domain of interactions. As I intend to show, a characterization that highlights the constitutive role of historical, situated and embedded activities into cognitive processes. Fleshing out the claim *all cognition rests on know-how* is central for my argument. The claim is not new and it is at the core of the approach:

> The central idea of the embodied approach is that *cognition is the exercise of skillful know-how in situated and embodied action* (Varela, Thompson, and Rosch 1991). Cognitive structures and processes emerge from recurrent sensorimotor patterns that govern perception and action in autonomous and situated agents. *Cognition as skillful know-how is not reducible to prespecified problem solving*, because the cognitive system both poses the problems and specifies what actions need to be taken for their solution. (Thompson 2007, 11, italics added)

The embodied approach in the quote refers to the EA, specifically to *The Embodied Mind* (more on that in the following sections). My original contribution is a more thorough

1 See (Ward, Silverman, and Villalobos 2017)

2 See (Barandiaran 2017)

3 Not to be confused with IA (Artificial Intelligence). Enactive Approach is a more accurate label because it's how the majority of the members of the tradition refer to it (Froese and Di Paolo 2011). Autopoietic Enactivism is a nomenclature given by thinkers outside of the tradition and Autonomist Enactivism is a more recent attempt to fit the approach into the "isms" typical of philosophical categorization. I will use Enactive Approach or EA throughout the text. EA is distinct from radical enactivism and sensorimotor enactivism — both briefly discussed in this introduction — yet, the three perspectives intersect greatly.

elucidation of *what is know-how* for the EA, as well as the entailments I take from such elucidation. The answer to what is know-how for the Enactive Approach — one's bodily processes and structures enabling reliably successful action (structures for differential responsiveness according to self-imposed norms) in specific situations (cognitive domains of interaction) — appears in the third chapter. The epistemology of our time has highlighted the social character of knowledge (see Fantl and McGrath 2002; Stanley 2005; Lackey 2021), such character is not neglected by the EA. The enactive account of cognition and know-how entails an account of Language and linguistic cognition as resting on the shared know-how of linguistic communities. This is the topic of the fourth chapter. In it, I highlighted the *continuum of participation* of cognition: the normativity of an agent's cognitive performances – from the action-perception loop to cognitive performances requiring language use – rests on shared know-how. Our becoming necessitates it. The topic of discussion of the final chapter of this dissertation is the primacy of knowing-how that emerges from the EA. From the aspects of cognition and know-how argued for in previous chapters, I advance to considerations about what a primacy of action entails. From considerations about human knowing, I argue for an enactive action-first epistemology where knowledge is relational all the way through. The basal aspect of knowledge is not to represent, but to engage properly with ourselves and the world. The reframing demands the reconceptualization not only of the relation between action and cognition, but perceiving and conceptualizing and everything else. The complexity of cognitive phenomena is non-eliminable, nonreductive, somewhat chaotic and unruly. One of the takeaways of enactive thinking is there is a messiness that cannot be completely tidied up by traditional distinctions between mind and body, subject and world, nature and nurture, perception and action, basic and higher-level cognition, cognition and affectivity, innate and acquired and so on. Messiness of various kinds are a theme throughout, but the arguments hopefully are not messy and can be easily followed (even if they don't convince the more skeptical reader). In the rest of this chapter: I first briefly look at the history surrounding EA employing the nautic metaphor of navigation (sections 1.1 & 1.2). Section 1.3 outlines what I considered relevant for my purposes in the current discussion about the term "enactivism" and its varieties. Section 1.4 outlines the general argument of the dissertation and the final section calls attention to the interplay between forms of inquiry and the form of naturalism put forward by an enactive account of cognition.

1.1 Entering the boat

Hutchins put it better than I could ever do: 'Everything is connected to everything else. Fortunately, not all connectivity is equally dense' (2010, 705). The 'everything is connected to everything else' idea refers to the claim that there is an inherent complexity in both Nature and cognition. The second part 'not all connectivity is equally dense' is what opens the possibility of knowledge and understanding even in the face of such complexity. Hutchins (2010) writes of an ecological project to study cognition takes the cognitive system in its ecosystem. The ecosystem is the web of mutual dependence between processes enabling and constraining cognitive phenomena. Even if one believes the brain is the most important part of the body to the study of cognition, in an ecological approach the interaction with the environment and the other organs would also be of relevance. But obviously, an ecological approach has a strong tendency to decentralize the relevance of the brain, it is in fact what historically has been the case. Hutchins (2010) describes three fields approaching cognition in a deeply ecological way in the twentieth century: Gibson's Ecological Psychology, Bateson's Ecology of the Mind and the Cultural-Historical Activity Theory developed in the Soviet Union. Phenomenology and its emphasis on lived experience and Pragmatism and its focus on action as the guidance of cognition are not mentioned, perhaps because his analyses look exclusively to the sciences (mainly Cognitive Sciences, but also Psychology, Anthropology, Cybernetics and Linguistics). The Enactive Approach (Froese and Di Paolo 2011) is characterized by Hutchins as a continuation of Bateson's Ecology of Mind project. But it is an imprecise account (see also Maturana 2011). The enactive approach is its own fourth field (or sixth, if we count Phenomenology and Pragmatism) emerging at the end of the century bearing some resemblance to the Ecology of Mind project, but it is distinct from it. Bateson's (1972) project was a cybernetic approach to the study of mind. As reconstructed in the excellent *The Mechanization of the Mind: On the origins of cognitive science* (Dupuy 2009), the early cognitive science of the late nineteen fifties found itself at a crossroads between the reductionism of information processing approaches and the holism of cybernetics. Information processing in the form of cognitivism eventually won (specially in the United States) and the term cybernetics went out of fashion. But the holistic alternative didn't fall away without leaving its mark. Cybernetics and information theory was first viewed as "new sciences" coming out of Norbert Wiener's *Cybernetics* and Claude Shannon's two volumes paper 'A Mathematical Theory of Communication', published in the same year, 1948 (Kline

2015, 10–20). Cybernetics intended to be a general account of feedback loop control systems, for that reason it could study and be applied both to animals and automatic machines. That is because they both have sensors, effectors, feedback-paths with which they communicate with the outside world (exchange information by signals, be they electrical or biochemical) and operate *in* and *on* that world. For instance, Cybernetics considered the nervous system and its control over the contraction and relaxation of muscle tissues for the purpose of movement a model of a control system. However, contrary to cognitivism, Cybernetics didn't postulate a core component to cognition (internal events computing information about external events) to be studied prior to looking at other structures. For instance, the cybernetic inquiry into *our* cognition would include the communication networks our control systems (the nervous system) formed with other control systems (social groups: institutions, societies and culture more broadly). Ideas later explored by the Enactive Approach: circular causality, self-organizational systems, self-control (autonomy) as central to a cognitive system, cognition as an emergent propriety or process of self-organization, were first cybernetic ideas (Dupuy 2009: 7). Cybernetics was strongly committed to the analogy between brains and computers, but it was holistic nonetheless. Its project and ambition was in many ways unprecedented.

The anthropologists Gregory Bateson and Margaret Mead attended the meetings now known as Macy Foundation Conferences on Cybernetics between 1947 and 1953 and thought a cybernetic approach could possibly bridge the gap between the social and natural sciences (see Klein 2015). *Steps to an Ecology of Mind* (Bateson 1972) is a theoretical manifesto for a cybernetic approach to several cognitive phenomena, from psychiatric disorders to animal learning. But against the first cyberneticists, the focus had shifted away from the nervous system. Bateson was still very much interested in information, but he emphasized the information loops that would constitute a mind extend through the body into the world. This view acknowledges the constitutive roles of the non-brain body and the world in cognizing. Two of the three authors of the foundational work of the Enactive Approach met in a conference in 1977 called “Mind and Nature”, organized by Bateson and the philosopher W. I. Thompson. The work is the 1991 book *The Embodied Mind* (TEM) and the authors are Francisco Varela and Evan Thompson (the third author of the book is Eleanor Rosch). Thompson was a teenager and Varela was 32 years old in 1977. Throughout the following years they established a sort of mentee and mentor relationship. In 1986 Varela and Thompson started working on the book by first reviewing Varela’s work on the current state

of Cognitive Science, a version of Varela's initial work was later published (Varela 1992b). Eleonor Rosch joined the two in 1989[4]. TEM aims to explore the many ways in which cognitive science and human experience can inform each other. It presents "Enaction", an alternative approach to both Cognitivism and Connectionism, the main research programs in cognitive science at the time. One of the ways of trying to bring cognitive science and human experience together was by identifying a convergence between insights from phenomenology and core tenets of Buddhist traditions. A convergence that could inform and be explored by science. In a recollection of their first encounter, Thompson (2004) points out Varela was known by cyberneticists for his work on the 'calculus of self-reference' (Varela 1975). One major motif of Varela's work and of EA in general was shared with 'second-order cybernetics' (Froese 2011; von Foerster 1979): the role of the observer in the inquiry process. This is the challenge imposed by the circularity around studying cognition while being themselves[5] cognizers engaged in cognizing. This is not just a methodological problem, it has experiential and existential dimensions:

> It's one thing to have a scientific representation of the mind as "enactive" – as embodied, emergent, dynamic, and relational; as not homuncular and skull-bound; and thus in a certain sense insubstantial. But it's another thing to have a corresponding direct experience of this nature of the mind in one's own first-person case. (Thompson 2004, 382)

Differently from Physics or Chemistry, it is in question if and how the results of Cognitive Science obtained by a third person perspective have a first person perspective equivalent in experience. Following Buddhism and Phenomenology, Varela believed some disciplined practices could give us not only direct experience of our own (enactive) mind, but those practices would also be useful to scientific endeavors. In fact, a more complete account of cognition could only be achieved by the joint work between those disciplined practices and scientific endeavor, this insight led to Varela's proposed "Neurophenomenology" (see Varela 1996). Thompson's quote above is also a good way of elucidating their approach to mind. First, minds are embodied, not separated from the body and its embodiment, i. e, its bodily processes, understood both in physiological and experiential terms[6]. Minds are not skull-

4 The historical information is found in Thompson (2004) and the revised edition of TEM published in 2017.

5 The gender neutral pronouns they/them are the ones used for examples and counterfactuals.

6 A good example of these two aspects of "body" is presented by Husserl (1952). If you touch your left hand with the right one, "lefty" appears as a palpable object offering resistance to the right hand's touch. However, through awareness, the left hand can also become a feeling hand, sensing the touch of "righty". Our bodily processes, like hand movement, are both the background and medium of world-directed experience and also the ontological basis (the enabling conditions) of experience.

bounded. Second, minds show up or emerge in certain kinds of self-organizational dynamical systems. They have an integral role in the process of maintaining their self-organization in virtue of such systems being in constant and structural interaction (coupling) with the environment. This role is what is distinctive of the mind's activity. Minds are emergent, dynamical and relational and in this sense insubstantial (fine-tuned descriptions would be in terms of relations or processes). As it turns out, minds are messy and weird.

1.2 Setting sale

Since the overall goal is fleshing out the underlying epistemology of EA, one can set sail with an initial characterization: *knowing-how as learning how* to navigate being alive, being a sensorimotor agent and living with others. Why this is a *enactive* metaphor is elucidated by highlighting two points of this initial characterization. First, the more directly epistemic: the enactive tradition puts 'learning-how' center stage. Di Paolo et al, (2017) provides an account of perception in terms of perceptual *learning*. I look at this account in depth in chapter 3. Hanne de Jaegher (2021) writes of knowledge by looking at a particular sophisticated form of interactive know-how she calls human *knowing*. Her focus is on a knowledgeable and open-ended relation of *letting be* (Maclaren 2002). I look at her account more closely in chapter 5. The general idea is that knowing as "letting be" is not passive, it is the expertise of learning how to interact with the known in order to know it without coercion, subjugation or destruction. Her examples of people that usually master human knowing are (good) teachers and therapists. Her work takes part in the interactive turn (De Jaegher, Di Paolo, and Gallagher 2010) in cognitive sciences. This turn results in looking at how the interactive activities under the right circumstances are constitutive of cognitive phenomena. These are neglected aspects of knowledge in analytic epistemology. Since the nineties there has been a "practical turn" in analytic epistemology (see Fantl and McGrath 2002; Stanley 2005; Lackey 2021). But changes in philosophy happen at a very slow pace. Besides that, the practical turn was not a "pedagogical turn", questions regarding learning are still peripheral. Enactive thinking, on the other hand, draws heavily on developmental psychology. Thinkers like Jean Piaget (see Varela 1999, 4; but especially Di Paolo, Buhrmann, and Barandiaran 2017) and Lev Vygotsky (see Di Paolo, Cuffari, and De Jaegher 2018) are featured and engaged with. Another term for 'learning-how' is mastery or mastering. I'm going to argue that agents, and

especially human agents, live in a context of open-ended meaningful relations to the environment, always adapting their know-how to different situations.

Another important difference with respect to analytical philosophy is methodological. EA draws heavily on dynamical systems theory in their inquiry. The idea of applying dynamical systems theory to cognitive phenomena is not new or exclusive to enactivism (for non-enactive dynamical accounts, see Thelen and Smith 1994; van Gelder 1995; Wheeler 2005). What motivates it is that, for both life and mind, historicity is at the core of the phenomena. The actual rates, trajectories, paces and rhythms characterizing a particular cognitive process play a central role in identifying that process and in identifying how that process relates to global states of the system. Small changes in rhythms can alter the systems as whole in very drastic ways. In a more general configuration, employing dynamical systems theory to describe the agent and the environment results in treating them as coupled dynamical systems described through a set of differential equations, some variables describing the agent and some other variables describing the environment. There is no necessity for going into great mathematical detail, but some basic understanding is required. For my purposes, the more important theoretical distinctions are the difference between variables and parameters, the notions of dynamical coupling, attractors and metastability. Dynamical systems are mathematically described in terms of variables specifying states of a system in a specific point in time, equations that describe the value changes in the passage of time (or how the system evolves over time) and parameters that specify quantities (values) that can change states of a system, but are not themselves altered by changes in the system (in this sense, external to the system). Two systems are coupled when the parameters governing the equations in one system vary according to the variables of the other systems. What are the values of the parameters of a system is dependent on what are the values of the variables of the other systems coupled with it. The systems can be unidirectional or bidirectional coupled. Graphically, dynamical systems can be represented as trajectories standing in for all the possible values that a given system might have as it evolves over time. In those visualizations it is easy to identify the *attractors* of the system, the states the system tends to evolve to as time passes. Attractors are interesting because they are the more discrete entities in an always changing system, and depending on the configuration of the system, many trajectories can converge in a single attractor or in a region with multiple attractor points (attractor's landscapes). Dynamical systems can be stable or not given a time frame of reference.

Metastability is the stability of the system in a given time frame. As it changes states over time, dynamical systems' parts can segregate and express their own intrinsic dynamics or they can reintegrate and create new global dynamics of the system (see Kelso 1995; 2012). Metastability refers to this tension, the system remaining stable on the verge of dissolution (segregation of the parts), or transition to a new identity (a new globally coherent configuration). A few crucial concepts are going to be characterized in terms of metastable patterns, such as the cell's architecture (chapter 2), habits (chapter 3) and participation genres (chapter 4).

Another important highlight is how EA views the different densities of the connections between everything. They can be divided into domains or cycles themselves highly complex. From an enactive perspective one can talk of at least three dimensions of embodiment — also referred to as domains of interaction or cycles of operation — distinguishable in humans and large apes (see also Fuchs 2020)[7]:

> (1) cycles of organismic regulation of the entire body;
> (2) cycles of sensorimotor coupling between organism and environment;
> (3) cycles of intersubjective interaction, involving the recognition of the intentional meaning of actions and linguistic communication (in humans). (Thompson and Varela 2001, 424)

The term "cycle" helps to understand we are talking of dimensions with their own dynamics, their changes over time sometimes are a result of it. Referring to these dimensions as "domains" helps us understand how they only make sense when taken as characteristics of the agent-environment coupling also coupled with each other. They are both processes and zones of interaction, depending on which emphasis is added (as often the case with enactive thinking, the inner and outer are dynamically conceived). Also, the coupling and subsequent causal influence occurs in synchronic and diachronic ways. It occurs at the scale of the interaction here-and-now (synchronic coupling), but also at the timescale of development and at the transgenerational scales of cumulative culture and evolution (diachronic couplings). The dissertation focuses on the interplay between these dimensions and the image of knowledge that emerges. For this reason "domains of interaction" is the preferred phrase. Intersubjective interaction, for instance, can change and reshape sensorimotor skills in perhaps all of the timescales mentioned above and can change and reshape organismic

7 I will leave open the question of how far these three domains generalize. If other mammals or the cognitively complex cephalopods have the same domains of embodiment is a question in its own right that is not answered here.

regulation at least at the more diachronic timescale of evolution. One example is the evolution of the human larynx: it descended to a lower position in comparison to other primates. One consequence is the opening of a unique space that allows both the production of differentiation between vowels and the tongue to move more freely (see Fitch 2000). The lowered larynx is dysfunctional in some aspects, increasing the chances of choking and lethal aspiration. However, the ability to speak outweighs such disadvantages, for it allows several novel forms of social coordination. These social processes (happening at an evolutionary timescale) appear to reshaped the human organism. According to the enactive approach, human beings are in an ongoing and never finished process of becoming (Di Paolo 2020), a process with a spiral structure (Fuchs 2020) of reciprocal influence between the domains and the environment. The multiple ways in which the domains of interaction influence each other are so complex that distinctions like nature/nurture are often incapable of mapping the phenomena appropriately. It is not the case that such distinctions should never be used, but they sometimes create obstacles for our understanding.

I explore the topic in this Introduction with a nautic navigation metaphor partially due to the similar metaphor present in *The Tree of Knowledge* (Maturana and Varela 1987/1992) and in a sense is expanded in TEM. The 'Epistemological Odyssey' in *The Tree of Knowledge* is the journey to create a biological account of cognition navigates between two extremes: the Scylla of representationalism and the Charybdis of solipsism (Maturana and Varela 1987, 135 Image 35). In TEM, Varela et al (1991/2017) view the dilemma slightly differently. Now the challenge is to sail 'between the Scylla of cognition as the recovery of a pregiven outer world (realism) and the Charybdis of cognition as the projection of a pregiven inner world (idealism)' (172). The goal remains the avoidance of two extreme positions in our studies (be it scientific or philosophical) of cognition. However, now the extremes have an underlying cause, namely, the strong undersea current of representationalism: '[I]n the first case representation is used to recover what is outer; in the second case it is used to project what is inner' (ibid). This metaphor is important because it elucidates how the enactive tradition has been hard to pin down philosophically since inception. Epistemologically and metaphysically the perspective aims to break away from traditional philosophical debates. Avoiding old-age philosophical trappings is a good goal to have. But for most people with a theoretical framework informed by analytic philosophy and the western history of philosophy, it is hard to understand if and how such avoidance is obtained. But we can avoid going too deep into an

ontological conundrum by using the original image in a different way. Like the myth that originates the monstrous figures, the question can be more directly conceived as how to navigate the path we must take to achieve our goals successfully. Differently from Homer's narrative, however, most times there is no predetermined best path. In the story Odysseus is advised by Circe to pass alongside the Scylla's rocks and lose only a few sailors, rather than risk the loss of his entire ship at the Charybdis (See Odyssey, Book 12, 108-11). But it is possible there is no fixed path, the path depends on your goals and what monsters one faces in a particular situation. Using another metaphor explored in more detail in the next chapter, it is laying down a path in walking. Henceforth, the metaphor can be read as methodological rather than ontological. It is stressing an ongoing difficulty never fully overcome in the study of cognition and its related matters. The middle way is therefore treated in this dissertation less like a bonafide metaphysical position and more as a question of knowing how to position ourselves in different situations concerning inquiries of different kinds. The ongoing mastering-how view of knowledge is going to anchor itself in this methodological way of interpreting the "middle way". This move is not unwarranted, one of the explicit motivations for a middle way of "Enaction" is the inescapable circularity between lived experience and scientific endeavor (see Vörös, Froese, and Riegler 2016, 191–93). Let's look again at the cognitive scientists that study cognition and are themselves cognizers engaged in cognazing as an example. They are at the same time knowers and known. In their epistemic practice they have to navigate this circularity presenting itself and their subsequent tensions. One may argue that in some contexts the emphasis should be put more on the knower side, the fact the agent is a person with motivations, goals, problems with financing and with a self image affected by their discoveries. In other contexts emphasis should be put more on the known side, the results, the methodology, the implications to further research, possible technological applications and possible sociological and philosophical consequences. And finally, sometimes the emphasis should be on the circularity itself, on the mutual and reciprocal influence that these sides have in each other. One advantage of taking this path is remaining somewhat neutral in regards to the metaphysics of the enactive approach. An enactive epistemology is work enough. Some metaphysical commitments do emerge from the view being put forward, but they are related to a certain approach to scientific inquiry. I explore this in the last section of this Introduction.

1.3 The philosophical sea of Enactivism

Now is a good moment to go into more details about the jargon and classifications used in the field. The distinction between autopoietic, sensorimotor and radical enactivism became the language through which many came in contact with the enactive framework in the last few years. Insofar as it signals internal disputes and differences in agenda it is a useful heuristic, but for newcomers it might do more harm than good if they take it at face value. Creating an unnecessary image of opposition and dispute for hegemony not true to the actual historical development of projects converging in ways more than one. In the next paragraphs I present the distinction, how it leads to an image of opposition and dispute, and how in actuality this resulting image is misplaced. After those considerations the choice of referring to an Enactive Approach is justified. Enactivism is introduced in a *Topoi* special issue as having these three branches that may intersect in some key features, but are otherwise distinct: autopoietic enactivism, sensorimotor enactivism and radical enactivism (Ward, Silverman, and Villalobos 2017). One core tenet of enactivism is action as constitutive of cognition, in opposition to having a mere causal role. The emphasis of any inquiry about cognitive phenomena should be on the dynamics of agent-environment sensorimotor coupling because embodied interaction is constitutive of cognition. Another core tenet intertwined with the first one is anti-representationalism. Anti-representationalism is a rejection that all cognitive states are representational states, it rejects representations as the mark of the mind. If representationalism is the undersea current leading to the extreme positions to be avoided, it is relevant to give a brief and general idea of what it is.

The representation as the mark of the mental view is also referred to as representational theory of mind[8] (RTM for short). RTM is a very prominent view of the mind, in some readings traces back at least to Brentano's philosophy[9]. The view takes intentionality as a fundamental characteristic of mind. Intentionality in this context is the capacity mental estates have of being about something, of representing the world. Mental states would always make reference by having a (normative) content. An illuminating example is a RTM description of visual experience. Imagine you are walking in a dark alley and see something moving fast as a black cat. According to the view, you did represent something as a black cat, but were you actually seeing a black cat? If it was just an old newspaper blown by the wind you did not. You

8 For RTM accounts of the mind see Fodor (1975) and Sterelny (1990).

9 I'm not going to look into the merit of such reading. See Chisholm (1957) for a RTM view of Brentano's thought.

misrepresented the world. The content here is the black cat, the intentional object that provides the correctness conditions of that particular representational act. Representations are vehicles that carry correct or incorrect information about its targets (in this case the newspaper) depending on its contents (in this case a black cat) (Neander 2020). This capacity to represent the world would be the key distinctive feature of mind: 'This intentional inexistence is characteristic exclusively of mental phenomena. No physical phenomena exhibits anything like it.' (Brentano 1874, 68). A naturalistic approach to mind agrees with this general idea would correct Brentano affirming that 'no *other*' physical phenomena exhibits anything like it, intentionality understood in terms of mediating representations is a distinctive feature of the natural mental phenomena. But "content"' is also a polysemic term. Some traditions have non-representational views of contents. According to them "content" might refer to different aspects of the agent coupling with the world. These aspects could range from the different spatio-temporal perspectives an agent can take, to perspectives relative to morphology, physiology, goals and prior history. Content can also refer to affective tonalities (defined in a broad way to include feelings, emotions and moods, i.e, pain, pleasure, fatigue, excitement, curiosity and disinterest). For those other meanings of content "modes of presentation" and "phenomenological qualities" are sometimes used as synonyms. RTM does not deny causal roles to modes of presentation or phenomenological qualities, but postulates that for an event to be a mental event it has to be representational. Sensations without representations associated with them, for instance, would be at best only bodily phenomena, no mentality there. The content that matters for mental phenomena is representational content (correctness conditions). The core tenets mentioned above are present in all branches of enactivism. Their differences would be in agenda, theoretical commitments and the methods used for further developing enactivism. Autopoietic Enactivism (AE) or 'Autopoietic Adaptative Enactivism' (see Hutto and Myin 2017) would be the first branch of enactivism, following directly the path put forward by the publication of *The Embodied Mind* and the previous work by Maturana and Varela on autopoiesis and the biological roots of cognition (1980; 1987). AE follows TEM by focusing on finding a "groundless ground" for cognition in the biodynamics of living systems. It grounds cognition in the deeds of the living beings, in their actual doing. For that reason such grounds are "groundless", it is in relation to action. What are the cognitive structures of a particular living system? How do they relate to each other and how they evolved? The answer inescapably looks at what the organism can do in its

environment. Such a groundbreaking proposal does such work by offering a theory of living beings that links living and cognizing. Cognitive systems are autopoietic systems. Autopoietic theory is a "minimal life" theory, a theory of the minimal requirements for a system to be an individual *living* system[10]. The term "Autopoiesis" means "self-production". It refers to auto-productive processes that produce an individual entity dynamically (identifiable over time even if under closer inspection in constant change). This entity maintains its identity through time through constant material exchanges, as it interacts with the world. In other words, an autopoietic system 'generates and specifies its own organization through its operation as a system of production of its own components' (Maturana and Varela 1980, 79). The active engagement of the organism with the environment is what dynamically generates and maintains its closure (at the metabolic level the inner and outer boundaries between itself and the milieu). For this reason, "autopoietic enactivists" incur in a commitment to the *deep continuity of life and mind*: organizational structures and principles distinctive of mind are enriched versions of the organizational structures and principles distinctive of life (see Thompson, 2004). Already in the simplest possible form of sensorimotor coupling of a living being, the interaction between unicellular organisms and the environment exists a form of teleological directedness to the environment. Organisms are thus understood in terms of natural purposes with vital norms enacted by the organisms themselves (Weber and Varela 2002; Thompson 2007, 133; Di Paolo, Cuffari, and De Jaegher 2018, 24). Having purposes relating to their self-maintenance, the engagement with the environment has value, at least a polar structure of positive and negative regarding the continuation of the network of enabling relations that characterizes the organism. At the metabolic level, a "web of significance" between engagements beneficial and engagements that increase the chances of cellular breakdown (death). In other words, the living system makes sense of its interaction with the environment. This capacity is generally called *sense-making* and it is central to AE comprehension of cognition. Significance or value is enacted by the organism in its coupling with the environment. The two major takeaways of AE would be: (i) where there is life there is mind. And (ii) there is not a pre-given world decoupled from the organism and organisms don't fully determine their environments, organisms and environments are co-determined by sense-making activities.

10 "Autonomy" and "adaptivity" are now more central terms in the enactive characterization of cognitive systems. More on this topic is found in chapter 2.

One may think AE makes claims regarding the connection between life and mind that are too strong and has some undesirable shades of a quasi-idealistic constructivism (see Fultot, Nie, and Carello 2016; Vörös, Froese, and Riegler 2016; Heft 2020). But they may agree with the centrality of action to the emergence of cognitive structures. The idea that cognitive phenomena are embodied interaction (sensorimotor couplings with the environment) sounds appealing. What to do? One alternative is Sensorimotor Enactivism (SE). Key works include Hurley (1998; 2001), O'Regan and Noë (2001), Noë (2004; 2012), Hurley and Noë (2003) and O'Regan (2011; 2014). Other names for this enactivist branch are "sensorimotor theory" and "the dynamic sensorimotor account of perception" (see Bishop and Martin 2014). SE focuses on the structure, content and characteristics of (perceptual) experience. "Experience" is a very theory-laden term. SE authors tend to relate the term to how what an organism does changes what it senses (and vice-versa). Abilities involved in perception and action are actually an overlapping set of abilities[11]. The enactment of these abilities is also crucial to our understanding of the phenomenological aspects of perceptual experience. In research terms, the proposal is shifting research efforts away from analysis of the patterns of "raw" stimulation (the retina, the visual cortex, etc), refocusing on law-like changes in stimulation brought about as the result of an agent's actions. "Experience" can be understood in terms of those qualitative changes. One cannot understand qualitative aspects of experience without looking at sensorimotor patterns. Instead of thinking of those qualitative aspects as being generated somewhere in the brain, patterns related to the whole organism are relevant. Take it color vision: redness is not the result of a "red-generating" neural network responsive to the appropriate wavelength. For SE, such qualities are constituted by the set of objective patterns concerning the interaction with different wavelengths. How one acts and reacts to wavelengths is crucial to an account of the sensations associated with color vision. The enactment of sensorimotor patterns (patterns of actions and its resulting sensory changes) are a constitutive part of experience. Those patterns are called 'sensorimotor contingencies' or 'sensorimotor dependencies' (see O'Regan 2014, 23-25). The same applies to the other sensory modalities. The softness of a sponge, for example, is partially 'constituted by the fact that when you press on the sponge it cedes under your pressure.' (O'Regan 2014, 24) Therefore, SE is taken to be a phenomenological account of the action-perception loop, an account of perceptual consciousness and related phenomena, not necessarily an account of

11 More on that in chapter 3.

mentality in general. One common type of criticism of SE is that it is not enactive enough or it is semi-enactive at best. Some say it focuses too much on the environment, neglecting subjectivity. Thompson (2005) observes it lacks a notion of the experiencing agent, being an incomplete account of phenomenological experience. Others claim it is still too close to the RTM approaches to perception. Hutto (2005) and Rowlands (2010) point to the fact that in spite of the skill-centric approach, SE makes room for the possibility one could introduce once again the notion of mental representations under labels like 'practical understanding' (Nöe 2004). It is a problem to have representationalism lurking around.

A perspective that definitely doesn't have this problem is Radically Enactive Cognition (REC) or radical enactivism (Hutto and Myin 2013; Hutto and Satne 2015; Hutto and Myin 2017; Hutto 2017; Myin and van den Herik 2020). The general project is to reject cognitivism and RTM in favor of analyzing minds in terms of dynamic patterns of adaptive environmental interactions. RECers (as they are called) aim to do that by improving and unifying anti-representationalist approaches to cognition coming from different perspectives. The strategy is to 'RECtify' the existing approaches fighting the same fight: 'REC never stands alone. Its analyses and arguments are designed to cleanse, purify, strengthen and unify a whole set of anti-representational offerings' (Hutto 2017, 379). Not only autopoietic and sensorimotor enactivism, but also dynamical systems theory, embodied robotics and ecological psychology. This more indirect way of moving forward is the way they usually go, by criticizing representationalism in all forms, by advocating for revisions in radically enactive-adjacent approaches and by answering objections to REC. The distinction between radical, sensorimotor and autopoietic enactivism is drawn by Hutto and Myin's (2013, 23–36) in very much the same terms as Ward et at, (2017). But Hutto and Myin use the distinction in an effort to differ themselves from other more 'conspicuous' (2013, 23) forms of enactivism. These more conspicuous branches fail to be a truly anti-representationalist account of mentality according to REC (needing RECtification).

But how does REC criticize representationalism? In Hutto and Myin (2013), REC attacks the notion of mental representation wholesale. The attack is wholesale because it aims at the notion of information grounding notions like (mental) representation and content. The fourth chapter 'The Hard Problem of Content' (2013, 57-82) offers an argument against the possibility of naturalizing mental content by arguing it is impossible to naturalize semantic

information. The takeaway would be, if one aims to give a naturalistic account of a widespread cognitive phenomena like perception one must reject representationalism: 'Our basic ways of responding to worldly offerings are not semantically contentful' (Hutto and Myin 2013, 82). The notion of mental content REC concerns itself is the narrow notion of content as satisfaction or correctness conditions (see also Hutto and Myin 2017, 12; 101-103), or semantic content. This conception of content relies on an understanding of mental states as conveying or carrying information about something else, communicating a state of affairs (for instance, that 'a is F and not G'). But what is information? RECers claim the only reputable notion of information is covariation (see Hutto and Myin 2013, 66). Covariation is the relationship between two quantitative variables. If one variable changes value, the corresponding values of the covarying variable also change. The now classical example is the covariation between the number rings in the trunk of a tree and its age. The rings inform the age of the tree *for us*, but they do not inform (or represent) to the tree its own age. Which means covariation is not sufficient to constitute semantic content. What else is needed? A special kind of mastery is required: 'Only minds that have mastered a certain, specialized kind of sociocultural practice can engage in content-involving cognition.' (Hutto and Myin 2017, 177). In other words, contentful cognition is culturally scaffolded. In subsequent work (Myin and van den Herik 2020) it is elucidated that the specialized sociocultural practices are "truth-telling practices", i.e, communicative practices with public symbols where truth is the standard of evaluation. Most of our cognition, all of perception, some instances of memory and even some forms of linguistic cognition, are actually contentless (in the narrow sense of content). Criticism against REC ranges from being too radical to not being radical enough. Weichold (2018) points out that the distinction between contentless and contentful cognition makes it almost impossible to account for how they come together in concrete instances. He uses the example of going to the theater: walking to the theater to see *Funny Girl* is at the same time walking (contentless) and walking to see *Funny Girl* and not any other production (contentful). It seems most concrete human activities will be ambiguously both or require two minds in the same agent: one concerning itself with walking and the other with the intention of seeing *Funny Girl*. REC draws too harsh of a line. Others say restricting content to the scale that they do leaves too much out the picture. Evan Thompson, in a critical review of Hutto and Myin's second book (2017), praises them for reminding scientists and philosophers of the problems with representationalism, both in its traditional and new formulations. But he

does that while claiming that radical enactivism ‘does not provide a positive alternative account, and it is enactive mostly in name only’ (Thompson 2018). The positive side of REC would be meek. They don’t argue against the idea basic (contentless) cognition involves modes of presentation or phenomenological qualities, but there doesn't seem to be much space for those notions either. A person or organism is directed toward its objects in instances of basic cognition by what they call *Ur-intentionality* (see also Hutto and Stane 2015). If the most basic level of intentionality is not representational, how come one responds to the world's offerings? The directness of cognitive engagement is given by the outcome of successful phylogenetic adaptations and ontogenetic developments. One’s inherited and developed biological dispositions are what regulates their coupling with the environment. But what is it like to have them? If one thinks of it in terms of abilities (as RECers oftentimes do), do they appear/feel different to the agent as the level of expertise grows? How does the agent regulate their learning? In their books, Hutto and Myin’s main standard of “success” is the natural selection of traits, improving fitness (i. e., increasing the chances of offspring proliferation)[12]. It doesn’t seem this version of REC gives us the tools to answer those questions. Some suggested REC itself needs to be RECtified. Rolla and Huffermann (2021), for instance, claim REC’s dependence on the notion of know-how entails at least a notion of “basic content” as stable success in dealing with environmental contingencies.

The above distinctions and value judgments about the different branches of enactivism might be interpreted as evidence of a fragmented research program where incommensurable branches compete for hegemony. Do AE and SE fail to escape the undersea current of representationalism and need to be RECtified? Does REC offers a way forward or is it just a nice assault on the abuses of the notion of mental representation? A more Pollyannaish outlook is possible. To avoid such colorful opposition it is important to attend to the differences in agenda between these authors and the context in which “Enactivism” emerges. Let’s look at the agendas first. Their differences in goals and target audience are significantly important. REC positions itself as an alternative position in analytic philosophy of mind and for that purpose grants a lot of conceptual ground to the orthodoxy in this field. Take the adamant choice of narrowing the notions of content and intentionality:

12 REC’s ur-intentionality is based on teleosemiotics, a RECtification of teleosemantics (Neander 2012; 2020). According to teleosemantics, mental representations can be understood in terms of biological functions. Taking representations out of the picture we get the strategy of grounding explanations of intentionality on biological selection.

> Dreyfus and REC are both attempting to provide an understanding of basic world-relating attitudes ... However, since most *analytic philosophers* assume that content entails correctness conditions, to introduce talk of intentional content at this crucial juncture is likely to breed only confusion. Hence REC *recommends* the *keeping* to the vocabulary of *contentless intentionality* rather than nonrepresentational intentional content. (Hutto and Myin 2017, 101-102, italics added)

The overwhelming majority of analytic philosophy of mind is deeply committed to RTM, a view of mental content as representational content. Contrary to Noë (2021 fn. 2) there is a hard problem of content, but only if you accept RTM's narrow conception of content as RECers do. At least in the two books written by Hutto and Myin, it seems the main focus is beating the analytic philosopher of mind at their own game. They grant more than someone outside of an analytic tradition would to RTM and still shows it is unattainable if one really wants to keep a naturalistic approach. A very common argumentative strategy in analytic philosophy. This also explains REC's methodological procedure of analyzing and critiquing other theories as the way to move forward. They are trying to change analytic philosophy's take on mind. They do well when analyzing representational theories. But being so close to RTM makes them lose the nuances of other forms of anti-representationalism, like Chemero's (2009) ecological-embodied dynamics approach or the other branches of enactivism mentioned. As Thompson (2018) puts it 'Hutto and Myin fail to connect with the enactive approach, and so are not in a good position to rectify or otherwise revise it'.

For starters, The labels used to discuss the "conspicuous" branches are terribly misleading. Sensorimotor enactivism is in many ways EA applied to perceptual experience. Alva Noë would agree with this characterization:

> 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. … To enact ourselves in the world is to alter the world and so, in that sense, to make it. (Noë 2021, 5 italics in the original)

Adding to that, the authors cited as the main figures of SE build their proposals on top of "autopoietic" enactive work (both theoretical and empirical) of the early nineties on color vision (Thompson, Palacios, and Varela 1992; Thompson 1995) and results of "sensorimotor enactivists" are incorporated into the EA. At least since O'Regan and Noë 2001 paper published in *Behavioral and Brain Sciences*, the enactive understanding of perception is in

terms of mastery of sensorimotor contingencies. Inspired by Piaget's theory of equilibration this understanding is further explored by "autopoietic enactivism" in *Sensorimotor Life* (Di Paolo, Buhrmann, and Barandiaran 2017). Which brings us to the awfully mislabeled Autopoietic Enactivism. The first problem with the label is no major figure identifies as such (what usually is a good sign of mischaracterization). The proponents of the view attributed to the label use Enactive Approach or sometimes "Enactive Cognitive Science" (ECS). The second problem is Maturana's autopoiesis theory (Maturana 1975; Maturana and Varela 1980; Maturana 1981; 2002; 2011) and the enactive approach not only don't agree on everything, but have considerable differences. Remembering his collaborations and friendship with Varela, Maturana (2012) claims that their scientific aims were too different, preventing a more significant intellectual partnership (they didn't collaborate after 1987). Obviously, there is a strong continuity between classical autopoietic theory and the enactive approach, a connection much stronger than the one with second-order cybernetics. For instance, crucial notions like organizational or operational closure and cognitive domains, were first developments of autopoietic theory (see Maturana and Varela 1980). But enactive thinking expands on the ideas of autopoietic theory making both approaches sufficiently distinct. Works like Barandiaran (2017) and Villalobos and Palacios (2021) clearly demonstrate that one can be an autopoietic theorist without being an enactive thinker (even if being a member of the enactive tradition involves incorporating the autopoietic theory of life, as shown in the next chapter). Take the previous characterization of organisms as natural purposes. For classical autopoietic theory it is a mistake: 'living systems, as physical autopoietic systems, are purposeless systems' (Maturana and Varela 1980, 86). Autopoietic theory doesn't endorse the three dimensions of embodiment picture. Instead, assumes a strictly naturalistic methodology in studying cognition. The aim is a thoroughly biological account. Cognitive systems are living systems, and living systems are 'natural systems and must be studied as such; that is, by appealing to the same ontological assumptions and explanatory principles that the current science uses to study any natural system in general' (Villalobos and Palacios 2021, 76). If respectful natural sciences don't talk of purposes, cognitive science shouldn't either. In contrast, for the EA, autopoiesis is the single cell instance of a more general feature of cognitive systems, *Autonomy* (see Barandiaran, Di Paolo, and Rohde 2009; Barandiaran 2017). Autopoiesis is the most basic form of biological autonomy. Cognitive systems are autonomous systems and an operational characterization of autonomy is provided (as

"organizational or operational closure", see chapter 2). Living systems are the model case for the study of cognition and its features, like autonomy and agency. But eventually it might be possible to create artificial cognitive systems; it will also produce itself under precarious circumstances, perhaps a non-carbon based self-producing system (what would make it really hard to not call it alive). The Enactive Approach is a research program in cognitive science and its philosophy, it concerns itself with establishing theoretical commitments, grounding empirical issues and uses what establishes to motivate the careful construction of a positive and testable framework. Its procedure for moving forward is to build novel proposals building on previous enactive or enactive-friendly work, not in fending off oppositional views and critics. It is from the beginning an interdisciplinary research project. To launch a new perspective on cognitive phenomena and their study people and expertise from different fields are needed. The authors of *The Embodied Mind* are a neuroscientist, a philosopher and a cognitive and social psychologist, a fact sometimes deserving of no attention by its readers[13]. A common commentary is the terminology being not accessible. Terms like sense-making and participatory sense-making may evoke a very linguistic (therefore, representational) image of meaning inimical to the explicit goals of the tradition. But once one takes it into account the agenda of crafting almost from scratch a new outlook with new models, new theoretical understandings and new empirical issues, novelty and strangeness becomes something to be expected. New readers will come in contact with the perspective with their own baggage, so it is also to be expected some readers cannot see the terminology used without a representational lens. If one removes the misplace gumption of rectification several aspects of REC can be incorporated by the Enactive Approach. First, clarification in the face of this new approach to cognition is a very good thing. In many ways what I do is analyzing and critiquing theories as a way to move forward. Hutto and Myin's failure to connect to the EA in its own terms should not desmotivate this already commonplace methodology in analytic philosophy. Secondly, REC attacks on representationalism do motivate the consideration of alternatives, so it is good to have a alternative with at least 30-something years of developments[14]. So, instead of rectifying EA, I prefer to "enactivize" radical enactivism. REC's criticisms of attempts to naturalize semantic information and its notion of ur-intentionality can helps us think of the non-representational directedness to the world that

13 And the perhaps best account of the approach is written by a cognitive scientist and a philosopher with a background in engineering (Froese and Di Paolo 2011).

14 A tradition that is even longer if we consider Pragmatism and Phenomenology as predecessors.

emerges in an evolutionary timeframe. Francisco Varela, quoted many times in this introduction, spoke of "enaction" and not "enactivism". At first glance trivial, this point deserves to be highlighted, it opens up the possibility Varela deliberately avoided using the "ism". And as far as I know, it is the case. In interviews in remembrance and celebration of his life and work (Varela passed away in 2001), Evan Thompson talks of how they thought of enaction as an "approach" and not a "ism" because the latter has a connotation of being a "doctrine" (Thompson's term)[15]. A doctrine for them would imply a well-defined field of inquiry with a well-established set of core commitments and its own theoretical and methodological tools. It seems they thought that Cognitivism and Connectionism were doctrines and their proposed alternative Enaction was not. It continues to be true that "enaction" is not a doctrine in the aforementioned sense, the fact that I have to clarify what are the branches of the now called enactivism and how they relate to each other is enough proof. However, nowadays "Enactivism" is widely used and doesn't have this connotation. It is used to refer to the approach to mind loosely following the publication of TEM, be it an effort of revision, limiting the scope of it or following more directly. For practical reasons it makes sense to use enactivism in an open-ended way, referring to all the branches when their internal disputes are not in question. Since I do not look at internal disputes, when discussing aspects of all the branches, "enactivism" is going to be used. The major focus is the Enactive Approach (EA), however, so this label is the one featured prominently.

1.4 The journey's itinerary

Now the reader has entered the boat, went into the ocean and knows the sea they are in, it is only fair to tell where I want to go. Here I announce the central claims of each chapter. The next three chapters go into more detail on each of the domains of interaction dense enough to allow some semi-isolated study. One core component of EA in its more contemporaneous form is the *agency* displayed by cognitive systems. For that reason, each one of the next three chapters focuses more on one particular kind of agency. The main claim of the next chapter is that all living things act and sense, they are cognitive systems with their specificities. In a minimal or basilar sense, all living systems are agents. But agency and cognition are

15 The interviews are available in the *Mind & Life Europe* youtube channel (see for instance <https://www.youtube.com/watch?v=0vSulZA7EWg&ab_channel=Mind%26LifeEurope>). This point also appears in print in a footnote in Vöros et al, (2016).

generalizable in such a way, their characterizations do not imply minimal individual life. Agency and sense-making can be instantiated in other self-organizing systems; a cognitive agent does not need, in principle, to be a biological individual. In the third chapter I argue in favor of the enactive approach to perception. The account is framed in the context of action-based theories of perception. Such theories claim that the capacity of self-generated movement is constitutive of perception. One more provocative and specific formulation is perception is sensorimotor agency. The enactive approach provides a robust account of perception as the ongoing mastering of sensorimotor contingencies. Perception is shown to be a form of know-how and from that I propose *a deflated notion of mastery or knowing-how generalizable to other domains of interaction*. In the fourth chapter I show in detail the linguistic bodies theory (Di Paolo et al., 2018) of languaging (enacting language). In showing how linguistic agency is a special kind of social agency, one crucial point emerges. One key characteristic of languanging is the ongoing process of mastering know-how shared between the linguistic community. The acquisition of shared interactive know-how shapes one's individual development significantly, in a sense, no individual sense-making is absolutely individual. Together with the accounts of the other domains of interaction one arrives at what I labeled the *continuum of participation view* of cognition: the normativity of an agent's cognitive performances – from the action-perception loop to cognitive performances requiring language use – rests on shared know-how[16]. Most of the work in the first four chapters is a careful reconstruction of the state of the art of EA. The final chapter touches more directly on the underlying epistemology and what I called the primacy of knowing-how, therefore, the last chapter is where the reader finds my major original contribution to the field. The general argument one finds in this dissertation can be outlined as follows:

- Chapter 1: EA is presented in the context of a larger trend of studying cognition in an ecological way. EA is similar and yet distinct from Autopoietic Theory and Cybernetics, and it has intersections with other projects cited throughout (Phenomenology, Ecological Psychology and Cultural-Historical Activity Theory). The background behind the distinction between varieties of Enactivism is also explored. Both contexts are important because my account of knowing-how borrows something from those approaches insofar as some of their claims have already been incorporated by EA, while others compatible with it are incorporated in my argumentation.

16 For a similar view developed on the basis of both linguistic bodies theory and radical enactivism, see (Rolla and Huffermann 2021)

- Chapter 2: Living systems and precarious autonomous systems in general are intrinsically teleological systems whose defining activity consists in being responsive to the viability boundaries or conditions of their own existence. Cognition is characterized as the meaningful relation of matter with its surroundings[17]. Since their self-individuation happens under precarious circumstances, they need to skillfully change in adaptive manners to not disintegrate, even if their changes are not optimal. The account provides (i) a naturalization of normativity based on specific modes of self-organization; (ii) a theory of agency; (iii) a relational account of adaptive behavior as the basis for an account of know-how.

- Chapter 3: One mode of self-organization human beings instantiate is the formation of a sensorimotor autonomous agent. The more general notion of know-how can be articulated from the notion of perception as mastery of sensorimotor contingencies, where mastery is the ongoing accommodation and equilibration of sensorimotor schemes. Know-how in general can be understood as the organization and reorganization of bodily processes and structures that enables reliable successful action. The bodily processes and structures required for reliable successful action will be the ones related to metastable patterns that support different precarious autonomous organizations. Those metastable patterns constitute the cognitive domain of interactions. Know-how as the bodily sensitivities and capabilities relative to the cognitive domain that reliably result in the success of action is a feature of all forms of cognitive engagement. Cognition and some form of expertise (know-how possession) are inexorably linked.

- Chapter 4: The cognition or knowing-how of languaging consists in acquiring, producing, interpreting and modifying the know-how shared within linguistic communities. Crucially, the influence of the interactive context in a participant's sense-making varies in a *continuum of participation*. In one end of the spectrum one finds sense-making that remains largely (but not absolutely) individual and in the other end where what characterizes the activity is a joint process of sense-making. Knowing-how to language is knowing-how to be in dialogue with plural and idiosyncratic identities while being both yourself. Shifting the focus to different interactions at different scales, the image of objectivity changes. The focus becomes our objectifying practices, how shared awareness, appreciation, scrutiny and other critical attitudes create shared meanings and intersubjective normativity. A shared community of practices emerges as the basis of objectivity; knowing-how is a communal affair.

- Chapter 5: From a deep reconceptualization of the relation between action and cognition, perceiving and conceptualizing, one arrives at a new understanding of knowledge as a whole. The most basal aspect of knowledge is how knowers relate, contact or engage with what is known. If cognition is the skillful and not necessarily optimal adaptation of a precarious systemic identity to an always changing environment, all cognition rests on know-how. Cognition rests on know-how in the sense that all cognition is understood in terms of skillful transition between states of a system struggling with possible disintegration. Intelligent behavior is not based on

17 In technical terms: differential responsiveness to the environment on the basis of the viability boundaries of the system.

> symbolic structures and context-free knowledge, it is based on richly detailed, context-specific know-how. The knowledgeable interaction with the world is the responsiveness to the now that incorporates the history leading up to it. The know-how of intelligent behavior consists of bodily processes and structures for differential responsiveness according to both normativity related to the present situation of its instantiation and to norms pertaining to the history of interaction, historical norms whose incorporation characterizes the knower as a systemic identity. Knowing, I argue, is perspectival, historically situated and intertwined with affect. In this chapter one finds approximations between my proposed enactive epistemology and standpoint theory, feminist epistemology and virtue epistemology.

Understandably, simply introducing these novel claims can look like a trite holism suited for Philosophy in the new age of Aquarius. One may be swept up by its exciting siren-call only to hit the rocky coastline. Very interesting if true, but one mustn't get seduced by excitement alone. To mitigate this feeling I motivate some of those claims with some favorable (but not definitive) empirical evidence or I show how the claim in question is in line with recent proposals coming from different areas of scientific research. However, being a work in Philosophy, the work is as good as its arguments. The point of sometimes bringing scientific research to the forefront is to show that these ideas may look very much "out there", but they are as fringe as some ideas already being pursued in departments, journals and research centers outside of Philosophy. Their heterodoxy and novelty are not sufficient reasons for acceptance, but also are not enough for rejection.

1.5 Once at open sea

It is of the utmost importance to make it clear the goal here is not to refute once and for all the more traditional and hegemonic research programs in Cognitive Science. That is not even the way the story goes in the Sciences, generally speaking. Scientific revolutions tend to take their time and can be more or less opaque to the participants (specially after the fact). Kuhn deals with this aspect of science in the tenth chapter of *The Structure of Scientific Revolutions* (2012). The tendency after a scientific revolution is to the manuals and textbooks, the books popularizing the field and the philosophical works based on those to reconstruct the history emphasizing continuity rather than disruption. We are not at that point yet in Cognitive Science. It could be argued that now we are at the eye of the storm. The common phrase "post-cognitivism" is oftentimes used to refer to the current state of Cognitive Science. Nowadays enactivism is one between several alternatives to the classical versions of

Cognitivism and Connectionism. The other main ones are Predictive Processing, Active Inference and Deep (machine) Learning. But if Kunh is right, in looking back at this moment in the future all those approaches will look very similar and converging at the same point (whatever point that might be). There is no privileged position to be taken in the present, what we can do is work within the world are in. However, EA does have a more general implication to the understanding of scientific endeavors, it endorses its own form of naturalism. EA challenges the more traditional realist conception of science as revealing the way things are in themselves apart from our interactions with them. Cognitive science is one example of where this conception does not hold, but the lesson generalizes. There is no 'carve nature at its joints' (Phaedrus 265d–266a). The goals and skills of a scientific community matter not just for the carving, but in a sense to the joints themselves. Yet, science is not just the creation or projection of our minds, a mere reflection of our goals and skills. The goals and skills do not *fully* determine the joints. Again, the difficulty lies precisely in navigating between a Scylla and a Charybdis. Scientific practices are shaped by the need of the scientific enterprise (people, but also institutions) to connect with the world. The scientific enterprise usually is motivated by desires to understand and modify/transform, in this manner is heavily constrained by the world itself. In other words, one wants 'real patterns' (Dennett 1991). But the scientific enterprise also needs to connect with its human practitioners and its audience. It needs to connect with its human practitioners and its audience because of a starting point and always present background condition, the concrete ways in which we make sense of the world, i.e, the embodied experiences of the communities the sciences are part of, including their shared and dissonant values. What real patterns one has access to are context-dependent, and the context partially depends on goals and abilities. As Thomposon puts it 'scientific knowledge is not the exhibition of the nature of reality as it is in itself; it is an *expression of the relation* between our embodied cognition and the world that it purports to know' (Thompson 2017, xxvii, italics added). In a sense it is not surprising, a relational view of cognition would result in a relational view of knowledge and of scientific endeavor. Scientific knowledge pertains to how the world is disclosed to us at different scales and on how we can intervene in its different processes. And not only how one can intervene, but what is disclosed is relative to skills and goals. Naturalism and the enactive approach might look at odds with each other given this *sui generis* view on science, but it is not the case. What it rejects are strict forms of naturalism with strong reductionist tendencies. One possible motto for enactive

naturalism would be “Nature has no levels, only scales” (see also Heil 2003; Potochnik 2010; Potochnik and Sanches de Oliveira 2020). New phenomena come to be according to degrees of organizational complexity, timescales and sizescales. Those emergent phenomena are as real as any other phenomena deemed more fundamental and are causally effective on it (perhaps with the exception of causal closure at the scale of particles’ physics). Different theoretical and empirical tools and methodology are going to be needed to disclose and intervene on the emergent phenomena, that need reflects itself in different sciences. Cognitive phenomena are a specially complicated case of that. But it is not the same as excluding reduction of one description of phenomena to another in principle or giving *a priori* arguments against it. It is trivial, when reduction is successful, it is successful. Chemistry successfully explains why water doesn't evaporate at room temperature by reducing “water” to its molecular structure “H2O”. The point being made is that it is not always the case, specially to phenomena that might have what is called global-to-local causation (See also Thompson and Varela 2001, Box 1). It makes sense in trying to give an account of cognition, for instance, to look at different scales of complexity, investigate entities big and small, on both the timescale of its existence and on larger timescales. To do it we need to use a variety of sciences from different fields, and we can do it without the assumption the vocabulary of one science has privilege over the others. Enactivism, as an account of cognition, can employ ‘the findings of a wide variety of sciences that include not just the hard sciences but also cognitive archeology, anthropology, developmental psychology, and so on’ (Hutto and Myin 2017, 168-9). The Enactive Approach in fact does that, it draws on theoretical biology, developmental psychology, empirical perceptual studies, linguistics and cognitive anthropology and many other disciplines. The enactive epistemology proposed throughout the chapters is anti-foundational or groundless, knowledge and science have no secure foundations outside or beyond *what we do* and *how we do it*. In this sense is very close to yet another famous nautic metaphor:

> We are like sailors who on the open sea must reconstruct their ship but are never able to start afresh from the bottom. Where a beam is taken away a new one must at once be put there, and for this the rest of the ship is used as support. In this way, by using the old beams and driftwood, the ship can be shaped entirely anew, but only by gradual reconstruction. (Neurath 1973, 199)

Neurath also offers a naturalistic anti-foundational image of knowledge. His “boat” appears in different stages of his thought and is used to argue for a unity of science that is reflexive and against over-systematization. The unity of science, if achievable, is not theoretical (by

reduction to one lexicon). It is practical by way of *negotiations* (see Cartwright et al. 1996, 92; 169). Transparency in theoretical commitments, tools, methods, gathering of evidence and values between the disciplines is what is called for. His physicalism didn't require all meaningful sentences of science be in the language of physics, only that they were spatio-temporal situated, what would enable negotiations. The difference to an enactive naturalism and its version of the boat metaphor would be in what is permitted and what is deemed significant. Rather than negotiations, the driving metaphor of enactive naturalism would be *multilingual dialogue* between disciplines. The aim would be to adequately address phenomena in-between scales and at the boundaries of academic disciplines. Due to my methodological reading of the Middle Way of Enaction, the role of lived experience as an always present condition of scientific endeavors cannot be ignored by such a version of naturalism. My overall goal is to elucidate the epistemological commitments of the EA, so new and better dialogues can come to be.

2. The enactive approach to life and its ties to the purposiveness of cognition

The past is all around us. Darwin's biggest contribution was to show us that all individual organisms are connected through time… We are also physically connected, and you can see evidence of this everywhere you look. Think of the protists that live in the hind-gut of the termite, or the fungi that live in the rootstock of trees and plants. The birds that flitter from tree to tree transport fungi spores throughout the environment. Their droppings host a community of insects and microorganisms. When rain falls on the droppings, spores are splashed back up on the tree, creating pockets for life to begin to grow again. This interdependence is an inexorable fact of life.
Lynn Margulis, 1993

Here I argue that living is a teleologically-constituted mode of being, that all living systems are cognitive and agential in a basal sense. Teleology and its place in the study of the living is where I start (2.1). Then I explore two specific theories of minimal individual life that strongly link living and cognazing in a way that opposes brain-centered views of cognition, classical autopoiesis and EA (section 2.2). It can be shown that EA part ways with classical autopoiesis in its naturalization of purpose. I argue that minimal life according to the enactive approach requires sense-making and agency. The enactive conception of cognition as sense-making in a domain of interactions and the enactive account of agency are then explained (sections 2.3 and 2.4, respectively). From minimal requirements and constraints for life, I explore operational definitions of both cognition and agency that set empirical and theoretical agendas for further inquiry. But the notions of agency and cognition that one arrives at by looking at minimal requirements for life are generalizable in such a way that their characterizations do not imply minimal individual life. Agency and sense-making can be instantiated in other self-organizing systems; a cognitive agent does not need, in principle, to be a biological individual. The final section (2.5) reinstate what I think to be the cornerstone of the deep continuity between mind and life.

2.1 Purposiveness in living systems: the two strategies after Kant

Following Kant's considerations about natural teleology in his *Critique of the Power of Judgment* (1790/2001), it seems one would have to understand organisms as intrinsically teleological. To know them, organisms have to be treated as intrinsic purposes. The basic insight is that teleological descriptions and worse, explanations, would be an uneliminable component of biological understanding. This was the main legacy of Kant's philosophy to biological theorizing (Gambarotto and Nahas 2022)[18]. I highlight Kant's legacy because of its

18 Discussing Kant's claims and arguments is not in the scope of this chapter.

controversial and multidirectional impact in contemporary biology. Philosophers and theoretical work in biology have used those ideas in different strategies to deal with the challenge of placing purpose and purpose-related concepts in the life sciences. Gambaroto and Nahas (2022) identify two main families of strategies to deal with the challenge of teleology in Biology following Kant's footsteps, strategies that employ a *heuristic* use of purposiveness and a *naturalistic* attempt to reintroduce purposes in the life sciences in a reputable way. The majority of strategies are heuristic ones and they see Kant's views as valuable research tools for producing mechanistic explanations of organisms. In thinking of the organism *as if designed*, one learns a lot about the mechanisms behind their operations by analogy with what would be the intentional and unintentional normative constraints of it. According to the heuristic position, we can apply normative constraints to organisms, as one does with artifacts, without literally thinking that organisms are the product of design. The 'as-if' instance would be a crucial insight about the appropriate methodology of the life sciences that eschews for good vitalism and the quasi-religious notion of intelligent design[19]. Another grouping of approaches sees in Kant's conception of intrinsic purposiveness the jumping off point to a radically new way of thinking about biological systems that aims to reinstate teleology into a legitimate concept in the study of nature. In most physical systems what is seen is the parts constraining the whole, the whole is the effect produced by operations of its parts. However, organisms would be such that their parts are what they are and their function is what it is because of constraints of the whole into the parts. In an organism the parts do not precede the whole in any meaningful way, a living brain is what it is only in the context of its biological unit (a bee, a dog, a human). EA has this second more ambitious agenda of naturalizing teleology as a theoretical project (see esp. Weber and Varela 2002; Thompson 2007).

The problem of the purposiveness of living is often tied to questions about how widespread is cognition as a phenomena. Few would deny that some form of goal-directness is necessary for cognition, some would insist that it sufficient for a minimal or basal type:

19 In the 20th century one sees the rise of neo-Darwinian approaches that naturalize 'biological function' through explanations in terms of natural selection; such attempts exemplify well the heuristic family of strategies. Examples of such strategies include the 'etiological' account of biological function (Wright 1973) and Mayr's notion of 'teleonomy' (1974/1985). Purpose-talk in biology would be a shorthand and still be in a pre-scientific discursive register. The adequate explanations would refer to measurable mechanisms. In 21th century theoretical approaches to cognition, one finds something in this vicinity in the *Technological Approach to Mind Everywhere* (*TAME*) championed by Michel Levin (2022).

> Compare the response of a plant's roots to water with the response made by a teaspoon of salt. The roots change their direction of growth; the salt dissolves. Both of them change—both "respond," in a sense. But the response of the plant is more than something that just happens. It is also a change in accordance with the role that water has for the plant's vital projects, for its continued existence and reproduction. A pathway has been built in the plant—with hormones and genes involved—that brings it about that the detection of water has this particular effect. The teaspoon of salt does not engage in minimal cognition. (Godfrey-Smith 2020, Chapter 8)

Godfrey-Smith's idea is that salt is not cognitive, but plants are. I agree with him. Water has a importance or salience for plants that is not accounted for only in strictly dispositional terms, contrasting with phenomena such as the solubility of salt in water. The notions of vital project, purpose and cognition, in a naturalistic approach, serve the research goal of better understanding this difference. Following Pamela Lyon's work (2006; 2020; Lyon et al. 2021), I prefer to use 'basal cognition' for the goal-directed, context-sensitive, basic sensing and responding of organisms, present in unicellular and multicellular life. Many would describe what follows as an account of "proto-cognitive", "quasi-cognitive" or "minimally cognitive" behavior. The difference is mostly in vocabulary, the more substantial disagreement would be with approaches arguing that proper cognition is what EA call sense-making plus something else. The deep continuity between life and mind rejects that there is a distinction of kind between basal cognition and human cognition.

2.2 Minimal life and purpose: diverging paths between autopoietic theory and EA

In the inventory of concerns of theoretical biology, unsurprisingly, it is the concern for the definition of Biology's topic, *life*. Not the main concern of this subfield of Biology, there is no crisis in the lifesciences resulting from the lack of such definition, researchers can successfully study the characteristics and processes found in recognizable individual living systems and their aggregates without it. Most of the advances in 20th century evolutionary theory were possible due to focus on the molecular level, by studying life and how it changes over time[20]. Amongst other things, the Enactive Approach is an attempt to return to the organism as the unity of relevance to the studies of both mind and life. The "return to the organism" *ethos* is also present in ground-breaking work from the second half of the twentieth century onward (Waddington 1966; Piaget 1978; Gould and Lewontin 1979; Lewontin 1985;

20 How one macromolecule and its components (DNA and their genes) interacts with other molecules (mainly RNA and amino acids), in a process of replication and mutation over time.

2001; P. Bateson 2005; Walsh 2015). One cluster of proposals of definitions of life are *minimal life* theories of the individual living systems. The assumption of theories in this cluster is that the relevant features of life are found in the most simple exemplar one can find, the living cell. Examples of such theories are the theory of autopoiesis (Maturana 1975; Maturana and Varela 1980; 1987) and Robert Rosen's (1991) metabolism-repair (M,R) systems. Rosen's (M,R) systems and the theory of autopoiesis are in general agreement on modeling how systems can be open to matter and energy exchanges with its surroundings in a way to maintain their self-production over periods of time. In principle, those systems could lack reproduction and mutation and still be considered alive. Of course, life as we know it is widespread and diverse. Life perhaps came into existence in an isolated place on the planet, but rapidly took over the globe and it changed Earth significantly. To say that life begets life is an understatement. However, self-production is at least conceptually prior to reproduction and heredity (see also Maturana and Varela 1980, 96–111). Unless one assumes a creator and perhaps reintroduces God into scientific theorizing, the reproducing system must produce itself and in reproducing generate a self-producing system, down to the first reproducing system in the lineage. Reproduction presupposes individual self-production. In the more specific case of autopoiesis, the main concern found in Maturana and Varela (1980) is in how to comprehend cognition as a widespread biological phenomena: '*Living systems are cognitive systems, and living as a process is a process of cognition*. This statement is valid for all organisms, with and without a nervous system' (13, italics in the original). For Pamela Lyon (2006), autopoiesis can be classified as one of the main theories that exemplify and inspire a *biogenic approach* to cognition. In this type of approach:

> the principles of biological organization and the requirements of survival and reproduction present the most productive route to a general understanding of the principles of cognition. Cognition, whatever else it may be in the future, is naturally a biological process and a biological function.[...] what is it that biological systems do such that they might require cognition? (12)

Theories that follow a biogenic approach are concerned with what cognition does for organisms and how it does it. As it is shown next, for classical autopoietic theory the biological function of cognition is maintaining *autopoietic organization* through constant *changes in structure*. Organization is to be understood as the 'relations between components that define a composite unity (system) as a composite unity of a particular kind [...] In this definition of organization the components are viewed only in relation to their participation in

the constitution of the unity' (Maturana and Varela, 1980 xix). The organization of a system is the set of relations of its constituent parts that authorize saying that the whole system belongs to a certain class, is what gives the system an identity recognizable by an observer. Having four legs, a back and allowing sitting can be said to be one of the organizations that make something a chair for us. The relevant contrast of 'organization' is the notion of 'structure', the actual realization, the concrete components (the organelles of a cell, the organs of an animal) and its relations that physically constitute a system of a given class. Different organisms are different overall structures that belong to (or instantiate) the class of autopoietic organization. Actual autopoietic systems come in a variety of physicochemical structures and the same structure can instantiate different organizations beyond the basic autopoietic one (my cat is a self-producing living organism, but it is also an animal and a mammal). The cases of changes of structure where the organization is invariant more immediately noted by us happen in development, as the one that goes from embryo to newborn kitten and eventually to adult cat. However, structural change with invariant organization is the absolute norm in cellular life. Recent empirical research on molecular biology has confirmed what long was suspected, that *self-organization is the main principle of cellular architecture* (Nicholson 2019). Let's break down this claim. Cellular architecture research studies what determines the shape, size and relative location of the parts of the cell in relation to one another. A popular assumption of the field was that the genome was the main determining factor. That turns out to be wrong. Self-organization, the other aspect of the claim introduced, in this context refers to a form of molecular organization. Groups of molecules in a self-organizing metastable configuration generate what is called a "dissipative structure": a structure where the components interact nonlinearly staying in a far-from-equilibrium state that maintains itself in this state by constantly expending energy and exchanging matter with the surroundings. Self-organization requires the grouping of molecules to be open to material exchange, they rely on constant exchange of matter to replenish the material that composes this organization. Turns out that the way in which most subcellular components reach a dynamical metastable state is by self-organizing. The term "structure" has connotations of static, materially closed configurations of matter (a building, a crystal, a mountain, a computer). Self-organizing structures are nothing of the sort, another way of describing them is as *temporally extended stabilized processes dependent on fluxes of matter and energy for their stabilization*. Another example of self-organized structure is a tornado, water and other molecules circulating in the

air form a pattern that reciprocally constraints the water and miscellaneous molecules into a macroscopic configuration (the spiral/vortex structure visible with the naked eye). A tornado exists as long as the climate conditions are met, its existence depends on a certain molecular flow. Cells and many of its components are structures in the sense that tornadoes are structures, not in the sense that transistors are structures. We are vortexes of activity all the way down.

In the case of the cell 'Strictly speaking, there is no genetic blueprint for the cellular architecture' (Nicholson, 2019 112). As far as the current science can tell, there is no single component functioning as a set of instructions in cell organization.[21] Such discoveries in cellular architecture are a good example of how structural changes can preserve organization. Looking at the evidence coming from molecular biology and employing the autopoietic organization-structure distinction, one can conceptualize *basic living systems as unities that maintain invariant organization through constant changes in structure occurring at different scales*. The theory of autopoiesis claims that autopoietic organization is the organization of the living. Autopoiesis is both necessary and sufficient for life, as we are going to see, this point is contested by enactive thinking. The assumption is that the components and properties of life as we know it can be explained by life's autopoietic organization. But what makes an organization autopoietic? The characterization of autopoietic organization goes as follows:

> An autopoietic machine is a machine organized (defined as a unity) as a network of processes of production (transformation and destruction) of components that produces the components which: (i) through their interactions and transformations continuously regenerate and realize the network of processes (relations) that produced them; and (ii) constitute it (the machine) as a concrete unity in the space in which they (the components) exist by specifying the topological domain of its realization as such a network. (Maturana and Varela 1980, 78-9, italics removed)

The authors use 'autopoietic machine' to refer to the theoretical construct articulated by them, life as we know it is but one instantiating set of structures of this type of 'machine' (organization). I use the term "autopoietic system" instead, an autopoietic system is any system that displays an autopoietic organization. Following more recent enactive work (Di Paolo 2018; Thompson 2022) I refer to condition (i) of the passage above as *self-production*

21 The evidence for something functioning as a central controller in the cell is also meak at best. Nicholson (2019) also argues against DNA-centric views of cellular behavior, what the cell *does* cannot be said to be encoded in the genome. There is some resemblance with brain-centric views of cognition and the behavior of organisms. In both cases, a characteristic that might be of the whole system is reduced to one of its more extraordinary components.

and to condition (ii) as *self-distinction*[22]. Self-production means that in the operation of the processes of the network the set of relations between the processes are themselves re-established (continuously regenerating). The self-distinction condition of autopoietic systems concerns the fact that the network emerges as a distinct unity apart from its surroundings (even if in constant changes in structure). Autopoietic systems materially self-produce and self-distinguish, they create themselves and separate themselves from everything else. Thus conceptualized, autopoietic systems also have the property of being "organizationally close" or "operationally close". All the processes that make up the system are enabled by other processes of the system in a continuous circular manner. It follows that no process is freestanding or self-sufficient. Although organizationally closed, such a system is both materially and interactionally open to its environment. Some processes that do not belong to the unity can enable processes within the network, but they are *external* because they themselves continue to exist without the network. Sunlight enables photosynthesis, but the Sun exists independently of the plants. Following the seminal work of Francisco Varela (1979), operational closure is a general and distinct sistemic-scale property that certain types of systems can have, autopoietic systems are but one subclass of the wider class of operationally closed organizations. Operational closure is also the technical definition of autonomy, what allows us to say that autopoietic systems are autonomous systems[23]. The exemplar of autopoietic organization found in the literature is the living cell. The cell is a complex unity observably distinct from the milieu in which it interacts. The cell structure quite clearly exemplifies the dynamic self-production and self-distinction that autopoietic theory deems the basis of life. What can be abstract away from the cell is a model of autopoietic organization with three criteria: any system that exhibits (c) *interdependency* between (a) *semipermeable boundary* and (b) *reaction networks* displays autopoietic organization (see also Thompson 2007, 103 table 5.1).The model of autopoietic organization is formulated by close attention to cellular life, but it is independent of it, any system with interdependence between a self-distinguishing semipermeable boundary and reaction network that produces such boundary is an autopoietic system. Of course, the question if a given

22 Beer (2015) refers to the same conditions as *closure* and *boundary*, respectively.

23 As seen in the next two chapters, the enactive approach claims that sensorimotor engagements (in the form of networks of interrelated sensorimotor schemes) and social interactions in a technical sense also display operational closure and are, therefore, autonomous.

concrete system instantiates an autopoietic organization sometimes can be a matter of debate[24]. Kauffmann (2000) and Thompson (2007) disagree about the claim that autocatalytic sets of molecules can organize in an autopoietic way. Randy Beer (2015) argues that some compact recurrent spatiotemporal patterns that arise in Conway's Game-of-Life cellular automaton can be framed as an autopoietic organization.

The case of the single cell is quite straightforward, some other concrete systems are more open to debate, but how does autopoiesis address multicellularity? Autopoiesis is not just a theory of the cell. Here we need to introduce the distinction between first and second-order autopoietic organizations (see chapter 4 of Maturana and Varela, 1987). In a nutshell, second-order autopoietic organizations are the aggregates formed by first-order autopoietic organizations. Living cells are conceptualized as first-order autopoietic systems following the three criteria above. The multicellular aggregates formed by those first-order autopoietic systems can be called second-order autopoietic systems. The metacellular organization, as it is called, is defined as any unit that under close inspection reveals cell aggregates in close coupling with each other and the environment as its structure. Metacellular systems would therefore include multicellular organisms, but also organic tissue, organs, and for Maturana and Varela (1980; 1987), colonies and societies. One difficult question appears: is it possible that some metacellular systems are also first-order autopoietic systems? For such systems to be possible one would need to show that the first-order autopoietic systems (the cells) are also the *structure* of a larger autopoietic organization. Are we nested autopoietic systems? The metacellular aggregate in question would organizationally be a self-producing and self-distinguishing whole formed by a semipermeable boundary that is interdependent with reaction networks that produce the boundary, but in this case the boundary and the network would be made up of cells or aggregates of cells. The idea of higher-levels of complexity[25] instantiating properties present at lower-levels of complexity in a nested way is not nonsensical. We might be nested self-organized metastable processes all the way (up, down

24 Parts of the cell, such as the replicative molecules DNA and RNA would not yet be living entities because they lack semipermeable boundary and reaction networks, so they could not produce their own organization. Viruses also fall short in this framing. A virus has a "semipermeable boundary" in the form of a protein coat. In SARS-CoV-2, for example, the spiked crown-like structure commonly depicted in news stories about COVID19. But the molecular components of the virus are generated in a host cell, so the boundary is not interdependent with an internal reaction network that produces the virus; outside of its host cell they are entirely subject to the vicissitudes of the environment.

25 I'm not going to give a precise definition of complexity in this dissertation, but in general terms a system A is more complex than B if it is more heterogeneous in regards to some criteria.

and sideways). However, the challenge of characterizing metacellulars systems as first-order autopoietic systems runs into some theoretical and empirical difficulties. The conditions of self-production and self-distinction demand more than self-organization and metastability. Intuitively one could say that bees and humans are first-order autopoietic organizations where the boundary is the exoskeleton and the skin, respectively, and their aggregates, the hive and human society are not. But then one would be stretching the conceptual boundaries of the very notion of "semipermeable boundary", used earlier to refer with extreme precision to a molecular boundary. In the case of the cell it is very clear what the boundary is and what the reaction network is. If skin and exoskeleton are the boundaries, is the rest of the physiology part of the interdependent reaction network? The molecular process of development of metazoans can help us make the case that metazoans are organisms that are both second-order and first-order autopoietic systems, even if it does not settle the question (see also Thompson, 2007, chapter 7). Metazoans, for the most part, are the result of the operations of a single cell, the zygote, a brief but crucial stage of the metazoa life cycle. At the beginning we were a first-order autopoietic system. The question is if we maintain such an autopoietic organization in the process of cellular replication and type specification. We do not need to identify the boundary with a specific structure (the skin or exoskeleton). The boundary could be defined in functional terms in a way that different sets of structures are the boundaries of autopoietic systems in different stages of development. The same goes for the reaction network strongly linked to the boundary, what is operating as a boundary and reaction network is what matters. If one has a self-producing system that distinguishes itself from the surrounding by a self-created functional boundary, one identifies an autopoietic system. Yet, the difficulty of specifying what is the boundary and the reaction network in the body formed after several replications and specifications of cell types remains. Emphasis in functionality makes metazoans better candidates, but does not settle the question if they are first-order autopoietic systems. Independently of the status of some metacellulars as first-order autopoietic systems, one can claim that organisms are autonomous with the theory develop so far:

> What we can say is that they have *operational closure* in their organization: their identity is specified by a network of dynamic processes whose effects do not leave that network [...] they are made up of first-order autopoietic systems and form lineages by reproducing through cells. These two conditions are sufficient to assure us that whatever happens in them, as autonomous unities, happens with conservation of the autopoiesis of their component cells, as also with conservation of their own organization. (Maturana and Varela 1987, 89)

Even if a metacellular is not a first-order autopoietic system, they can still be an autonomous system. Varela's (1979) efforts in defining autonomy were sensible to the consideration that this property can be instantiated by a very diverse set of systems. Being autonomous, they would be systems that produce and regulate their own internal topology and functional boundary (the idea of operational closure). Besides, we can still comprehend their activity as *structural coupling*. Structural coupling refers to the changes in structure resulting from the interaction between a composite unity (a unity made of parts) and its milieu. The unity triggers and selects changes in the structure of its medium, the medium triggers and selects changes in the structure of the unity. Structural coupling is not specific to autopoietic systems (Maturana and Varela 1980, xxi). The phenomenon occurs whenever a composite unity (a system) with some plasticity undergoes *recurrent interactions* accompanied by structural changes *without loss of the relevant organization*. What is particular of the structural coupling of autopoietic systems is that in them the autopoietic organization is the invariant configuration that entrains the structural changes during the history of interactions. In structural coupling, living systems can, over different timescales, change something about themselves or change something about the environment. The structural coupling of systems made of first-order autopoietic systems can be comprehended as maintaining the autopoietic organization of the first-order systems and also an overall organization of the larger system in which the first-order systems are parts. Therefore, in the case of metacellulars organisms, their activity would be understood as the joint structural coupling of multiple individual first-order autopoietic systems that maintains the organization that characterizes that larger unity (see Matura and Varela 1987, 142-145 for an example from plant behavior).

At this point I can elucidate the notion that, according to classical autopoiesis, an autopoietic system is *necessarily* a cognitive system. The term "autopoiesis" would refer to the organization of the system, whereas the term "cognition" would refer to what the system does to remain an autopoietic organization in the structural coupling with the environment. What is cognition's biological function? Or, what does cognition do for an organism? It helps to maintain its identity through constant change. The organization of a system generates the interactive domain in which the system operates without losing such organization, the behavior (that is enable and constrained by the domain) is their cognitive performance: 'A cognitive system is a system whose organization defines a domain of interactions in which it can act with relevance to the maintenance of itself, and the process of cognition is the actual

(inductive) acting or behaving in this domain.' (Maturana and Varela 1980, 13). Distinct and more specific organizations, such as the nervous system, would bring about the emergence of different domains of interaction where different forms of structural coupling would take place. Cognition in this perspective would then be the operations or behavior of a system in relation to the demands for the preservation of its identity imposed by a certain domain of interactions, where the domain is defined by the organization. Brains expand cognition significantly, but it is already present in the activity of prokaryotic bacteria (the simplest life form found in our planet). Among the goals of classical autopoiesis was not only to give an organizational account of life's basic units, but also to give an account of it that does not rely on (apparently) suspicious notions like "purpose" and "aims": 'if living systems are physical autopoietic machines, teleonomy becomes only an artifice of their description which does not reveal any feature of their organization' (Maturana and Varela 1980, 86). The difference between a hurricane and my cats, amongst other features, is in the organization of the parts, not in the presence or absence of motivations and goals. The project was to explain the characteristics of the living (cognition, reproduction, evolution, but also what we usually describe as motivation and goals) with only the help of some central notions like autopoietic organization and structural coupling.

The notions of structural coupling and sense-making give rise to irreconcilable views on cognition (see Barandiaran 2017; Villalobos and Palacios 2021). Classical autopoiesis is against the DNA-centric views of its time and against brain-centric views of cognition pervasive in cognitive sciences to this day, but does not try to reintroduce agency or goal-directness neither to the sciences of life nor to the sciences of the mind. The Enactive Approach on life builds upon classical autopoiesis. Autopoietic organization is a necessary condition for life, but not sufficient as originally proposed, something already questioned by those trying to advance the theory of autopoiesis (Bitbol and Luisi 2005; Bourgine and Stewart 2004). Following a biogenic approach to the study of cognition, the fruitful path for the inquiry about cognition demands putting it in the context of how cognitive capacities contribute to the life of the organisms that have them. In this sense, EA is also one biogenic way of studying cognition. The paths of EA and autopoietic theory diverge when it comes to the purposiveness of life. So how does enactive thinking naturalize purposes and what does that have to do with a characterization of minimal living systems? If one takes actual organisms as the model of the living one observes another crucial feature of life, that turns out

to be relevant for mind, is what Di Paolo (2018; 2005) calls ‘adaptivity’. Adaptivity is a feature of the relation between a system and its own viability conditions. Systems have viability conditions, outside of those conditions, the system starts losing its integrity and in due time ceases to be. This applies to cyclones, as well as to a burning candle and living systems in general. If one puts a burning candle inside a glass, the candle stops burning due to the lack of oxygen. In this scenario one has moved the burning candle beyond its viability conditions. Now consider the scenario where the candle suddenly started trying to escape the glass, one in awe would be warranted to shout “It's alive!”. The candle would have in this scenario displayed adaptivity, the capacity to self-regulate with respect to the boundaries of its own viability. In more precise and operational terms, adaptivity is:

> a system’s capacity, in some circumstances, to regulate its states and its relation to the environment with the result that, if the states are sufficiently close to the boundary of viability,
> 1. tendencies are distinguished and acted upon depending on whether the states will approach or recede from the boundary and, as a consequence,
> 2. tendencies of the first kind are moved closer to or transformed into tendencies of the second and so future states are prevented from reaching the boundary with an outward velocity. (Di Paolo 2005, 438)

Adaptivity involves several processes of attunement to the environment and reorganization of internal and external structure. Adaptive systems modulate their states in relation to their conditions of viability, which implies some form of self-monitoring of internal states in relation to the external states of its environment. It requires sensitivities related to and capacities to respond to breakdowns and to maintain itself in favorable situations, by moving away from the limits imposed by the viability conditions. The notion of autopoiesis does not allow gradation, as shown earlier, is an all-or-nothing affair. The notion of structural coupling, as defined in Maturana and Varela (1980), also doesn’t allow gradation and refers to conservation of organization, rather than improvement. Adaptivity, on the other hand, allows for degrees while it is also a whole system’s property not reduced to its parts. Adaptive systems behave as such by moving away from disadvantageous situations in favor of more advantageous ones. Some organisms do it by literal motility, self-generated changes in the relative position in space. But moving from disadvantageous to advantageous can also mean alterations of its own morphology, production and secretion of chemical substances and other possible complex responses that change organismal internal structures or functions. Examples include animals that hunt and the running of its prey, playing dead (thanatosis), as well as

plants that grow in the direction of available sunlight and produce chemicals as defense mechanisms. The alterations can also be external, transforming the environment, either physically or chemically or both, in such a way to move the *situation* from disadvantageous to advantageous. The beaver's construction of a dam, ants building their tunnels, bacteria changing the chemical composition of a milieu, plants changing the atmosphere.

Bacterial chemotaxis is one of the most studied cases of unicellular motility and it is an exemplar of autopoiesis plus adaptativity (Egbert, Barandiaran, and Di Paolo 2010). Chemotaxis is the self-generated and self-directed movement of bacteria toward nutrients and away from toxins. In *Escherichia coli* (*E. Coli*), and other members of the genus *Escherichia*, that is achieved through the rotation of their flagella. They achieve two types of motion, so-called tumbling and running. In tumbling motion, clockwise rotation of flagella generates a random reorientation of the bacteria. In running motion, the counterclockwise rotation of their flagella produces a motion in an approximate straight line. Egbert et al (2010) review the literature in chemotaxis studies going back to the 60's and present a simulation model of a chemotactic agent that moves only in a way directly modulated by its metabolism. The model is simpler than other previous models where specialized chemical pathways and sensors are not coupled to the metabolic network. Yet, the proposed model displays varying sophistication of chemotactic patterns, displaying behavior adaptive to different situations. The simulated model of Egbert et al (2010) contributes to the understanding of the relation between metabolism and chemotaxis, as well as reproduces previous empirical observations (Alexandre, Greer, and Zhulin 2000). Another important result is showing that in the model bacterial metabolism-based chemotaxis operates according to *current* metabolic needs (it behaves differently after periods of starvation). One interpretation of their results is that the relevant metabolic needs guiding behavior are the ones that *presently* maintain autopoiesis, not metabolic needs in general or typical metabolic needs for that organism. What this shows is that the behavior is adaptive in the sense that it is sensitive to both the here-and-now and to the history of the organism. Autopoiesis plus adaptivity allows us to expand our understanding of behavior and to naturalize purposiveness. First, it becomes necessary to adhere to a broader conception of behavior, in line with what is required from a biogenic approach. A working definition of behavior that seems to do the job has already been proposed by biogenic theorists. Behavior as 'An organism's capacity to adapt to changes in its internal or external milieux by changing its own structure and function (internal) and/or its

spatial and interactive relations (external).' (Lyon et al. 2021, 5). The phrase "adaptive behavior" becomes redundant in the sense that all behavior aims at an adaptive self-regulation of the organism-environment system. But not all actual behaviors achieve their aim, and they vary between themselves in degrees of accuracy, effectiveness, energy consumption and so on[26].

In introducing the notions of adaptivity and behavior together, through the backdoor I introduced the notion of goal-directness. That was done implicitly in referring to a self-regulation according to a tendency to keep itself within boundaries set by viability conditions. That would be the general description of the goal of living. The organism itself is its goal. What one sees captured by those notions are aspects of the living that the notion of structural coupling was trying to capture without explicit reference or use of goal-directedness; those aspects are the changes in organism and environment brought forward by the organism's active maintenance of its organization. For classical autopoiesis the goal (maintaining autopoietic organization) is in the eye of the beholder. For EA, one has good reason to ascribe the goal (keeping adaptive autonomy) to the systems themselves. Those two perspectives go along with the major trends in biological thinking mentioned in the first section. In the first case, reference to a goal is a heuristic tool. In the second, it is the change in point of view that allows for better characterizations of an organism's behavior. Adding the proper goal of self-regulation within boundaries set by viability conditions (adaptability) to the picture has ramifications. Now the idea is to direct the attention to the more or less stable and beneficial *transitions between states* of both organisms and environments. Di Paolo (2018) points out that this change in perspective leads to considering that both organisms and environments are, generally speaking, non-stationary systems[27]. Adaptivity and non-stationarity imply path-dependency, historical directionality of behavior, what one can call historicity. Enaction focuses on the history of mutual change between agents and their environments. Present already in the groundbreaking *The Embodied Mind*, the concern is in what happens in transitions between the different situations of the situated cognitive system. The laws that govern the transitions between the organism-environment states themselves change over time,

26 The one important caveat to have in mind with the working definition is that the internal and external are constantly changing and can oftentimes be fuzzy boundaries.

27 A process is described as stationary if the probability distributions for its states do not change over time, that is, general statistical properties such as mean or standard deviation remain the same. A stationary system cannot change in open-ended ways, their general statistical properties work as boundaries of what that system can be and do. Crystals and computers are stationary systems.

as well as the relevant parameters, variables, attractor landscapes and other dynamical features (Di Paolo, Thompson, and Beer 2022). The same holds true of the set of viability conditions of the organism. A good illustrative case is the radical life cycle transitions of some organisms, such as a caterpillar that becomes a butterfly. In the process the animal changes drastically, their morphology, physiology and behavior changes, so is to be expected that the nomic relations between the organism and their environment also changes. In other words, the path life takes matters. The minimal possible living entity is an autopoietic adaptive system. One exemplar of autopoiesis plus adaptivity is bacterial chemotaxis. I derived from the concept of adaptivity and a closer look at the exemplar a working definition of behavior broad enough to include the diversity of behaviors of the living and to foster dialogue with empirical disciplines. A comparison between adaptivity and classical autopoiesis's notion of structural coupling allows me to make explicit the ascription of goal-directedness involved in the notion of adaptivity. The following step was to further derive consequences from this new characterization of living as inherently tied to the goal of maintaining adaptive autonomy through its transitions. One major consequence is what can be called the *historicity of life*, the strong path-dependency found in living systems. I arrive at a naturalistic understanding of life's purposiveness as the path-dependent pursuing of the goal of adaptively keeping their autonomy. The living system is the type of system that regulates itself as a whole in relation to conditions registered as advantageous or disadvantageous, such conditions emerge or are brought forth by the history of interactions between the system and the environment[28].

The purposiveness of life thus understood does not imply a final stage or ideal state of the organism. The set of viability conditions forms a 'viability space', there would be several regions that are neutral in relation to each other, that is, the organism would be equally adapted regardless of the comparatively neutral region it inhabits. Norms are derived from the goal of adaptively maintaining autopoiesis, the conditions in which the organism presently finds itself are differentiated as neutral, better or worse.The path-dependency of the pursuing accentuates that the system may enter new paths in adapting, it is not always the case that superating a negative tendency leads to a return to a previous state. There is an inherent

28 The notion of history being used contemplates both the developmental timescale, as well as the transgenerational timescales of culture and evolution, the scales are all interwoven with each other (see the discussion on enactive evolution at the end of the chapter). What is characteristic of life is that it changes with time.

normativity that follows the naturalization of purposiveness, but such normativity is somewhat open-ended since the normative framework can change over time, both at the scale of individual ontogeny and in transgenerational timescales. In multicellular life the model is the same, it only increases in complexity[29]. Organisms constituted of autopoietic units (multicellular beings) display the general feature relevant for enactive theorizing; they are instances of *adaptive operational closure under precarious conditions*. Precariousness is a complement to Varela's (1979) account of autonomy that helps explain the *active* self-regulation in relation to the environmental conditions. The basic idea is that precarious autonomous systems not only maintain themselves, they enable themselves as well, they produce the preconditions for their own existence (Di Paolo 2009). Precarious conditions are ones in which the constituent processes of the operationally closed organization, if isolated in an otherwise equivalent physical situation, would run down and cease to be. The operationally closed organization is a dynamic stable network of processes, to be under precarious conditions means that the individual processes of the network are not only coupled with each other, modified and modulated by each other, they are also enable by the overall organization of the network, they strongly depend on it for their continuation. The processes that constitute the network have their continued existence dependent on an interdependent relation to the network itself. Precarious autonomy would be instantiated by *E. coli*, but also by you, my cats and myself. Precariousness can be simulated by a computational model, but the simulation itself would not be precarious, the machines running it are independent from the simulation and do not engage in material self-production. On the other hand, the bacteria swimming the sugar gradient is in quite a literal sense made up of sugar and it needs sugar partially because the physical-chemical characteristics of sugar constraints the possible structures that such a system made up of sugar can have. Such constraints are what makes constant material turnover a necessity and depending on constant material production puts the system under precarious circumstances. Life without precariousness would be indifferent persistence. The precariousness of life helps us account for the directionality of it, the living is not living despite precariousness, but because living somehow goes beyond it. Adaptivity and the more

29 There is a strong dependency between the cellular processes of multiple cells between themselves, as well as with external material and energy flows that might include other organisms. Multicellular organisms typically outsource some of the processes necessary for maintaining their organization to other organisms in a symbiotic relation. The case of us humans and our gut microbiota is one example, our guts are the environment of organisms that exploit it in their self-production and self-distinction, and in doing so they provide a necessary assistance in our organismic integrity.

recognized features of life as we know it can be conceptually linked to precariousness by the well known connection between life and metabolism. The role of metabolism in self-production and self-distinction of cellular existence seems to give life an inherent tendency of avoiding the final breakdown of their far-from-equilibrium condition. The model based in *E. coli* demonstrates that motility directed by metabolism is sufficient for adaptive behavior. It is because organisms self-organize under precarious situations of necessary material turnover that they must adapt. Therefore, precariousness is even implicit in our previous naturalization of purposiveness as pursuing adaptive autonomy. The concern of both Maturana and Varela was with a precise characterization of *biological autonomy*, a feature that needed to be understood prior to any real advancements in a biological (or biogenic) account of cognition. The scale of biological autonomy in a strict sense is the organism, what further demonstrates how a return to it is important. Since autopoiesis alone cannot account for such autonomy even in the most simple case of the unicellular organism, a proposal has been made of defining an autonomous system as 'a system composed of several processes that actively generate and sustain an identity under precarious circumstances.' (Di Paolo 2009, 15). The reasoning is that proper, non-trivial autonomy, requires precariousness. According to the enactive approach, the equation that best encapsulates minimal life is "Life = autonomy plus adaptivity", but autonomy here follows the formula "autonomy = operational closure plus precariousness". The focus of this chapter is on accounting for organismal agency in an enactive way. Organisms are agents, they have a perspective on the world and act in virtue of it. Their processes are not just the system passively undergoing externally determined changes. They are actually pursuing change due to context-sensitive goals. Organisms have the capacity to adaptively regulate their operations and their relation to the environment depending on the virtual consequences for their own viability and flourishing. Their operations can be described as proper acts and behavior, such descriptions are not shorthands or a useful heuristic. Rather, they are supposed to be the reinstating of an agential vocabulary in a disciplined mode of inquiry about living organisms in conversation with current sciences. The consequence of the enactive account of life is that with minimal individual life comes normativity, cognition and agency, topics explored further in the next sections.

2.3 From minimal life to sense-making

In this section I present the notion of sense-making as the behavior or conduct enacted on the basis of the interactional normativity that the autonomous system brings forth in virtue of its adaptive autonomy, and the notion of cognition as sense-making in a given domain of interactions. I first related the notion of sense-making to the naturalization of purposiveness given in the previous section. I then explore the picture of cognition that emerges from the definitions, a model of cognitive performance (chemotaxis), as well as the motivations for upholding the intuitions that the definitions uphold. All the considerations of section 2.2 above were about life, what about mind? If life implies goal-directness is not hard to see how it would require mindedness. What was labeled sense-making in the Introduction can now be redescribed as the activity of adaptive self-individuation display by autonomous systems. This activity brings a 'sense' or 'significance' to the world of the organism. Organisms understood in terms of natural purposes with vital norms that are enacted by the organisms themselves entails some form of regulating themselves in relation to those norms. Tracking current states (internal and external), capacities for anticipation of possible future states and compensatory capacities for avoiding the complete loss of identity, would be operations of such systems. Sense-making and adaptivity are notions that complement each other. It is because of the purposiveness of the organism that the surroundings of such a system show up as a web of significance between engagements that are beneficial and ones that increase tendencies of breakdown of its organization. Some interactions lead to better situations in regards to its autonomy, other interactions lead to worse situations, and organisms sense and respond to that in different degrees of efficacy and with different capabilities. Differential responsiveness to events on the basis of those events having positive or negative values for the organism is another way of characterizing sense-making (see Thompson 2022). The characterization of sense-making in terms of differential responsiveness to a value-laden environment is helpful to move us away from an understanding of sense-making related only to sensorimotor patterns as in patterns between what an organism senses and changes in relative position in space (motility). Chemotaxis is a case of sense-making that involves sensorimotor coordination in this sense. But sense-making is not exclusively tied to it, a response to negative tendencies in the surroundings can be the production of chemicals into the environment to change it to a favorable one. Living systems whose lifecycle does not involve moving around, like plants, are also sense-makers. In the following paragraphs I'm going to continue to use chemotaxis

behavior to elucidate the notion of sense-making due to being the example most explored in the literature. Another reason for focusing on chemotaxis is showing the complexity and cognitive nature already found in very simple systems. The prokaryotes are a very old branch of the tree of life, the line of inquiry being pursued here is that cognition in our planet is as old (and diverse) as life.

Sense-making is the closest thing to a "mark of the mental" in EA. Due to the connection between autonomy, adaptivity and sense-making, the suggestion is that all living systems that we know of are cognitive systems. Similar to the relation between the terms "autopoiesis" and "cognition" in the classical autopoiesis literature, adaptive autonomy refers to the dynamic organization, while sense-making to the enabling activity. However, one crucial difference is that adaptive autonomy refers to the ongoing transition between states without loss of a relevant identity, not to specific sets of invariant organizations. Sense-making then refers to the on-going activity of keeping its identity through such transitions. In an organismic register, that amounts to navigating the complexities of remaining alive and fulfilling metabolic needs while operationally closed throughout the life cycle. Autonomous adaptive systems are made up (individuated) by their actions, as shown in section 2.4, they embodied the minimal criteria for agency and for that reason their operations can be described as actions and behavior. Sense-making can thus also be defined as the behavior enacted on the basis of the interactional normativity that the system itself brings forth in virtue of its adaptive autonomy (see Thompson 2007). Inspired by Antonio Machado's poem *Caminhante*, Enation was described as *laying down a path in walking* and enactive thinkers have often used the evocative phrase to emphasize the constitutive aspects of the organism's actions to its own goals and normative frameworks. Another evocative characterization of Enation is the *bringing forth of worlds of significance*. The combined ideas of "bringing forth" a "sense or web of significance" indicate EA's non-representational relational account of cognition and meaning. The "sense" in sense-making alludes to both path directionality, the "sense" as in the direction of the activity; as well as to the norms of viability that the system has to be responsive to in order to achieve its context-sensitive goals, the "sense" as the significance of some activities as means to certain ends. The value-laden environment emerges as the organism develops different responses as means to achieve its goal of self-individuation. To "bring forth" does not refer to a mere causal role, it is not the case that the organism's actions are simply generative of an effect to be described as a "normative framework". "Bringing

forth" refers to a constitutive relation where the organism's actions, skills and abilities are conditions of possibility for the organism's own modes of presentation. What is made present to an organism, its lived environment, is deeply organism-dependent. Writing about how both EA and the phenomenological tradition agree on the mind's constitution of the world, Thompson says: 'Things show up, as it were, having the features they do, because of how they are disclosed and brought to awareness by the intentional activities of our minds.' (2007, 15). However, it would be a mistake to understand this as a crude constructivism, where the mind constructs or fabricates a world without any constraints of such a world. The canonical example of a bacteria swimming uphill in a food gradient of sugar (Thompson 2007, 74–75, 157–58) allows the elucidation of this topic. The motile bacteria while swimming samples the concentration of chemical compounds in the environment. It swims towards concentrations of nutrients and other attractants and away from repellents (mainly toxins). One common behavior is swimming in a straight line as long as it continues to sample an increased nutrient concentration, randomly changing direction otherwise, or in the case of sampling increase concentrations of repellents. What Egbert et al (2010) model shows is that metabolic driven motion is sufficient for such differential responsiveness to a value-laden environment. In the case of the bacteria swimming uphill in a gradient of increasing concentrations of sugar, sugar is a chemical compound in the surroundings, but 'food' as a content in the broader sense used in the Introduction (a mode of presentation of that chemical compound) is given only by the activity of the bacteria as an autonomous system:

> significance and valence of sugar are not intrinsic to the sugar molecules; they are relational features, tied to the bacteria as autonomous unities. Sugar has significance as food, but only in the milieu that the organism itself enacts through its autonomous dynamics. (Thompson and Stapleton 2009, 25)

It is because of the value that sugar has for the bacteria as something it needs for its material turnover that sugar in that interaction presents itself as "food". Contrast this with a view based on the RTM. If *E. coli* had intentional minds in the relevant sense, then their mental states should be conceived as carrying information about their targets, i.e, as having correctness conditions. In the example, the mental target is the chemical compound sugar. For sugar to be cognized as food, states of the bacteria would have to have the function of conveying the information that the chemical compound can be metabolized, since representations are minimally characterized as vehicles that carry correct or incorrect information about their targets. The activity of actually consuming sugar would be a motor action, a process distinct

from the mental process of cognazing it. Cognazing refers to the proper mental phenomena and swimming is a distinct process, even if directly modulated by a supposed representational system. Having the representational content "food" would be intrinsic to the glucose molecules, they have the propriety of being metabolizable and that information is correctly conveyed and exploited. Their "food" appearance is how the information is conveyed. EA questions the reasoning of postulating these two discrete moments in the organisms' functioning, one of registering information and then acting on it, preferring conceptualizing environment-organism interactions as in constant sensorimotor loop (more on that in the next chapter). The endogenous activity of the organism is part of the constraints on how things appear as they appear. More generally, it is because organisms have needs related to their self-maintenance that they value things in a "web of significance". The contents or modes of presentation of a cognitive system are always going to be related to the endogenous activities of the organism. Therefore, a cognitive system's contact with the world is always contentful in the sense that it is always in terms of modes of presentation related to path-dependent normative frameworks that emerge in the history of interactions. A cognitive system's contact with the world is not always contentful in the sense that it always involves states that convey information about other states of affairs.

Sense-making is not the active (and intellectual) structuring of sense experience or representations; it is a corporal activity of discrimination of environmental structures in terms of salience. This discrimination is directly related to bodily abilities: an organism makes sense of its environment according to the skillful couplings which it can enact. The discrimination is an ongoing active process, that is why it can be described in terms of differential responsiveness to a value-laden environment, a vocabulary better fitting an observational description of sense-making. What a researcher sees when studying populations of *E. coli* in a microscope is how they react differently to different chemical gradients. Attempts to explain such occurrences can restrict themselves to the molecular scale and the properties of the different chemical compounds and receptors in the single cell organisms. However, according to EA, generating new and responding to already existing viability conditions (values) is part of a more complete explanation of such happenings. The mind constitutes the world or brings forth meaning in the sense that the differential responsiveness of organisms' not only follows, but also creates the environmental patterns related to the virtual conditions for the viability of that organism, i.e, the "web of significance" or values that provides the *telos* or directionality

of the adaptive autonomy. This is what it means to be laying down a path while walking (or swimming, in the bacterial case). Basal cognition is not the process of representing independent states of affairs. Rather, cognition is the process of generating relevance for the system through the need of maintaining an identity at the always present possibility of disintegration (Thompson 2022). EA grounds mental activity in sense-making activity, so it's neither a form of internalism nor a form of externalism about cognition. It is not a form of internalism because the autonomous sense-making system is not skull-bounded or skin-bounded. Internalism about the mind assumes cognitive processes are explained appealing only to the internal processes of a presumed *locus* of cognition, a localized spatial boundary such as the skull. Cognitive states are states constrained by such boundaries, or at least typically constrained to some specific location in space (and sometimes specific arrangements of matter such as brains). They are obviously under the causal influence of external factors, sensory and motor input for instance, but what gives them their identity is a configuration of states of some internal part of the cognitive system. The popular idea that the mind is a product of the brain is the more common form of internalism. Of course, a theory can be internalistic about some processes and allows for the extension of some other mental phenomena under the right conditions. In this case the position would amount to a variety of externalism. Externalism denies that only by appeals to internal processes that cognition can be elucidated. Arguing by showing counterexamples, externalism claims that some cognitive processes “extend”, meaning that factors outside the usual locus can integrate the cognitive process and for that reason be of significance in its explanations. Mind might be partially skull-bounded, but it is not always skull-bounded or it could have some processes that are never skull-bounded. Externalism, so constructed, would be still committed to the idea that the paradigm case of cognition is the bounded, spatially restricted one, where the extended cases would have a comparable or equivalent status to the paradigm. Clark and Chalmers (1998) “extended mind” exemplifies the externalistic position. EA does not accept the basic premise that supports the debate between internalism and externalism. To equate cognition with some internal process of cognitive systems would be a confusion or a categorical mistake. The mind is never skull, skin, or membrane-bounded. The example of sense-making used so far was chemotaxis, highlighting the *movement* of bacteria towards attractants and away from repellents, a behavior that is context-sensitive and therefore cannot be fully accounted for without explicit reference to the current environment where the behavior is

displayed. But the environment is just part of the picture, internal structure also matters greatly. Even in the most simplified case presented in Egbert et al's (2010) model, the inner workings are crucial. In that case, metabolic needs of the bacteria are equally important to an accurate explanation of the behavior. The cognitive performance of chemotaxis is distinct from the metabolic physico-chemical processes of actual breakdown of sugar molecules for production of energy and material turnover characteristic of cellular life. There is no identity between living and cognizing, but the acknowledgment of the crucial role of basal cognizing in the process of living. The term "mind" refers to a *relational feature* of an organism-environment system.

Differently from the notion of structural coupling, sense-making is explicitly an asymmetrical relation, the direction of the relation is given by needs of the autonomous system under appreciation. In this chapter I am only considering the biological individual as the autonomous system under appreciation, that is why the emphasis is on a relation between the whole organism and its environment. But as shown in the following chapters and alluded to in the Introduction, the enactive approach distinguishes between three intersecting cognitive domains of special relevance: organismic regulation of the entire body, sensorimotor interaction and intersubjective interaction. Nevertheless, a general claim applies to all domains: *cognition is a relational process of sense-making taking place in-between, that is, takes place between the system and its environment*. Mind not as one form of matter, but as the meaningful relation of matter to their surroundings:

> Cognition is sense-making in interaction: the regulation of coupling with respect to norms established by the self-constituted identity that gives rise to such regulation in order to conserve itself. This identity may be that of the living organism, but also other identities based on other forms of operationally closed networks of processes, such as socio-linguistic selves, organized bundles of habits, etc. Some of these identities are already constituted by processes that extend beyond the skull. But in any case, cognition is always a process that occurs in a relational domain. Unlike many other such processes (e.g., getting wet in the rain) its cognitive character is given normatively and asymmetrically by the self-constituted identity that seeks to preserve its mode of life in such engagements. As relational in this strict sense, *cognition has no location*. It simply makes no sense to point to chunks of matter and space and speak of containment within a cognitive system. Inspect a baby all you want and you'll never find out whether she's a twin. (Di Paolo 2009, 19)

Sense-making in a given domain of interactions (relational domain in the quotation above) is the working definition of cognition extracted from EA. The definition aims to capture a particular cluster of intuitions about the term "cognition": 'it is normative, asymmetric (there

is a centre of cognitive activity), relational, oriented and extended in time, capable of mistakes, and it implies a self-constituted identity to which norms refer.' (Di Paolo 2009, 15). The idea there is a center to cognitive activity is perhaps the main intuition for the conceptual frame from which the debate between internalism and externalism arises. The intuition boils down to the observation that agents cognize their environments and not the other way around. But that does not need to be understood as cognition happening inside the agent (be it in some, or all cases). Within a relational view, asymmetry of the agent-environment relation preserves the intuition. Normativity is assumed to be a feature of cognition if not simply for the fact that our common ascriptions of cognitive states almost always presume a way things can go wrong. Misremembering and having hallucinations are possible states of cognitive systems striving for remembering and genuine perception. Once again, that does not necessarily need to be understood as a representational internal state not matching the external represented reality. EA does not deny the importance and normativity of the relation between the internal and external. On the contrary, the relation is of the utmost importance given that cognition is the relation of agents following norms of their own in the environment in which they are embedded. Difference configurations of the relationship between agent and environment leads to different ascribable cognitive states. Cognition as oriented and extended in time almost needs no motivational reasoning behind it. Cognitive systems are physical systems, they inevitably have constraints of space and time in their actual instantiation.

The relational nature of cognition and a self-constitutive identity to which cognitive norms refer to are intuitions more closely connected to enactive theorizing than to common sense discourse. The self-constitutive identity intuition can be tied to the ancient philosophical concern with what are the referent and meaning of the "I" in claims such as "I think", "I'm feeling nauseous" and "I don't really enjoy poetry". Similar to intuitions about a center for cognitive activity, but in those new examples the mind's constitution of the mental state is more directly recognized. Usually, the "I" that thinks and does not enjoy poetry is conceptualized as distinct from the body as a material or biological entity. EA is not a crude version of materialism that denies mentality in the sense that the "I" refers to absolutely nothing, but also does not subscribe to a substance view of the self to which mental states are ascribed to. The understanding of the "I" is grounded in a novel conceptualization of identity. Identity is conceptualized in terms of operationally closed precarious organizations. The term "body" in general refers to any network of processes that self-organize in operationally closed

precarious organizations. A body is any autonomous network. The chaotic complexity (messiness) mentioned in the Introduction is that the different bodies that a cognitive agent embodies always intersect in a myriad of ways. For the purpose of studying and comprehending, the heuristic of emphasizing the separation between an organic, a sensorimotor, and an intersubjective body is proposed. The "I" that thinks is constrained and enabled by normative frameworks of those three dimensions of embodiment, without being fully determined by any of them (the historicity and open-endedness already present in minimal life carries through the other scales of analysis). Both TEM (1991: 205–6) and Thompson (2007: 22-27) draw on the account of intentionality provided by the phenomenological tradition as one source of reasoning to motivate a relational approach to mind. Not mere introspection or reasoning based solely on individual introspection, the phenomenological tradition stems from the philosophical project originally proposed by Husserl and further refined and developed by the other authors (Merleau-Ponty and Hans Jonas often cited by EA thinkers).

Phenomenology is characterized as a systematic inquiry into the structures of consciousness as experienced from the first-person perspective, as well as their instantiation in the human body, social intuitions and material objects (Gallagher and Zahavi 2021). It aims to provide an account of the structure and the conditions of possibility of first person lived experience; experience in many ways sidestepped in the scientific studies of the mind. In the Husserlian old-school tradition, Phenomenology aims at uncovering the *necessary* structures and conditions of possibility of experience. EA borrows from Phenomenology the idea that the mind is intentional in the sense more closely related to the Latin *intendere* (to aim or direct). Intentionality refers in this context both to object-directness and to a more broad notion of openness to the world, intentional as being world-involving. One guiding metaphor for this conception of intentionality is the act of drawing a bow and arrow. The act is intentional in the more restricted sense of aiming arrows at a specific target, but it also has a more general openness to the world, it involves some awareness of the weather, the conditions of the bow and arrow, and awareness of one's posture. The contrast is to views of the mind as having relative or absolute independence of the physical body and its surroundings (one example is RTM). Moods, bodily pain, general curiosity about a topic and undetermined anxiety are intentional under this characterization. Intentional experiences are viewed as acts and those acts are oriented to the disclosure of the appropriate intentional object, and such object does

not need to be an existing physical entity. The intentional act of imagining a unicorn is a type of aiming, whose goal is the disclosure (to bring to awareness) a particular kind of object, for our purposes let's label it a mental image of a unicorn. Therefore, the intentional act has directionality, the act is completed as that act when the mind arrives at their goal. In the example, the act is instantiated when the mental image of a unicorn is disclosed or brought to awareness. But the mind is a dynamic entity, one intentional act leads to others in a stream of intentional experiences (imagining a unicorn can lead you to remember a particular unicorn from a work of fiction). Intentional experiences would have the feature of being an ongoing process involving directness and some form of teleology. Intentionality is always a relation. More than that, it is a relation that transcends the current states of the mind (more below).

As I have shown, minimal life according to EA is also conceptualized as having directionality and teleology. Minimal life also is transcendent in the deflated sense that is directed towards sets of states that are beyond the current configurations of the living unity. The notion of adaptivity as self-regulation according to boundaries of viability captures this feature. Enaction also refers to something transcendent in this deflated sense: 'cognition as embodied action is always about or directed toward something that is missing … actions of the system are always directed toward situations that have yet to become actual.' (TEM, 205). It seems like the phenomenological mind is a good fit for enactive life. As stated in the Introduction, some enactive ideas were first cybernetic ideas, I bring this back to the awareness of the reader to point out what Dupuy (2009: 104–5) calls the 'missed encounter' between the scientific study of the mind proposed by cybernetics and the phenomenological tradition. Borrowing from dynamical systems theory, different cybernetics models of cognitive systems from the 70s and 80s would generally describe them as autonomous networks in transitions between states tending towards an attractor (the more stable states that the network tends to evolve to over time if it does not disintegrate). The operations of the network were understood as the transition from one attractor to the next due to external perturbations. Dupuy highlights that the meaning of the external perturbations is given in the context of the network's own endogenous activity. An autonomous network can be identified and defined as that which tends toward an attractor, even though the attractor is just the product of the operations of the network situated in an environment and therefore subjected to external forces. The network would follow the general trend of transitioning from one attractor to the next regardless of specific perturbations (what they determine is the specified trajectory of actual transitions).

That is an odd system as it is, but Dupuy goes one step further in oddity and says that such systems display intentionality in the phenomenological sense. He compares the cognitive system modeled as an autonomous network that tends toward an attractor to Husserl's (1952) notion of 'transcendence within immanence'. It is not the case that what appears to be beyond the current state of the network in the case of cybernetics and beyond the current intentional acts of the mind in the phenomenological tradition are somehow contained or prefigured within them. Rather, the idea behind the comparison is to point out that in both frameworks there is an external reality that can be said to be really transcendent, to be completely out of the scope or sphere of influence of both minds and autonomous networks. However, when in contact with minds or autonomous networks, such "things-in-themselves" 'do not arrive labeled, as it were, as external events; instead they are constituted or disclosed as such, and with the significance they have, by virtue of the network's autonomous (self-organizing) dynamics'. (Thompson 2007, 27). Their status as external is given by the autonomous network's activity. In the act of perceiving the objects of perception are disclosed to the mind as external and volition-independent due to the conditions of possibility of the act of perceiving. In both cases, the external world is presented as such due to the own activity of the system for which the external appears as external. The mind, according to this line of reasoning, is a relation between a really transcendent reality ultimately beyond reach and an immanent intentionality trying to bring it to view[30]. What was shown is that a working definition of cognition as sense-making in a domain of interactions entails a relational view of the mind very similar to the above reading of the phenomenological tradition. The intuitions about cognition that the definition tries to uphold come both from the common everyday discourse about the mind and from some theoretical motivated understandings of what a definition of cognition should include.

30 This interpretation of Husserl's 'transcendence within immanence' and of intentionality according to the phenomenological tradition might not be the best scholarship available, it is outside of my expertise to judge it. What both Thompson and Dupuy brought forward successfully regardless is a relational view of the mind based on a form of transcendental philosophy compatible with the efforts of naturalizing cognition. The relationality of the mind can be motivated both by a transcendental philosophy framework and by a naturalistic framework. It would be disingenuous not to acknowledge other theoretical reasons in favor of relationality. In TEM, more than Phenomenology, Buddhist thought, specially the notions of groundlessness and codependent origination, are what motivates a relational account of cognition. Beyond that, the Pragmatist idea of cognition as the guide of action and Ecological Psychology's affordances are all conceptual frameworks that provide motivating reasons for a more relational conception of the mind. Common discourse and RTM's view of intentionality are not the only game in town regarding the intuitions that a definition of mind (or cognition) must uphold.

Sense-making was explored from different angles, one adequate definition is differential responsiveness in the interaction with the environment on the basis of the values that different interactions have for the system. Accordingly, cognition as sense-making in a domain of interactions would then refer to the value-laden environmental interaction of different identities in different environments. The cognitive domain of interactions refers both to the autonomous systems (the identity) and to the environment inhabited by it. The environment here refers to the spatio-temporal extended sets of processes that a system (autonomous or not) is coupled with. The environment is the set of processes that affect and are affected by a system. In the cybernetic model mentioned above, the external forces that affect the trajectory of the system from one attractor to another are part of the system's environment. Forces or processes that don't affect or are affected by the system are currently not part of it. The set of processes that constitute the environment are also not fixed. Due to the coupling and mutuality of the cognitive system and its environment, both are always changing. From the side of the system, cognitive performance is what aims to regulate and direct the mutual changes. A hurricane and an *E. coli* are both systems with their respective environments, the crucial difference for our purposes is the asymmetry between *E. coli* and its environment display in behaviors such as chemotaxis[31]. My objective is not to make the Enactive Approach immune to criticism, but to show it in the proper context. The context is the theoretical discussion on the *suis generis* character of living systems and the relation between life and cognition. The answers provided by EA are both elucidative and generative, they aim at understanding the target phenomena but also at setting an agenda for further inquiry. However, something has been assumed in this whole discussion so far and needs to be better characterized: the notion of agency being implicitly assumed. The notion is assumed both in the working definition of cognition and in the working definition of behavior. The agent is the one behaving and doing the cognazing.

31 A skeptic can say that cognition as sense-making in a domain of interaction is not a good definition of cognition, since it leaves out other supposed features of the phenomenon or includes features not related to it. Even if sense-making is only proto-cognitive or quasi-cognitive, due to its ties to minimal life, any biological or biogenic account of cognition would have to include what is being captured by the notion of sense-making. Cognition is a normative notion and sense-making appropriately naturalizes norms as the viability conditions to which a system is responsive to. The skeptic would have to provide their own naturalization of normativity or argue for the heuristic stance.

2.4 From sense-making to agency

Behavior and action are typically associated in philosophy with concepts such as volition, desire, intention, motivating reasons and reasons to act. Recently, enactive cognitive science and theoretical biology have associated behavior with agency rather than with intentionality or the related concepts of the previous sentence due to some connotations of those terms. Agency as in the capacity to act is contrasted to systems that are only subjected to forces and constraints, as in being acted upon. Di Paolo et al (2017: 109–10) compare a sheep, a lamb and a group of small rocks going downhill on a slippery mountain. All of them are subjected to the laws of physics, but we can observe clear differences between the descending or falling of the tree. Intuitively, the small rocks are not agents and it is possible to distinguish between different levels of agency in the lamb and sheep. But to assume an intuitive notion of agency without effort to more precisely delineate it is a mistake. The problem is at least twofold. First, relying on an intuitive notion without proper characterization is unproductively polysemic. What counts as an agent becomes a matter of seeing-as, it would rely on preconceived notions not universally shared. For some, agency includes only humans. For others, humans and some animals. Some would associate agency more directly with complex motility, so it would include both bacteria and us, but would leave out plants and perhaps include particular kinds of robots. Another matter with this seeing-as is the associations between agency and other concepts, such as goal-directness and experience. Some might judge goal-directness as sufficient for agency, others might associate agency with sentience and the experiential aspect of living; if something is an agent, there is something that it is like to be them? An intuitive notion is too vague. The second problem is that, like goal-directness and purpose, agency does not look at first glance compatible with the natural sciences. That is a problem insofar agency is to be treated as a concept of biological significance. Agency does need to be reduced to biological phenomena, some aspects of it or some types of agency might be the proper domain of biology without being entirely reduced to it. The following comparison highlights the oddity of agency to natural science. To say something is an agent implies that it (or they) ought to perform actions according to some normative framework, for instance, you have to tie your shoelaces if you don't want to trip on them. Such "ought to" vocabulary is radically different from how interactions between fundamental particles in physics are described or the transformations of matter and energy occur at chemical reactions. Typically, natural events are conceptualized in stark contrast with actions, which creates a

challenge for a unified scientific picture of both. Agency has the same problem as purposiveness, certain events involving biological individuals seem to require it for their explanation, but it is unclear if the use of the concept is just a useful heuristic or should have a more putative status. As with purpose, EA aims at reinstituting agency as a serious scientific category. EA proposes a definition of agency not restricted to living organisms. The definition is not restricted to individuals as biological units because it allows the recognition of agency in other scales of organization, such as networks of interrelated sensorimotor schemes (chapter 3) and social-linguistic individuals (chapter 4). The proposal offers three necessary jointly sufficient conditions for agency: *individuality, normativity and asymmetry* (Barandiaran, Di Paolo, and Rohde 2009; Di Paolo, Buhrmann, and Barandiaran 2017, Chapter 5). The three criteria are interwoven in a way that the elucidation of one makes apparent the necessity of the other two.

Normativity is the more easily graspable condition. As stated in the previous paragraphs, the problem of introducing agency in the natural sciences is introducing an "ought to" vocabulary of normative evaluation to disciplines often thought of as purely descriptive of states of affairs. The same problem of naturalizing goal-directed activity since introducing goals introduces a normative framework as in the adequate conduct that is conducive to the achievement of the goal. Proper actions require reference to conditions to which an interaction is responsive and sensitive to when being carried out. While playing volleyball one cannot hold the ball because it is easier than the single contact demanded by the rules. Without such a normative set of conditions, it is hard to describe an action as that particular action. In analytic philosophy, this theme appears with special prominence in Anscombe's (1979; 2002) account of action as intentional under certain descriptions and not intentional under others. Deliberately poisoning a well can be described as a series of muscle movements that leads to a substance getting into contact with a body of water. Nothing in terms of performance, of actual further events, needs to be added to make this act one of poisoning. However, the act is one of deliberately poisoning the well because other descriptions are also true of it, like a desire to cause harm and practical knowledge about how to do it. For Anscombe, it is not necessary that the agent be aware of the relevant descriptions or even that they have in principle some form of access to such descriptions (birds and other non-linguistic beings have intentions according to her view). The present account agrees with Anscombe's account insofar considers that intention or agency is not something (say, proprieties) added to an

otherwise neutral event, but a feature of a particular type of event (an action) where some descriptions are true of it and some are not. In action, certain descriptions need to be proper descriptions of that event. One proposal is that those descriptions are the ones that include norms or goals according to which it makes sense to say of the agent that they had the adequate conduct concerning those norms and goals.

"Action" is a category that has normativity built into it. Going back to the case of chemotaxis, the description of the behavior as a *proper behavior* (and not just a physical-chemical occurrence) required the additional claim that the movement towards attractors and away from repellents is in response to a value-laden environment. Another example is given by Barandiaran, Di Paolo, and Rohde (2009), they contrast proper action with the spams of a person suffering from Parkinson's disease. There is an event with a causal explanation, but there is no non-derived sense in which it makes sense to classify the spasms as successes or failures, there is no dimension of normative evaluation from the agent's point of view. There is the possibility of evaluative judgments such as "frequent spasms decrease quality of life" or "frequent spasms decrease my overall life expectancy", but in such judgments, the spasms are events that affect the agent, not their actions. Actions are events that have effects on the agent, smoking also can decrease our overall life expectancy. But actions are events also caused by the agent. Actions are the agent's (normative) regulation of their own interactions. Another important distinction concerning normativity is the one between norm-following and norm-establishing. Extrinsically teleological systems are normative only in the sense of being law-abiding relative to a perspective. Normative frameworks from an observer perspective can be applied to such systems. One example is a clock, an artifact that can be judged on its accuracy. The atomic clock, under this framework, is the best clock. Other normative frameworks, such as cost of production, favor other types of clocks. Extrinsically teleological entities are only norm-following entities, it can be said of them that they follow norms of a given framework. A pertinent inquiry is on who's imposing normative frameworks onto entities. One reasonable answer is to deny scientific legitimacy to such inquiry. Maturana (1987) assumes that all assessments of adequate conduct are relative to an observer, which implies that all the normativity that can be studied is of the norm-following variety. There would be no system that not just follows norms, but also creates its own. In other words, there would be no intrinsically teleological systems. To create its own norms (to be norm-establishing), that system has to have its own goals from which behavior aimed at its

achievement is adequate or not. Rigorous scientific study has no place for the assumption of the existence of such systems. Normativity is only in the eye of the beholder.

A more robust account of agency, where agency is not just in the eye of the beholder, demands an account of intrinsic teleology. As the examples provided in the previous paragraphs suggest (poisoning a well and chemotaxis as instances of agency, spasms as not instances of it), for agents to be agents they need to be normative in a strong sense, as being both norm-following and norm-establishing. There has to be normativity from the agent's perspective, which leads to questions about the individuation of beings with an intrinsic normative framework. Commonly taken for granted, the identity of an individual as distinct from their environment cannot be trivially assumed, as if agency was a feature of a "pre-given" agent. The roles are reversed, agency is relational and "agent" refers to the identity distinguishable and relatively stable that it is in interaction with its environment in the pursuit of particular goals. The intersection between a strong sense of normativity and a theory of individuation becomes noticeable. To argue that a system displays normativity in the stronger sense of the term one has to argue that the system is a certain type of individual where goals are not derived from something or someone external to it. I already argued that biological individuals (organisms) are intrinsically teleological. Organisms were characterized as autonomous in a technical sense, as operationally closed precarious systems. Precarious autonomous systems are self-enabling systems, they produce the preconditions for their own existence. For an autonomous system to be under precarious conditions means that the individual processes of the network are strongly dependent on the network for their continuous existence. Individual processes and the emerging network are interdependent. A corollary of this characterization is that *to do* (as in to pursue goals) is both the consequence and the condition of possibility of an organism's existence (Barandiaran and Egbert 2014). In *Biological foundations of individuality*, Has Jonas is another figure that identifies in teleology the distinction between the individuality that is owned by a subject (as in intrinsic to it) from the individuality loaned to an object by a subject observing it:

> Teleology comes in where the continuous identity of being is not assured by mere inertial persistence of a substance, but is continually executed by something done, and by something which has to be done in order to stay on at all: it is a matter of to-be-or-not-to-be whether what is to be done is done (Jonas 1968, 243)

The individuation of teleological systems (what they are) is co-defined with some of its processes (what they do). Organisms are an example of a teleological system. The systems that undergo this type of ongoing self-individuation are purposive and therefore normative in the stronger sense. In the process of distinguishing itself from the environment "to be" can be said to be its intrinsic goal. For EA 'agents are systems that *actively define themselves as individuals*, and may be identified as such without arbitrariness' (Di Paolo, Buhrmann, and Barandiaran 2017, 112). It is because of this constant individuation that autonomous precarious systems can be identified as individuals, clear criteria for predicting that X is an agent is provided; it is not just a matter of intuitively seeing-as anymore. Cellular life fits the criteria, but the proposal is that any system with such active ongoing individuation also would have normative relations to its environment. As demonstrated in the following chapters, operationally closed precarious systems can be identified at different scales; they can be as lasting as addictive habits such as smoking (chapter 3), they can be as fleeting in duration as a brief hallway encounter (see chapter 4).

The last of the three criteria is interactional asymmetry. Agents act on their environment, not the other way around. The language of actively undergoing constant individuation used above already points to the asymmetrical relations of agents with their environment. The agent is the source as well as the result of their individuation. Causation in complex systems is a very complicated topic to tackle, let's consider interactional asymmetry as the modulation of the encounter with the environment whose source is the agent; agents as causes of certain events. Interactional asymmetry relates to the ways agents direct their path in the coupling with their surroundings. That can happen in a variety of ways. EA highlights two general senses in each the agent modulates the encounter, as controlling the flow of energy in interaction and a statistically causal sense (Di Paolo, Buhrmann, and Barandiaran 2017, chapter 5; Barandiaran, Di Paolo, and Rohde 2009). First, one way of modulation is by control of energy flows. Agents manage and gather the energy resources for action. Pumping ions through the ion channels in the cellular architecture and chemotaxis directed by metabolic needs are ways systems constrain the flow of energy to sustain processes that move the system away from the general tendency of thermodynamic systems, thermodynamic equilibrium. That is very different from a candle burning its wax as fuel as long as the situation allows it, and it is also very different from being moved by a strong wind or river flow. In this sense, a system that controls the flow of matter and energy between itself and the surroundings, while staying in

the same relative position in space, displays interactional asymmetry. The chemotaxis example is one in which a negative tendency is avoided, but not all forms of modulating the interaction with the environment are negating negative external tendencies with some internal mechanism or complex behavior. Exploiting positive flows of matter and energy is as important as negating disturbing tendencies. Our own bipedal upright walking can be described as a "controlled falling" where we exploit gravity for locomotion (DeSilva 2021). Agents can be understood as the source of their actions in the sense of being what drives the energy resources (of an otherwise neutral interaction) in the direction of some of the system's goals (what connects interactional asymmetry with normativity and individuation). Driving or directing energy resources can have an element of passivity in the sense that the agent might let themselves be carried by a favorable external energy flow that does most of the enactment, as in birds gliding or a person surfing. The second way in which we can understand the agent's modulation of their encounter with the environment is by trying to assess statistically how one system (the agent) affects another system (the environment). Interactional asymmetry would be the case when changes in the system identified as the agent precedes in time changes in the system identified as the environment in a statistically significant way. That would be a more mathematically rigorous way of claiming that agents act in their environment and not the other way around. There are a series of debates and concerns about the mathematization of agent-environment interactions. Nonetheless, taking an enactive stance (even if just for the sake of the argument), the agent-environment relation can be seen as two coupled dynamical systems. In such coupling, what marks the agent as the agent in this interaction is the capacity of altering the parameters and conditions of the relation in some situations. Modulation could take the form of a reshaping of the dynamic landscape of the coupling. Modulation could also require work in the physical sense, as in the deployment of energy, which connects this understanding of modulation with the energetic sense mentioned before.

The "some situations" condition is important because it highlights the contextual aspect of action. Di Paolo et al give the example of a cliff diver (2017: 118). The driver standing at the edge of a cliff does a series of muscle movements that result in a dramatic change in the constraints of the interaction with their surroundings. The movements put the agent in a situation of free-fall, hopefully in the direction of a deep enough body of water. But had the diver not positioned himself on the edge of the cliff, the same neuromuscular changes would

not result in a change in the situation, from standing to free-fall. In other words, cliffs are required for cliff diving. Actions are contextual, which means they are spatio-temporally extended and dependent on their proper environments. The environment can also be a source of asymmetric modulation, such as falling off a cliff due to a strong wind. It is not asymmetry alone that defines an agent, rather the joint conditions of self-individuation, normativity and interactional asymmetry. The self-individuated agent is capable of engaging in modulations of its coupling in certain cases. As defined, *agency is the self-modulation (or self-regulation) of the autonomous organization's interactions with the environment according to an intrinsic normative framework.* In the most general sense, an action is an instance of agency as characterized in the sentence above. To act a system must be of the purposive kind, that is what guaranties that the system is not only norm-following (a notion relative to an observer perspective), but also norm-establishing (capable of generating and following their own intrinsic norms). It is the three conditions together that allow talk of agency instead of the classical autopoiesis notion of structural coupling, for instance. Any self-individuating autonomous organization asymmetrically coupled with its environment will also generate an intrinsic normative framework, therefore, will constitute an agent under the current conceptualization. Agency will henceforward be taken to be a systemic-scale propriety instantiated at different scales, biological individuals being just one example.

2.5 From a philosophy of biology to a philosophy of mind and back again

I have argued in this chapter that living is a teleology-constituted mode of being, that all living systems are cognitive and agential in a basal sense. Living systems' activity is constituted by path-dependent, context-sensitive goals, the more basic goal being maintaining its precarious autonomous self-organization under constant material and energetic influx. The goals, the context and the path emerge in the actual operation of the system, they are *enacted*. Purpose, normativity and meaning are not out there in ready-made form. They exist in the in-between, as living beings pursue their goals. This relation to the environment where meaning arises, the relation that creates and enables normativity and purpose, was labeled cognition. In the broader sense in which mind and cognition are synonyms, mind and life are coextensive, yet distinct. More broadly, the mind is understood as the complexification and enrichment of the organizational properties distinctive of life. To show how the claim is not preposterous, I

started this chapter with the problem of the place of purposiveness and teleology in the life sciences. The problem was already a topic of discussion in the 18th century and one can reconstruct a Kantian legacy of two competing approaches to the problem in contemporaneous theorizing about life, the heuristic stance and the naturalizing project. One of the approaches, the minority position favoring naturalization, sees Kant's thought as a launchpad for a radical understanding of biological systems that reinstates teleology as a legitimate concept in the study of nature. EA goes in this direction, building upon the theory of autopoiesis. I have shown the reader the enactive naturalization of purposiveness, in which purpose and meaning are directly tied to the fact that living beings are self-producing, self-distinguishing adaptive systems keeping their existence under precarious conditions. Meaning and purpose come from the active self-regulation that enables our precarious existence.

The account of mind provided is in direct dialogue with a solution to a problem of the philosophy of the life sciences. For this reason, I presented to you a journey from philosophy of biology to philosophy of mind. Of course, the journey required some bridges. As is the case with any theoretical proposal, some intuitions and metaphors guide the development of its operational definitions. The account of mind provided aims to put the mind in the context of living, it is a biogenic approach. Also, I did rely on my exposition on some phenomenological considerations about the structure of intentionality, on a comparison between Phenomenology and Cybernetics' dynamical models of cognitive systems, and on the metaphor of laying down a path in walking to try to convince the reader that sense-making in a domain of interactions meets the criteria for a definition of cognition. Some considerations about intentionality and action, as well as types of normative systems, were also necessary for the enactive account of agency. Even with those bridges, the model of cognitive performance explored was metabolic driven chemotaxis, phenomena of interest to microbiologists. But going from life to mind does not mean that the account reduces the mind to biological phenomena. Enaction emphasizes the transient, the space between the moments. The identity that self-produces under precarious circumstances coupled with their domain of interactions forms an extended developmental system that transforms itself over time, going from one dynamically stable configuration to the next. If one looks at the sensorimotor development of individuals, a similar organization is found in the scale of networks of interrelated sensorimotor schemes, where the identities are sensorimotor habits and the domain of interactions is a sensorimotor environment. If one zooms out to social interaction

and languaging, a similar organization also occurs at the scale of social acts. Nature and culture are in a continuum, they are intertwined processes and products of each other. This is the core of the deep continuity between life and mind. Not the reduction of mind to life, but the opening up of life to the immanent transcendence of mind.

3. From knowing-how to perceive as mastering sensorimotor contingencies to knowing-how in general

Our view of the world is contingent on how we move. They only know what they know in the context of a particular type of locomotion.
Karen E. Adolph, 2021

For EA, agency is constitutive of perception, and perception is embodied know-how. Being embodied know-how, learning how (acquiring know-how) is at the core of perception. The first section introduces EA in the larger framework of action-based accounts of perception. The second section focuses on the enactive view as providing a robust account of perception as the ongoing learning (mastering) of sensorimotor contingencies. Section three deals with questions that emerge from EA's account of perceptual learning: contributions to sensorimotor theories as a whole, how to understand the know-how in perception and how a deflated notion of mastery might generalize to other domains of interaction. Finally, section four examines how empirical work in broad agreement with action-based accounts has investigated the role of agency in perception. This section highlights how inquiry into perceptual learning reveals itself as crucial for studies trying to assess the role of agency in perception. With what was learned about perceptual learning, I sketch a possible route for enactive empirical research on the role of agency in perception.

3.1 Action-based accounts of perception and the primacy of action

EA is one of the many action-based accounts of perception (Jacob 2015). Those accounts question a prevalent assumption in twentieth-century analytic philosophy that an agent's abilities to act and their abilities to perceive are two distinct sets of abilities (Davidson 1980; Searle 1983). Perception and action would have different directions of fit: to act would be to seek a possible (non-actual) state of affairs represented in the mind through bodily mediation and to perceive would be to register or record an actual state of affairs in the mind. The substantial distinction between action and perception seems to fit nicely with the rejection of behaviorism central to the cognitive revolution of the 1950s and the subsequent rise of the computational paradigm. For that reason, one could say that this distinction is also an underlying feature of projects like Marr's (2010) computational theory of vision. It is important to point out that this distinction between the abilities to act and the abilities to perceive did not go unquestioned. Notable cases of disagreement in the twentieth century are

the phenomenological tradition and ecological psychology. From phenomenology, a good example is Merleau-Ponty (1945/2012) arguing that the capacity for meaningful (cognitive) interaction depends on our capacities for bodily interaction. The details of our embodiment are the result of bodily interaction; the interaction also constrains the structure of experience and thought. From ecological psychology the work of James Jerome Gibson (1979; see also 1966) became the *locus classicus.* Gibson argues in strong opposition to what he calls the "snapshot view of perception". For him, vision (the perceptual modality explored in the 1979's book) is *direct*, not mediated by states 'standing in' for features of the world. Perception is active in the sense that it is a process that unfolds in time being modulated by the organism's activity; and in the sense that, what we perceive, are *affordances*, i.e., opportunities for action related to our purposes and skills. Additionally, already in the last decade of the 20th century, a significant number of cognitive scientists and philosophers started to look at the reciprocal interaction between what an organism does and what it senses. Notably, Susan Hurley's (2001; 1998) work was crucial to the development of action-based theories into the beginnings of the new millennia. Nowadays a lot of attention shifts to the causal interdependencies and evolutionary complementarities of acting and perceiving. There is a growing consensus that all forms of cellular life sense and act in some limited capacity. Nothing controversial in claiming that what an agent does influences what it perceives. The most common place or received view of perception states that our senses are channels that convey information to the brain in the form of sensations, then organized as perception. The motor systems can modulate the information received by the sensory system, but both are sufficiently distinct systems and perception is the result of the workings of the sensory and the nervous systems. Seth's (2021) "controlled hallucination" approach to conscious perception is a good example of contemporaneous theorizing from this point of view. In opposition, action-based accounts tend to view our senses as part of systems employed in action-perception or sensorimotor loops. Critics are correct in their claim that action-based accounts redefine perception in terms of its relation to action[32]: action and perception belong to an overlapping set of abilities, a sensorimotor loop between what an organism does and what it senses/perceives (Hurley 2001). To put it simply and somewhat provocatively, *perception is for action and action is for perception*.

32 The reasons for redefinition come from different disciplines and lines of inquiry. In Barrett (2011), for example, a positive case for action-based accounts is made by looking at how the non-brain body and the environment shape the cognitive processes of humans and non-humans animals.

J. J. Gibson, for instance, emphasizes the ambiguity of the verb to perceive (1966; see also 1979). The phrase "to perceive" might mean "to have a sensation", but can also mean "to detect something". It is the second meaning that matters, the perceptual systems have for him the purpose of detecting patterns of information available in the environment. Perception is direct because *it is* the detection of the environmental patterns, it does not represent the pattern, it is not a mediation. He uses the example of the "obstacle sense" (Gibson 1966), sometimes referred to as "facial vision", to show how some forms of perception can be "sensationless". Some blind people are capable of detecting objects using this sense. However, this skill has nothing to do with vision, it is a form of echolocation. Perhaps the experience is not as sensationless if taking into account how reports and experience may differ. But an important point is made regardless, sensations do not need to match the mechanism by which environmental information is "picked up" or detected. But what kind of information is there for picking up? The information in question is information *for* action and not *about* the environment (see also Carvalho and Rolla 2020). This type of information is labeled *ecological information* and is 'contingent on the existence of spatial-temporally extended and structured patterns in the topology of the ambient energy array' (Segundo-Ortin and Heras-Escribano 2021). Ecological information is the behaviorally relevant structured energy patterns detected by the perceptual systems. By moving around, exploring, and controlling the flow of stimulation, behaviorally relevant structured patterns of the ambient energy array (ecological information) can be detected (perceived). What is usually labeled "sensations" do not inform much about the mechanisms of detection or the information available to be detected. The structured patterns of energy are the important feature.

Enactivism tends to focus on the dynamical dependencies between what the agent does and what it senses, the dynamical patterns of sensorimotor contingencies that explain both the perceptual systems and characteristics of the qualitative features of conscious experience:

> […] to *see* something is to interact with it in a way governed by the dynamic patterns of sensorimotor contingency characteristic of vision, while to *hear* something is to interact with it in a different way, governed by the different patterns of sensorimotor contingency characteristic of audition. [...] perceptual experience is a skillful activity, in part constituted by such practical know-how. (Hurley and Noë 2003, 146, italics in the original)

Independently of which flavor is preferred, the more controversial claim of action-based theories remains the same: the set of capabilities typically related to perception are enabled

and constrained by the set of capabilities typically related to action, and vice-versa[33]. Our focus in this chapter is on a subset of the action-based accounts, the enactive sensorimotor theory of perception. Without surprise, sensorimotor theories of perception have consequences for our inquiry into the phenomenon. The main consequence is what is sometimes called the *primacy of action*. For enactivism in general and EA in particular, perceptual research should study perception through the complex, dynamic and emergent interactive patterns known as sensorimotor contingencies. As said in the introduction, the research efforts should switch away from analysis of the patterns of "raw" stimulation (the retina, the visual cortex, etc), refocusing on law-like changes in stimulation brought about as the result of an agent's actions. The idea is not new, it can be seen in Dewey's critique of the concept of "reflex arc" in psychology:

> The ordinary interpretation would say the sensation of light is a stimulus to the grasping as a response, the burn resulting is a stimulus to withdrawing the hand as response and so on. [...] the real beginning is with the act of seeing; it is looking, and not a sensation of light. The sensory quale gives the value of the act, just as the movement furnishes its mechanism and control, but both sensation and movement lie inside, not outside the act. (Dewey 1896, 358–59)

This primacy of action insight about the relation between perception and action is also at the core of enaction: 'the enactive approach consists of two points: (1) perception consists in perceptually guided action and (2) cognitive structures emerge from the recurrent sensorimotor patterns that allow action to be perceptually guided.' (TEM, 173). The proposal of cognitive structures emerging from sensorimotor patterns works as an expansion of the primacy of action to cognition in general, and for that reason, the constitutive role of action is one of the core tenants of enactivism.

Another important framing of this debate around the relation between action and perception is in terms of the role of *agency* in perception. One of the major challenges of the sciences of the mind is to distinguish the mere happenings of a system from proper actions guided by goals and purposes. What distinguishes hurricanes from eukaryotes and prokaryotes? The action-based accounts of perception are committed to a strong dependency of perception on agency.

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33 I would like to stress that this is not the same as claiming that they are one and the same, claims of interwovenness and continuity are not claims of identity. It might be contexts in which drawing a distinction might prove itself productive.

After all, following Dewey, the real beginning would be the *act* of seeing/touching/smelling[34]. For EA agency is constitutive of perception. In section 3.2 I brought forward EA's theory of perception as a theory of perceptual learning. In the specific domain of sensorimotor interaction and using dynamical systems descriptions, EA provides an operationally grounded concept of sensorimotor contingencies, which in turn grounds the technical notion of sensorimotor schemes. Now, these notions enable us to speak of *perception as mastering sensorimotor contingencies*. The ongoing mastering of sensorimotor schemes by a sensorimotor agent is the enactive theory of perceptual learning; we are always learning to perceive. Following those steps, one arrives at three central claims: (a) agency is constitutive of perception, (b) the doing of the agent is their mastering of sensorimotor contingencies (c) in their skillful interaction with the world. Epistemological implications of the enactive view are made explicit after making the positive case for it. Perception is embodied know-how, so perceptual failures occur when agents fail to adjust to environmental conditions, that is, either they do not bring forth the relevant sensorimotor schemes or the environmental constraints do not provide the possibility of enacting what would be a favorable sensorimotor scheme. The interactions between sensorimotor agents and the environment have an embodied and situated normativity that is not cashed out in terms of accuracy conditions (representations) but as responsiveness to success conditions required for a sensorimotor agent's self-maintenance. The resulting image of know-how is one in which know-how is pervasive in all cognitive performance (see also Myin and van den Herik 2020). Being so, *a deflated notion of mastery as know-how generalizes to other domains of interaction*. Not only is our most basic mode of cognitive engagement practical, all cognitive performance ultimately rests on mastering the relevant know-how. The final section of this chapter analyzes agency in perception as an empirical hypothesis. It is shown that much of the empirical evidence is equally compatible with the weaker claim that asserts an *instrumentality of agency* (see also Figure 2 in Hurley 2001); the capacity to act, i.e., self-generated movement, would be the way by which we access sensorimotor invariants that in principle could be accessed by being moved or by staying still while the environment changes. Exercising motor agency, i.e., moving around, would be the way by which we detect environmental invariants that in principle it could be possible to detect in other ways. What a review of the empirical literature shows is that perceptual learning might be crucial for studies trying to assess the role of agency in

34 In philosophy in general, but especially in a RTM framework, the question is usually framed as an inquiry into the nature of intentionality, a framing not used here.

perception. Using the enactive theory of perceptual learning, one route of empirical investigation is proposed.

3.2 EA's sensorimotor theory

Enactive concepts like autonomy and adaptivity can provide a naturalization of normativity based on specific modes of self-organization. In this section, I explore the idea of an *autonomous sensorimotor agent* (Barandiaran 2017) and its *sensorimotor life.* The main focus will be the book *Sensorimotor Life: An Enactive Proposal* by Ezequiel Di Paolo, Thomas Buhrmann, and Xabier Barandiaran (2017), where EA's sensorimotor theory is shown in greater detail. The expression "sensorimotor life" refers mainly to what in chapter 1 was labeled as the cycle or domain of interaction of sensorimotor coupling between organism and environment. The life lived when engaging in our activities, or as Di Paolo et al (2017) puts it: 'the ongoing bustle of animate embodied being' (p.4)[35]. Sensorimotor approaches in general claim that the content and form (what is perceived and how) of perception are constituted by the know-how of those sensorimotor regularities. The term 'sensorimotor contingencies' (SMCs) seem to unproblematically refer to the regularities in the sensorimotor field: predictable or lawful-like co-variations of sensory stimulation, neural, and motor activity (Buhrmann, Di Paolo, and Barandiaran 2013). But without proper qualification, SMCs are ambiguous due to differences in the role of the agent's actual doing in the formation of a sensorimotor pattern. They can refer to all the possible sensory and motor coordination of a given environment relative to a sensorimotor apparatus. The notion also points to specific sets of patterns in the conceptual space of sensorimotor configurations. SMCs can also refer to the co-variations that arise in actual behavior or self-generated activity, analyzed according to context, levels of skill and timescale of interest. In *Sensorimotor Life*, four interrelated notions of SMCs are brought forward: sensorimotor environments, sensorimotor habitats, sensorimotor coordination and sensorimotor schemes.

35 Our life is not reducible to sensorimotor activities. Due to the fact that we are highly social animals, even the simplest action-perception loop possible is embedded in a cultural world, it has history and it is constrained by social or intersubjective normativity (more on that when discussing sensorimotor agency and the metaphor of agents as Gaia of habits). It is also true that humans are material, dynamic, self-organizing structures that constantly fluctuate between metastable states in a constant condition of precariousness. Phenomena in one domain are constrained by phenomena in the other domains without being fully determined by them. Each domain has its own dynamics, allowing quasi-independent inquiry.

The most general notion of SMC is the notion of *sensorimotor environment*, it refers to the open-loop system formed by the sensorimotor contingencies that depend only on the sensorimotor apparatus of the agent and the structures of their environment. Those lawful relations are independent of how the agent movements originated or how they combine with other movements. The sensorimotor environment is shared by all agents with sufficiently similar bodies in sufficiently similar environments. The scale that includes most of the more general perceptual properties, like smoothness and voluminousness. It is the less temporarily sensitive conceptual level of analysis (it does not take into account the agent's actual movements). The *sensorimotor habitat* is where one can identify the actual patterns and trajectories enacted, distinguishing attractors and metastable regions of a "sensorimotor space of possibilities". It is important to notice that the environment puts some constraints on the habitat, but does not fully determinate it: 'The walls of the room constrain the possible behaviors but cannot determine whether the person will sit in meditation, lie down, or do exercise' (Di Paolo 2017, 55). Another important distinction between sensorimotor environment and habitat is the explanatory status of sensorimotor dependencies. The environment has a more general role as it puts general constraints on explanations. But the habitat is more informative, it informs how the movements of the agent originate and combine with other movements as a function of its internal states. But a detailed recording of movements still does not inform what the system is doing. By introducing goals one can see which patterns are crucial for their achievement. The reliable sensorimotor patterns that allow the performance of a task are referred to as *sensorimotor coordinations*. To identify sensorimotor coordinations one has to look at an agent within the context of specific actions and perceptions. Not every pattern found in the habitat is necessarily an instance of sensorimotor coordination for a particular task, some might have no goal associated with it. More than achieving a goal, one can look at how an agent achieves their goals in reference to some normative and adaptive standards. Is the task performed efficiently or not? What is the bare minimum of skill that the agent must acquire to achieve the goal in question? Notions such as knowledge, understanding, or skillful mastery of sensorimotor contingencies (see O'Regan and Noë 2001) indicate an evaluative dimension. Be it fitness, optimality, or any other normative framework, the different sensorimotor coordination patterns required to perform a task can be grouped accordingly. Even if distinct combinations of patterns may be efficient, some will be better than others under a relative normative framework. *Sensorimotor*

scheme is the notion that ‘describes an organization of SM coordination patterns that is regularly used by the agent because it has been evaluated as preferable (along some relevant normative framework) for achieving a particular goal’ (Di Paolo et al 2017, 58). In open-ended agents like us, the schemes formed by sensorimotor coordination are not stable in a static sense, but are metastable, meaning that schemes exist in a tension between modifying ever so to the concrete situation or changing into new schemes to better adapt to it. There are several ways to peel an onion, literally and metaphorically speaking. The *preferable* enacted sensorimotor coordinations are going to be a subset grouped according to the perspective’s relative normative frameworks. That is also why sensorimotor schemes are more personal and have a higher degree of variability between agents. It is in this level of description that a sensorimotor individual *style* emerges.

The idea of a theory of perception as perceptual learning becomes more precise with those characterizations. From a developmental perspective, the agent selects, acquires and sometimes creates sensorimotor coordinations to be better attuned to specific situations. The disambiguated notion of SMC is centered on the specific agent and their history. Sensorimotor schemes are *evaluated* organizations of sensorimotor coordinations. And since it is the organization of sensorimotor coordinations, it supposes a task or goal, a sensorimotor habit and a sensorimotor environment for a full dynamical description, that might not always be available. The four notions of SMC laid down a path that goes from more abstract and disengaged to more concrete and personal descriptions of our sensorimotor life. If one is thinking of SMCs only in terms of general features of the agent’s body and of the environment, without taking into account the agent’s internal dynamics, one is thinking about the sensorimotor environment. In taking the internal activity into account one arrives at a set of possible sensorimotor trajectories, the sensorimotor habitat. In this set of possible sensorimotor trajectories, there are individual trajectories that reliably contribute to the achievement of a goal, those individual trajectories are sensorimotor coordinations. Organizations of these sensorimotor coordination patterns are developed, selected or acquired as a result of being normatively evaluated, those organizations are the sensorimotor schemes of the agent (see also Di Paolo et al 2017, 59, Table 3.1). Now that one has a good grasp on what are sensorimotor contingencies, it is possible to understand what it means to master them. To perceive and act successfully is an open-ended process of development of capabilities that enable the agent to have relative control over their own circumstances. Both

the agent and the environment change as the agent engages with their environment trying to maintain or increase their attunement with it. The EA uses an anti-representational interpretation of Piaget's equilibration theory (2007; 1971), where mastery (in this context of perceptual learning) is the ongoing process of equilibration, of assimilating or accommodating sensorimotor schemes into our sensorimotor life. Assimilation and accommodation are the two processes of adaptation through which agents coupled with their environment in challenging situations assume a trajectory back to a (meta)stable situation. Di Paolo et al (2017) use Piaget's famous example of a baby assimilating the nipple of the person breastfeeding them into a suckling scheme. The behavior might look "innate", but it requires the baby to learn new patterns of sensorimotor organization 'involving a complex patterns of muscular coordination, proprioceptive, tactile, temperature and taste sensory signals' (Di Paolo et al 2017, 84). The baby has to become comfortable with the shape and feel of the breast, for example. Assimilation refers to:

> [...] a process by which an environmental aspect (a perturbation, a new object, or a novel situation, etc.) is integrated, coupled, or absorbed into an existing physiological (metabolic, neuromuscular, etc.) or cognitive/behavioral (sensorimotor, perceptual, and reflective) supporting structure in the agent. This is one way of saying that *the agent and environmental sides of a sensorimotor scheme are in agreement according to the relevant norm*. (ibid, emphasis added)

Learning to perceive is the process of perceptual assimilating the environment according to what has already been assimilated. The patterns of action enacted by the agent are always fine-tuned to variations of the particular situation. This is the process of accommodation of sensorimotor schemes. In accommodation sensorimotor schemes 'are modulated or transformed to facilitate or encompass a not-yet-assimilated aspect of the environment' (Di Paolo et al 2017, 85). The *equilibration* of sensorimotor schemes is the process in which a new form of stability is reached. Sensorimotor agents in general would strive for *maximal equilibration*:

> When the equilibration process is such that the sensorimotor organization readily assimilates most of the potential obstacles and lacunae for a given class of situations, we say that the agent has achieved *maximal equilibration*. In other words, maximal equilibration is that (sometimes unattainable) state where the enactment of sensorimotor schemes requires no further accommodation to a class of situations. (Di Paolo et al 2017, 87)

Schemes also equilibrate between themselves, in the sense that they form complex network relations filled with synergies and dissonances. Let's go back to the example of the baby suckling scheme. The suckling scheme involves not only suckling but swallowing the milk while breathing air. Both swallowing and breathing have their own relevant sensory and motor characteristics, the flavor of the milk, movements of the tongue and the operation of the muscles of the respiratory system. Those are more or less affected by different aspects of the environment. For example, if the nose is pressed onto the breast (part of the environment in this picture), it is harder to breathe. The baby that *constantly* chokes did not assimilate the scheme significantly. If the baby assimilated the suckling scheme, the *transition* between actual suckling, swallowing, and breathing is *stable*. Those are the two conditions for assimilation, stability and transition conditions. Obviously, a sensorimotor scheme can have a considerable number of coordination patterns. The baby's suckling is a relatively simple example, but complex enough to explore the dynamical interpretation of Piaget's theory.

Every time the baby eats there is a novel enactment of the scheme, and in that things can go wrong in various ways. But there are two general types of ways that matter to us here, violations of the stability condition and violations of the transition condition. Violations of both types can occur by virtue of both internal and environmental processes. Violations of the stability condition are cases in which the relevant sensorimotor engagement fails to occur reliably. Cases such as this lead to new unexpected trajectories, and the 'agent experiences this as an *obstacle*; something in the relation between environmental variables and the enacted sensorimotor coordination has failed where in the past it used to work' (Di Paolo et al 2017, 94). The case of a sleepy baby unsuccessfully trying to eat would be described as an obstacle to the enactment of the scheme (they could choke and sometimes miss the nipple), as well as the more literal case in which an obstacle (like a piece of clothing) stands in front of the breast. Circumstances that lead to breakdowns in the enactment of a sensorimotor scheme by affecting the stability condition are called obstacles. Another way in which things can go wrong is in the transition between coordination patterns. Unexpectedly something different occurs, handling the situation in the way that worked in the past does not lead to the next relevant stage in the enactment. Using Piaget's lexicon, this is a *lacuna*. One example would be the baby engaging in the suckling scheme when their breastfeeder, for some unknown medical condition, cannot produce milk anymore. The suckling coordination pattern in this case is not going to result in the swallowing pattern. The exact origin of the disruption does

not need to be known or felt (and usually it is not). In experience the breakdown appears as a lack of control or a loss of the "sense of agency" over the previous stable sensorimotor coupling: 'The terms obstacle and lacuna are used here for their effects on action and perception, not to indicate their proximal causes, which are not immediately perceivable.' (Di Paolo et al 2017, 94).

How does the agent deal with obstacles and lacunas? Unless the environment is the cause of the problem and fortuitously changes back to the reliable previous state, successfully overcoming the breakdowns implies changes in the structures of the agent or changes in the environment brought forward by the agent. To describe those changes one must pay attention to *plasticity*, i.e, the degrees of flexibility to actual contexts present in enabling structures. In physics and engineering, plasticity usually refers to the propensity of solid materials to undergo permanent deformation under the application of a force. One straight metal bar bending to form a 90-degree angle and staying that way is one example. The idea of plasticity usually includes the notion of semi-permanent transformation that remains stable across space and time. There are also other forms of plasticity. Phenotypic plasticity, for instance, refers to the characteristic of the genotypes-environment system of expressing different phenotypes in response to detectable and recurring changes. The same genes, coupled with different developmental environments (from biochemical characteristics of the "egg" to the actual temperature of the external environment) can result in different organs and behaviors. Sensorimotor organizations also exhibit degrees of plasticity. In breakdown (violations of stability or transitionality) plastic changes in the agent or the environment are brought forward in an effort to re-establish a scheme. It can be a gain of muscle mass, changes in neurodynamics or a reliable and intentional change in the environmental circumstances, such as the aid of new tools or other agents. The baby's transition from nipple to bottle is an example of a new environmental pattern that demands accommodation. There are notable and measurable differences, both in tactile feedback and in having to hold the bottle. But after an adaptation period, the new demand is assimilated, even creating a new and similar scheme relating to bottle feeding. Adaptations can be brief and without much effort or long and strenuous (as going from a sedentary lifestyle to running a marathon).

In the process of accommodation new parameters drive the agent-system in new trajectories until re-equilibration is achieved. Accommodation can take more or less time, and it can be

more or less effortful. Equilibration is thus going to be understood as an ongoing and potentially open-ended process where different parameters change the sensorimotor organization of the scheme. The directionality of the process is provided by a tendency to the maximization of robustness against violations of transition and stability conditions resulting from internal tensions or environmental perturbations (maximal equilibration). Sensorimotor agents are always attuning themselves to the environment. One crucial characteristic of the model is that open-ended accommodations, i.e., accommodation to new and completely unexpected breakdowns, if they occur, always involve an element of randomness (Di Paolo et al 2017:97). There is no deterministic accommodating strategy that an agent can employ every time there is a problem in the sensorimotor engagement of a scheme, that would mean that the so-called "disruption" was assimilated all-along. The randomness can lead the agent to further sequences of accommodation steps 'learning the new but also re-learning the old' (Di Paolo et al 2017, 98). In complex adaptive sensorimotor systems, a change in parameters alters not only one sensorimotor scheme, given that the same sensorimotor coordination can integrate a multiplicity of schemes. Small changes can be big changes over time. Let's stay in early life development and pay attention once again to the visual changes of a toddler when they learn how to walk. There is a very impressive body of empirical work on infant sensorimotor development (the transition from crawling to walking) by Karen E. Adolph and collaborators (Adolph, Vereijken, and Denny 1998; Karasik, Tamis-LeMonda, and Adolph 2011; Kretch and Adolph 2013; Kretch, Franchak, and Adolph 2014; Hoch, Rachwani, and Adolph 2020). Kretch et al (2014), using a head-mounted eye tracker that recorded gaze direction and head-centered the field of view, show the differences in field of vision of 13 months old crawlers and walkers. In the study, thirty children walked or crawled in a straight path using the equipment. The differences in their visual fields were analyzed[36]. The study concluded that visual experiences are intimately tied to infants' postures. Crawlers' field of vision contained fewer walls and more floor when compared to walkers. Walkers' direct gaze was on their caregivers (at the end of the straight path), while the crawlers gaze at the floor. To look at higher elevations (at caregivers and toys) crawlers had to crane their heads upward and many times they adopt a sitting up strategy to bring the full room into view, a room much more readily available to the walkers. The visual world of the infant, when they go from

36 Additionally, thirteen children wore a motion capture device that recorded only head orientation.

crawlers to walkers, opens up exponentially as a result of a change not associated with vision more straightforwardly. The infant's horizons expand.

The relation between posture and the visual field also helps us understand why it is so widespread and a marker of "normal development" that infants go from high-skilled crawlers to low-skilled walkers. Novice walkers don't have it easy, they are slower and less-skilled than expert crawlers. They have to learn new ways of interacting with the environment and re-learn how to perceive some features of the environment that were mastered as crawlers. One example is re-learning to specify if something is a step or a cliff/drop off (Adolph and Tamis-LeMonda 2014). That is one of the reasons why (initially) the infants adopt a hybrid strategy, they sometimes walk and sometimes crawl. Equilibration here is adopting the walking scheme more and more, but this process takes time and does not happen in isolation. It is a change that changes everything. One of the stronger hypotheses of what entrains this developmental transition from crawling to walking is the easier visual availability of the caregiver's faces. The behavior is connected to another aspect of our being, our intersubjectivity. In agreement with what was said in the introduction, everything is connected with everything: 'In other words, equilibration not only involves adaptation of individual sensorimotor schemes but also the re-equilibration of the sensorimotor repertoire as a whole.' (Di Paolo et al 2017, 103). Accommodation towards equilibration does not necessarily mean a return to an old cycle, but oftentimes involves transformation and reorganization of multiple schemes and their relations with each other, sometimes generating new schemes. Now I can summarize what sensorimotor contingencies are and what it means to master them. Simple task-oriented sensorimotor loops are organized under different situated normativities into schemes. Each encounter with an environmental situation in which the schemes worked in the past is different, both the environment and the agent change in those encounters. This ongoing interplay makes that '*previously established know-how is adapted to a new context or new patterns of interaction are generated and integrated with an already existing set of sensorimotor schemes.*' (Di Paolo et al 2017, 103, italics added). There is an ever-growing space of possibilities that cannot be determined prior to the actual implementation of the system. For us, sensorimotor agents with higher degrees of plasticity in constant becoming, the exact full set of sensorimotor coordinations that might emerge to solve our tasks cannot be known ahead of time.

The notion of mastery is usually formulated as a kind of knowledge (see Hutto 2005), and there is this long tradition of seeing knowledge of any kind in internalistic terms. it becomes easy to fall into an interpretation of mastery as something just *in-the-head*. An in-the-head interpretation of mastery treats it as a set of states in the 'agent's functional architecture' (Di Paolo 2014, 1). The interpretations that fall in this category don't necessarily limit the states to the skull of the agents, but mastery is something internal, where the environment has only a supportive role. The interpretation is the one that is most likely to be adopted by theorists that have a very internalistic view of mental phenomena; such a view inevitably includes epistemic states. One example of an in-the-head view is Seth's (2014) interpretation of the notion of mastery in terms of the creation of predictive generative models in the agent's head. EA adopts a *not-just-in-the-head* interpretation where forms of embodied know-how are what account for mastery. But to be truly not-just-in-the-head, know-how must be understood as not reducible to propositional knowledge and be context-dependent (more on that in section 3.3). What accounts for mastery are sets of sensibilities and capabilities that are not only context-dependent, but also precarious (if not enacted with sufficient frequency, the tendency is for the capability to degrade and disappear). At no point does the agent in this account have to model the world or their body, update prediction error Bayesian models, or create any sort of represented construct. The notion of representation has an abundance of meanings, so the enactive view of mastery might be compatible with some, but does not need to subscribe to one. The concept of mastery put forward relies on engagements with the world, be it actually enacted engagements or potential ones, it is a notion that 'involves as much the agent as the world as sources both of metastability and of novelty' (Di Paolo et al 2017, 108). Therefore, aspects of the environment in the dynamical coupling between agent and environment can become constitutive of any number of sensorimotor schemes, and this strong dependency can happen at synchronic and diachronic scales. Dynamical coupling with the word towards sensorimotor equilibration proposes an image of (sensorimotor) adaptation as the personal construction of "behavioral niches", i.e., personal sensorimotor styles tied to the agent's history (development) and prehistory (evolution and cumulative culture), but not fully determined by either of them.

The image of a tree of sensorimotor life is a good way to visualize the open-ended progression of worldly sensorimotor adaptation. Similar to the evolution of life in our biosphere, both the evolution of living beings and our sensorimotor lives are profoundly non-

ergodic[37]. In sensorimotor equilibration, the world and our relation to it provide an open-ended set of possibilities of sensorimotor loops that converge and branch out in different directions, forming the different sets of schemes and repertories of a person's life (the amateur chef, the cyclist, the anime watcher). There are even mechanisms of selection between sensorimotor schemes that shape a specific behavioral niche. One of the empirical agendas that opens up with this approach is identifying such mechanisms. One can also understand the flexibility of behavior as analogous to biodiversity, and maybe that analogy, at first glance absurd, can help us better understand research in positive psychology that shows that the inflexibility of behavior is higher in people that experience lifetime depressive and anxiety disorders, as well as lifetime history of eating disorders and substance abuse (M. E. Levin et al. 2014). Perhaps diversity generates more stable systems, in life and sensorimotor life. In all that was said it was implicit that *someone* was evaluating sensorimotor coordinations under different normative frameworks and that the same *someone* was in the process of equilibration with environmental structures. But who are they? It is also not a good option to just assume agency as a primitive psychological concept, leaving it without explanation of some kind. It seems to be a move that goes against even the more permissive and deflationary form of naturalism. In chapter 2 I have shown how the metabolic, biochemical self-individuation of living systems is already a display of agency. What started to be proposed was that the ontology of a cognitive system is intertwined with its behavior, the individuation of the systems (what it is) is co-defined with some of its processes (what it does). The proposal might have sounded mysterious or even preposterous at first. But it becomes less ludicrous when attending to the dynamical process in which the organism differentiates itself from the environment and takes that to be a model of a cognitive system. But what are the processes that individuate an agent in the sensorimotor domain of interaction? What is this agent if not

37 Ergodic systems are systems in which all possible states are visited at some point (or could be at some point actual states of the system). Ergodic systems have no sense of history outside of the passage of time, they have no relevant "historicity". On the other hand, non-ergodic systems visit only a fraction of their possible states. To understand those systems in more detail it is necessary to inquire *how* and *why* only a tiny subset of the possible states of that system became actual states. The system's history and historicity matters greatly. The universe will not create all possible forms of life and an agent is not going to assimilate all the available possible sensorimotor schemes throughout their life; to understand both one needs to look at the actual trajectories that take place. There are, of course, several differences. One important divergent aspect between the tree of life and the tree of sensorimotor life is that the different sets of sensorimotor schemes form a coherent agent, contrary to the not coherent whole formed by the forms of life of the biosphere (I'm not subscribing to the Gaia hypothesis here). The analogy is a conscious deformation, i.e, an exaggerated representation of one aspect of the target phenomenon. Therefore, it represents only one aspect of sensorimotor life, namely, their non-ergodic and historically rich dimension.

the organism of biological individuation? The answer to both questions revolves around the *acts* themselves:

> It is acts— the acts of an agent— that constitute and reassert a new kind of agency, one that is enabled and constrained, but ultimately underdetermined, by biology. It is literally a case of explaining who you are by referring to what you do, and explaining what you do by referring to who you are. (Di Paolo et al 2017, 142)

In the domain of sensorimotor interaction, sensorimotor schemes can become self-sustaining, forming habits. Our sensorimotor schemes also organize themselves in complex networks, those networks develop and change. In this process, some sensorimotor schemes are left behind and some emerge in response to novelties. In this complex history of interaction networks of sensorimotor schemes can achieve operational closure, i.e., can become autonomous in the technical sense. The authors of *Sensorimotor Life* write of "ontological dizziness" coming with sensorimotor agency. According to the enactive approach, sensorimotor beings are all multiple adaptive, precarious, self-sustaining networks of interactive processes involving the environment, the nervous system and the rest of the body. In a sense, we are a sensorimotor Gaia of habits. Habits are a promising psychological notion for theories that aim to connect the personal level with other levels such as neural-activity and historical context. But the notion has a complicated recent history, it was in scientific decline in the latter half of the twentieth century as the result of the dawn of cognitive science in the mid-1950s (Barandiaran and Di Paolo 2014). Habits were deemed disposable in the computationalism framework, the information processing of mental representations could do all the explanatory work required. However, the tie seems to be turning, in the 21st-century habits are once again becoming of interest (Barandiaran and Di Paolo 2014).

But the inherited conception of habit is meek at best. Habits are commonly characterized as 'rigid patterns of behavior that are automatically activated by context cues to which they have become mentally associated as a result of having been frequently repeated in the past in a stable context' (Ramírez-Vizcaya and Froese 2019, 2). Habits in this received view contrast with behaviors that are conscious, deliberated, flexible, effortful and intentional. The supposed rigidity of habits even has led some to say they are mindless (see Segundo-Ortin and Heras-Escribano 2021 for a discussion). This view of habit has roots older than behaviorism. Barandiarian and Di Paolo (2014) write of associationist tradition (associationism) that dates as far back as Descartes. This tradition 'conceives of habits

atomistically as units that result from the association of ideas or between stimulus and response' (Barandiaran and Di Paolo 2014, 6). As the emphasis in previous sections on plasticity and situated normativities attributed to sensorimotor schemes suggests, EA does not agree with associationism. Historically, parallel to the associationist trend one finds the development of one organicist trend containing the already mentioned figures of John Dewey, J. J. Gibson, Merleau-Ponty and Piaget (and many others, going as far back as Aristotle). Generally speaking, habits for the organicist are not the passive result of the reliable occurrence of pre-established structured patterns (stimulus or rewards). Habits are cause and effect of their own enactment, they relate to how the organism is thriving (and not only surviving) in the place *in-habit* by it. Organicism proposes a view of habits where "habit" refers to a 'minimal self-maintaining sensorimotor entity' (Di Paolo et al 2017, 143) connected to many others. In a sense, the proposal is a return to William James' idea that 'animals are bundles of habit' (James 1890, 104). The difference is that EA substitutes the "animals" in James' statement with "sensorimotor agents". But then, what are habits? Habits are self-sustaining and precarious sensorimotor schemes. Let's unpack that. The notion of precarious self-organizing or self-maintaining systems was already introduced in chapter 2. The core novel idea being introduced is that self-maintaining patterns of behavior share key organizational properties with the self-maintaining metabolic chemistry and overall self-producing processes of living systems. Instead of relying on external energy-matter gradients for maintaining a network of far-from-equilibrium chemical reactions (metabolism broadly constructed), habits rely on the structures enabling sensorimotor contingencies. Therefore, the notion of self-sustaining precariousness highlights the support structures that enable the exercise of the scheme (muscles, neural networks in the brain, physical structures of the environment, tools, other agents). The living has a very strong dependency upon the energy and matter flow of the environmental interactions and habits an analogous relation to a sensorimotor flow, a constitutive relation to the interactional dynamics of sensing and acting. In a habitual scheme, the reliable structures for their enactment are stable enough for metastability. Similar to the life case, an extreme openness and extreme closeness to the relative environmental flow leads to the degradation of that entity: ''if the habitual scheme is not enacted with sufficient frequency, the structures supporting it start to lose the properties that enable it. Eventually, the capability to enact the scheme degrades and disappears' (Di Paolo et al 2017, 144). Our habits are carved in us, they generate metastable changes in

structure. However, it is possible to grow out of habits by not enacting them, be it by making deliberate choices or by lacking the support structures. EA does not deny that different supporting structures can be transformed in irreversible ways, both in the environment and in the agent (one can lose limbs and have permanent brain injuries). Those changes can predispose repetitions of a certain behavior while preventing the repetition of others. Schemes are organizations of many coordinations of task-oriented sensorimotor loops, what those major changes would do is change the sensorimotor habitat of the agent, still leaving a variability of possible coordinations organizeble in different schemes. The precariousness schemes that become habits are also key to understanding their individuation (identity) and normativity. Habits are recursively individuated, their reenactment reinforces their support structures (the longer I keep running at the park the more I adjust to it, including how my sneakers mold into my feet). When positioned in the viability boundary of a specific habit, that puts the agent in a readiness-to-enact that habit as the more reinforced or sedimented are the structures. That is what authorizes us to say that habits form a closed pattern of recurrence, a form of closure that gives habits a "life of their own". It is this recurrent, metastable, sensorimotor pattern that (in virtue of being recurrent and metastable) acquires a kind of closure, operational closure, i.e., habits become autonomous relative to other habits (but as we will soon see, only a network of interrelated habits can acquire this type of closure). Their norms, as in the case of vital norms, are norms related to the continuous self-maintenance within the boundaries of that habit's own viability. Egbert and Barandiaran (2014) provide a formal-computational model of the process of formation and individuation of habits. In their study, the "deformation" of a "sensorimotor medium" was measured. The sensorimotor trajectories of a simulated robot induced plastic changes in a "sensorimotor medium" that made the probability of some trajectories being executed in that medium increase. An analogous concrete case is a path that is created in a grass field as people start to repeatedly walk on it, the more people walk in that path the less grass grows, and with time and recurrence, the path becomes more and more suitable for walking. The robot of this experiment moves in a simulated space, much like the field of grass, the space deforms as it moves around. The relevant difference is that any possible sensorimotor pattern measurably deforms the medium ("looking to the left" would deform that space). The technical result that matters most to us is that the robot coupled with the environment progressively generates self-maintaining metastable sensorimotor close-loop patterns (individuated patterns of behavior

analogous to our characterization of habits). The coupled robot also exhibits different levels of organization and formation of habits, some more and others less stable, some organizing in hierarchical structures. Another feature of the model that has significance is that those self-maintaining metastable patterns emerge in a context of *simulated precariousness*, i.e., the deformable medium gradually returns to a default state, which makes existing patterns fade away if not revisited frequently. Habits are self-reinforcing and their normativity comes from their fragile self-reinforcing existence. However, fragility or precariousness is a gradient. The sedimentation of habits can lead to a growth of the timescale required for self-sustaining them. Remember the case of people with alcohol addiction, they often say that they are "recovering addicts" and never "recovered addicts" to emphasize that the predisposition to engage in that behavior is still there after many years of abstinence. One can think of the gradation in precariousness and metastability in habituation as having an upper and lower limit. The upper limit is the habit that needs constant reenactment to persist, and the lower limit is the almost automatic "response" to certain conditions that persist until the death of the agent. Both limits are theoretical possibilities, not necessarily the actual reality in the life of each and every agent. Besides, even the less precarious habits are only metastable, henceforth, 'retain a residue of dynamic criticality without which they would simply be unchangeable automatisms' (Di Paolo et al. 2017, 102). The theory does not deny that it is possible to find in some organisms "unchangeable automatisms", such happenings, if present, it would simply not be a habit.

Until now I have been considering habits more or less in isolation, but it is crucial to not forget the "bundles" part of James' statement. There is no self-individuation or self-maintenance for a habit in isolation: 'habits (or schemes) are nested in hierarchical, sequential, and ultimately networked relations in a kind of ecosystem, whereby a given scheme calls for, reinforces, inhibits, or subsumes others' (Di Paolo et al 2017, 147). Once more one goes back to an analogy with the biosphere, now enriching it with an analogy to its different ecosystems. There is an *ecology of habit* in sensorimotor life. The agent is a meshwork of habits organized by different *activities* or *behavior genres*, from playing soccer as a kid to their current activities of cooking, running in the park, cleaning the house and paying the bills on time. Even at the scale of the most simple activities, like grabbing a mug and drinking coffee, habits are already organized in micro-networks. The different ecologies of habits have different complex relations of codependency; habits are never alone. The

realization that habits are always organized in a sensorimotor ecology adds another layer to considerations about normativity. As seen with the mastering of sensorimotor schemes, in the equilibration process the schemes themselves enter in a form of equilibration that results in sets or clusters of schemes that can be formed by other clusters (nested). In a nutshell, habits are interconnected in terms of time progression (they usually happen in sequential or parallel relation with other habits), hierarchical organization and structural dependencies (frequent exercise of other schemes are fundamental to their enactment). For example, the infant's suckling scheme involves not only suckling, but swallowing the milk while breathing air. In the stable transition where the infant's suckling the nipple leads to swallowing while breathing leads back to suckling, there is a clear interconnectedness of schemes. The habituated processes of human becoming only increase the interconnectedness of habits. It is because of the interconnectedness that most of the normativity of a given sensorimotor scheme might not be the result of its own precariousness, but originates from the relations it has with other schemes in the cluster. It is at this scale of the network of habits that the authors discussed agency in the more technical sense explored in chapter 2. To account for agency at the sensorimotor domain they show that networks of interrelated habits (sensorimotor schemes) satisfy the three conditions of agency: individuation, asymmetry and normativity (Barandiaran, Di Paolo, and Rohde 2009; see also chapter 2).

The sensorimotor networks of interrelated habits' individuation extend beyond the biological individual. Different from the model case of the living cell, there is no straightforwardly identifiable physical boundary (the membrane) to point to. Also, one cannot simply point at the organism's body, sensorimotor schemes are constitutively made up of support structures from both agent and environment. The nervous system, for example, is perhaps the more important support structure in terms of plasticity, but this system is part of networks that equally depend on the rest of the body and the environment. How can then the network be individuated? Similar to the case of biological individuation, an environment is always defined relative to a system. Self-sustaining networks bring forth their own domain of interaction, agency operates for the continuous adaptive self-production of that identity. Moreover, it is by doing that occurs the self-individuation of being. The sensorimotor agent's environment is therefore the aspects of the world relevant to the web of sensorimotor schemes. The steps in a stair are part of the agent's sensorimotor environment while the microorganisms they are breathing are not. It is not that they cannot become part of the

sensorimotor world. If the agent gets sick due to breathing a pathogen, hindering the support structures of a lot of their habits. The loss of sense of smell and loss of lung capacity in cured covid-19 patients is an example that comes to mind. Therefore, it is not only a physical structure or only systems in the organism that form the self-individuating sensorimotor agent, it is features of both the environment and the agent that interfere, influence, enable or constrain the agent's actions.

Normativity is a topic more directly explored throughout section 3.2. Networks of interrelated sensorimotor schemes are self-reinforcing and their normativity comes from their precariousness. The recurrence and self-producing character of networks of interrelated sensorimotor schemes create their own viability conditions (a normative space) to which the agent is sensitive. The conditions under which the different coordination patterns cohere into a sensorimotor scheme are the *sensorimotor norms* of that scheme. Another normative consideration is that the global coherence constraint on the formation of sensorimotor schemes makes the re-equilibration of sensorimotor schemes hinge on the re-equilibration of repertoires as a whole. In their self-maintenance through action, all of the agent's actions ripple. When performing an action, normative ramifications follow. Moreover, clusters of activities can combine and recombine in very different organizations. In playing hide and seek a child can go from running to climbing a tree to standing perfectly still on the branches in an uncomfortable position. The primary goal that centers the activity is avoiding being found, pursuing it can mobilize different sensorimotor schemes, in combinations that can be both novel and occur only once. In this combination and recombination of schemes, the agents found themselves in new situated normativities. Another source of normativity is the feel of the action itself. As was said early, sensorimotor schemes are evaluated organizations of sensorimotor coordination. The evaluation can be wholly affective and does not need to involve explicit evaluative judgments. In fact, giving the anti-intellectualism of EA a precondition for the latter is the former. The different normative dimensions (efficiency, robustness, dexterity) and frameworks from which an action can be evaluated (the rules of a sport, a self-imposed desire for the perfect performance of a dance choreography) can also be understood in the context of those combinations and recombinations of schemes and the feel of action. The self-individuating system that displays agency is able to modulate their coupling with the environment, it resists some of the tendencies and pressures of their milieu while initiating some trajectories of the interaction. That is what the asymmetrical interaction

condition of agency states. But how does this happen in the sensorimotor domain? The environment here consists of all the aspects outside of the network of schemes that enable but also can be disruptive or destabilize those networks. In the domain of sensorimotor interaction asymmetrical and adaptive regulation ‘is the network’s ability to be sensitive to and to counteract such perturbations and seek opportunities that help reassert the agent’s sensorimotor individuation’ (Di Paolo et al 2017, 157). A display of those types of sensibilities can be identified in situations of almost breakdown, where the agent slightly adjusts their actions for successful behavior. In volleyball, for example, the outside hitter or left-side hitter is the lead attacker in the offensive. To be a successful outsider hitter, they must be able to jump high, be quick, and be ready to adapt to different situations, the ball won’t always be placed where they would like, so they need to be prepared for hits from a variety of places. Another way in which the sensorimotor agent is adaptively and asymmetrically coupled is by shaping the environment to facilitate their activities. Experienced bartenders, for example, will put the glass of each drink in a line as soon as ordered. Apparently, this is one of the first things you learn at bartender school. They do that so they can make several drinks more or less at the same time and deliver them in the correct order. There is no need to remember who ordered what and in which order, the line of glasses does the job. Professional chefs often stress the importance of an organized kitchen for their efficient cooking.

Notions like sensorimotor agents, environments and behavior genres echo similar ideas proposed by Francisco Varela (1992a; 1999): the notions of a “microworld” and “micro-identity”. The microworlds are inhabited by microidentities and an agent is not a thing or substantial self. The agent is the transient path (shifts of attention) between microidentities in different microworlds. More recently a similar idea was proposed as a “topology of regional identities" (Di Paolo 2009). To summarize the view: in concrete agents, there is no monolithic identity that remains the same independently of the activities performed. Humans are meshworks of sensorimotor schemes. But that does not mean that a new agent arises each time an activity is performed. Rather, each network of habits has metastability. In ongoing sensorimotor interaction, metastability leads to a metastable integration between the networks. Stable integration gives rise to the sensorimotor agent. But such an agent is open-ended, always changing. There are metastable unities formed by networks of habits closely related to each other by activities (networks related to feeding, the ones related to locomotion, those

related to interacting with others); they achieve and maintain global coherence as an agent. In *Sensorimotor Life* they use the metaphor "ecology of habits", the analogy with the biosphere (the Gaia of habits) is my own description. The boundaries between regional identities are extremely fuzzy, where one ends and another one begins is messy. The larger unity, like the cell and the agent in the organismic domain, is constantly becoming. It is an organizational unity, a unity characterized by constant change and adaptive transition between configurations of structures. The Gaia of habits metaphor might seem at odds with Varela's microidentities and microworlds, but it is not. Varela (1999) focuses on the unity of the agent at the level of the subjective experience 'I'. Behaviorally we might accept that we are selfless selves: 'a collection of competing behaviors' (ibid, 60). But we do not experience ourselves as such. Varela's account of the feeling of oneself as an 'I' links it to the social phenomena of language:

> What we call "I" can be analyzed arising out of our recursive linguistic abilities and their unique capacity for self-description and narration. [...] Our sense of a personal "I" can be construed as an ongoing interpretative *narrative* of some aspects of the parallel activities in our daily life, whence the constant shifts in forms of attention of our microidentities.
>
> [...] the selfless "I" is a bridge between the corporeal body which is common to all beings with nervous systems and the social dynamics in which humans live. My "I" is neither private nor public alone, but partakes of both. (Varela 1999, 61–62).

I agree with the claim that the particular unity we experience as human agents comes from the fact that our sociality and becoming are organized linguistically. Our subject experience of self depends on our narrative practices, on the fact that we engage in dialogues about how, what and why we do what we do. The deep connections between sociality and language are explored in the next chapter. For now, I'm only going to highlight the fact that experience is not epiphenomenal in the present approach. The 'I' organizes and reframes activities, therefore, organizes and reframes sensorimotor schemes. The next chapters offer more details on how sociolinguistic activity shapes sensorimotor development. Dialogues (including the ones with oneself) progressively shape our development. Our habits develop in a context of social interaction, this context contributes to the unity formed by them.

All the technicality of characterizing sensorimotor agency is crucial to separate simple sensorimotor organizations from proper sensorimotor *agents*. At the beginning of this chapter

I mentioned how all living things act and sense in some capacity. However, not all living things are sensorimotor agents. The classical examples of sense-making like the bacterium *E. coli* already include the display of behavior, since the organism is able to switch between sensorimotor patterns according to metabolic demands. Several living systems display what in the vocabulary introduced would be classified as sensorimotor coordinations organized into schemes. The question now is if these creatures exhibit metastable sensorimotor networks under the three conditions of agency. In many instances what we'll find is that a system's behavior is coupled with organic processes like metabolism and are a display of organismic agency only. Such systems do not live a sensorimotor life permeated by sensorimotor normativity. They enact sensorimotor schemes guided by biological needs, lacking a fully developed sensorimotor life. They are cases of basal cognition tied to biological normativity (normativity based on specific ontogeny and constraints inherent by evolution). What one finds in us is a scale where organized networks of sensorimotor schemes are not fully constrained by strictly biological demands. TEM's original proposal of cognitive structures emerging from sensorimotor patterns can be seen as the progression and transitions of forms of agency displayed by cognitive systems, for basal cognition to all the cognitive complexity found in the psychosphere. Di Paolo et al (2017: 170) sketch a progression in complexity and its relation to agency that goes from the minimal agency of all living things (level 1) to the open sensorimotor agency displayed by beings like us (level 5). The categorization is, of course, provisional and with kinks to be figured out. There are likely to be many gray areas between the levels. Some living systems change so drastically in ontogeny that a worthy hypothesis is that they go from one stage to another in their life cycle (and not necessarily in an upwards trajectory). Besides that, it is presumed that changes in flexibility, plasticity and organization of sensorimotor repertoires, as well as from only vital norms to vital and sensorimotor norms between the levels are simultaneous. And finally, the proposed gradation of agency does not include social agency. In human beings, social agency is the joint coupling of at least two open-ended sensorimotor agents under social norms (more in the next chapter). Are out there other, more stationary, modes of being social? Empirical research in plant coordination, for instance, might reveal the necessity of other distinctions.

3.3 Empirical studies about the role of the agent in perception

I provided a fastidious account of the enactive sensorimotor theory of perception as mastering of sensorimotor contingencies. Focused on perceptual learning, the theory breaks down the concept of SMCs down to four distinct senses: sensorimotor environment, habitat, coordination and scheme. In developmental terms, the sensorimotor agent is a meshwork of networks of habits always open to differentiation and diversity, where habits are the 'metastable relations between organic and environmental processes poised between blind automatism and unpredictable spontaneity' (Di Paolo et al 2017, 177). So far we look at the relation between learning, agency and know-how in perception on more conceptual grounds. In this section the goal is to analyze examples of empirical studies that put the role of agency in perception to the test. I look at human testing in this section. Human testing has the advantage of relying on both perceptual performance and on experience reports. Even if looking at perception through the lens of agency provides a fascinating realm of experimental possibilities, challenges need to be overcome to gather empirical evidence both in favor or against the constitutive role of agency hypothesis. I end the section discussing a possible proxy to agency, perceptual learning.

The study of the active components of perception is not new, there is a rich tradition that dates back to the sixties. Enactivism already discussed some of those studies in greater detail (Hurley 1998; Hurley and Noë 2003; Noë 2004). But several questions remain open, including questions about ecological validity and the success of the experimental setups in isolating the relevant variables (in this case, agency or some proxy). Another difficulty is that the experiments allow two different interpretations of the role of agency: the already mentioned instrumental and constitutive views of agency in perception. In humans we can design experiments around the more or less everyday phenomena of sensory substitution and augmentation (Bach-y-Rita and W. Kercel 2003). Usually the phenomenon is brought up to discuss technology that allows access to some sensory information originally only available by another sensory modality (like the one discussed below). However, a blind person using a cane is a simple case that illustrates the core aspects of the phenomena. The end of the cane is a point of contact that provides a great deal of practical information about an object location and identification. The stimulation of the hand holding the cane, after a learning period, is experienced at the end of the cane rather than in the holding hand. The blind person's felt touch now includes what enters in contact with the end of their cane. There is a new

sensorimotor skill and qualitative changes to experience related to the acquisition and enactment of those skills. Those are the core aspects of the phenomena. The “substitution” consists of changes in the perceptual system (usually the incorporation of a tool or technology) that provides an overall augmentation of the individual's perceptual capabilities. In the blind person use of the cane case one has a “tactile-to-tactile substitution” or a augmentation of the sense of touch: ‘Sensory substitution can occur across sensory systems, such as touch-to-sight, or within a sensory system such as touch-to-touch’ (Bach-y-Rita and W. Kercel 2003, 541). The blind person’s use of a cane is a well known case of the embodied and skillful aspects of perception. It appears in different embodied approaches; it is used by both Merleau-Ponty (1945/2012) and Batson (1972) to question a cartesian view of the mind. The example also highlights that the so-called “sensory substitution” is not necessarily across sensory modalities and is an augmentation or expansion of our experience as much as a substitution. The everyday cases where one feels the conditions of the road through the tires while driving a car or riding a bike are so common that people usually do not describe it as an augmentation of experience, but they are instances of the same phenomena described in the blind person's use of cane for locomotion. Humans incorporate technology into their perception on a regular basis. What is particularly puzzling in the across modalities cases is if and how the new motor skills alter experience. For instance, in sight-to-touch substitution, in which modality the new experience presents itself? Paul Bach-y-Rita and different collaborators throughout the years developed different apparatus that allow blind subjects to detect optical information by converting the inputs from video cameras into an array of electrical pulses transmitted to the torso or tongue. The electrical array is spatially arranged in a way that resembles images in a video monitor, under training the apparatus allows subjects to learn to use the patterns to respond to distal objects as if they were actually seeing it. Subjects can identify shapes of the objects around them, avoid obstacles, and discern when one object overlaps with another. One interesting question is how similar to vision is this new ability? One could say that is just a new form of touch enabled by technology, something similar to proficient use of a cane by a blind person. It would be wrong to think that the sense of touch can only inform us about objects that make direct contact with nerves and skin. As mentioned in the last paragraph, augmentation of touch is something quite common: one can feel by touch the bumpy road while driving a car even though one is not in direct contact with it and feel the heat of a fireplace from across the room on a cold night. Direct touch in a

restricted sense is not necessary for the experience to be tactile in nature (Prinz 2006). But Bach-y-Rita's apparatus enables something quite different. Subjects use it in a way functionally closer to vision. The subject senses the objects around by detecting how light is distributed in the environment, not heat or pressure. In a Gibsonian view of perception, for instance, it could possibly meet the basic threshold of being an instance of pick up of visual ecological information. What would have to be investigated is if the visual information detected matches the conditions required to be considered ecological information. If the experience is similar to visual experience in sighted people, that would be a plus, but even if it is radically different it would still have to be considered visual. The case would be analogous to the phenomena of "facial vision", but the roles reverse, there are no sensations described as visual, but the perception is visual perception. The fact of the matter is that the apparatus enables the learning of new sensorimotor skills and, henceforth, novel forms of engagement with the environment that combine touch as normally experienced and this new recognizable experience made possible by the agent's coupling with an artificial sensory device. If those new learned motor skills result in qualitative changes in experience, the action in perception view of perception becomes more plausible[38]. If the qualitative changes in experience can only be achieved by learning, the results favor an agency framework: perception can develop only by active exploration of the perceptual agent, the acquiring of skills. For the purposes of an agency in perception inquiry is not as important if the qualitative changes are distinctly visual or not, if it is a vision-like-touch or a touch-like-vision. The more important connection is between the qualitative changes and active engagement and learning.

However, creating an experiment setup that contrasts "active" and "passive" perceptual performance is a challenge in itself. Froese and Ortiz-Garin (2020) claim that a good experimental setup ensures that active and passive participants undergo identical sensorimotor loops between sensations and movements. The difference has to be in the fact that only the active participants can freely regulate movement, and for that reason are the ones that in fact enact the sensorimotor patterns in which they are immersed. Because the two groups undergo the same sensorimotor loops, if the active participants improve in the perceptual task, there is strong enough evidence to attribute the improvement to active involvement in the task. Sensory substitution and augmentation research more broadly has aimed at restoring sensory

38 Success in perceptual tasks, the neuroimaging studies of subjects using the devices and their first-person experience reports give some evidence for this claim.

functionality and allowing regulation of behavior by enabling new forms of detecting environmental characteristics previously unavailable to the agent. Deroy and Auvray (2012) in an extensive and careful review of the empirical literature do not think that such regulation of behavior is properly perceptual due to the fact that many reports suggest reasoning, deliberation and other "high-order" strategies for the actual regulation of behavior associated with the use of the devices. They think that a better way of understanding the use of these devices is by taking their use to be analogous to the high-order cognitive ability of reading. According to them, like reading, the use of the devices is not strictly perceptual. It is true that not all cases of employment of those devices would necessarily generate new genuinely perceptual experiences. However, some researchers do claim that the devices can allow the acquisition of novel perceptual experience in certain conditions. What is required is a certain type of integration (like in the case of the use of the cane by a blind person). Schumann and O'Regan (2017) propose a hypothesis of how the technology might become part of the perceptual system of an agent, what they call "contingency-mimetic" sensory augmentation. The first steps for novel perceptual experience would be some training. But it is not the case that any training will do. Deroy and Auvray (2012) review does not find reports of genuinely perceptual experience in the use of sensory substitution devices when training involves only a few hours of learning. But it is also not a matter of only the amount of training. It is not uncommon for users to report engaging in explicit higher-order cognitive skills during the initial learning and continuing to rely on such skills after months or years of using substitution devices. If strategies like counting in the haptic substitution experiment are used in learning, they usually persist. What would be required for proper sensory augmentation by substitution devices is the mimicking of natural characteristics of the interfacing perceptual modality in such a way that their use can be integrated harmoniously onto the sensorimotor flow of the agent. Schumann and O'Regan (2017) developed a device that provide information about the orientation of the head relative to the geomagnetic North by mimicking the sensorimotor contingencies of distal sounds, the same sensorimotor contingencies that indicate a distance sound coming from a particular direction in space. A recording of a pleasant waterfall sound is used in a self-rotation experiment to test the hypothesis. The experimental setup created an artificial sensorimotor contingency that allowed reliable reference to body position apart from eyes, ears or vestibular system. But importantly, consistent with the existing perceptual processes by which a subject detects their bodily orientation in space (visual and auditory

cues and sense of balance and self-motion). What one has in this scenario is a new way to perceive self-rotation that can be *equilibrated* into the subject's current sensorimotor schemes. As the agent rotates in the chair, the sound on the headset "moves" reliably, maintaining the indication of the direction of the geomagnetic North. Blindfolded participants were seated in a motorized rotating chair. Sometimes they could control the rotation of the chair, but sometimes the rotation was controlled by a computer. Their task was to move back to their original position rotating the chair. In some instances of the performance of the task, the auditory device was turned off, to see the differences in performance (the participants were not aware in advance). After some non-extensive training, the authors claim that there is an auditory augmentation of the participants' vestibular system (the sense of balance and self-motion), increasing their self-rotation perception.

The participants that actively explored their environment by sometimes rotating themselves improved in correcting their rotation on the chair back to an original position (even when moved by the computer). Also, the performance of the task was to be done rapidly, which reduces the possibility of high-order cognitive strategies (not reported by the participants). The first-person experience reports also suggest changes in the experience of self-rotation. Similar to the proficient use of a cane by a blind individual, there is an integration between the tool and the sensorimotor flow. The learning required involved learning how to explore the artificial sensorimotor contingency. Therefore, it is not the amount of learning that matters. What matters most is what is learned, a pattern between movement and sensing, a sensorimotor pattern, that can be integrated into the sensorimotor life of that agent due to similarities between this new sensorimotor pattern and the ones already mastered:

> We thus present a novel method of sensory augmentation that leads to fast acquisition of perceptual experience from an artificial afferent signal. [...] This approach thus piggy-backs the 'magnetic' information of a head-based compass on sensory cues of distal sounds. The magnetic spatial information can this way interface with existing spatial processes via natural mechanisms of auditory localization. [...] the magnetic information is presented close to real time and shares the reference frame of the eyes, ears and vestibular equilibration, favoring temporal and spatial integration. (Schumann and O'Regan 2017, 8)

EA's theory (section 3.2) can account for why that is so. To become part of the perceptual system the new habit acquired using the technology must be incorporated into a regional identity or network of interrelated sensorimotor schemes. The training must alter at least one of the "micro-identities" of the sensorimotor agent. Since the experiment was aimed to show

how sensory substitution and augmentation devices can open the experiential space of an agent, it does not address the role of agency in perception directly. Perceptual learning might serve as a proxy for the empirical investigation of the question of agency in perception, perceptual learning in beings like us involves changes in the organizations of our networks of habits, changes in agency.

3.4 Perception as embodied know-how and know-how in general

One of the original motivations to introduce the enactive sensorimotor theory was to provide a robust theory of perceptual learning, an important and somewhat neglected aspect of action-based accounts of perception. My efforts were aimed at elucidating the non-trivial way in which to perceive is to act; it is exercising sensorimotor skills in a suitable environment where there is something to be perceived. Or, as professed in one of the main texts of sensorimotor enactivism:

> Visual experience is a mode of activity involving practical knowledge about currently possible behaviors and associated sensory consequences. Visual experience rests on know-how, the possession of skills (O'Regan and Noë 2001, 946).

The explicit aim of *Sensorimotor Life* is disambiguating certain aspects of O'Regan and Noë's (2001). Epistemological implications can be brought now to the forefront. Knowing-how or mastering can be generalized beyond the sensorimotor domain of interactions as the responsive bodily processes and structures that enable reliable successful action when the agent finds themselves in the relevant environmental circumstances. Perceptual experience is meaningful for an agent in ways that go beyond metabolic constraints, constraints imposed by evolution and constraints of particular cultures. EA has a theory of the meaningful relation to the world as the activity of sense-making that is expanded to the sensorimotor domain. Certain aspects of the world are relevant to the precarious networks of interrelated sensorimotor schemes, and that is what gives them their felt perceptual salience. The perceived meaningful structures in the world are the ones relevant to the success of action under normative frameworks. The meaningfulness of a tomato, for example, goes beyond its nutritional value, it includes the tomato's effectiveness for performing a series of actions (is it a good one for making sauce?) and the relation between the schemes involved in the performance of such actions (do I have the tools and skills to make a good sauce with that

tomato?). Following Merleau-Ponty's (1945/2012) insight that 'nothing is more difficult than knowing precisely *what we see*' (59, italics in the original), there is a common view that claims an inherent indeterminacy to perception (see Buccella 2021). Perhaps that is the main reason why Noë (2004; 2012; 2021) fixates on the conceptual problem of 'perceptual presence' (Noë 2004, 59) in much of his work. The notion of autonomous interrelated networks of habits can give an elegant treatment to the indeterminacy of perception. I propose reconceptualizing indeterminacy as the openness to the world characteristic of sensorimotor agents. The networks of habits that meet the threshold of agency and constitute the agent are closely connected schemes appropriate to certain activities or behavior settings. Mastery of sensorimotor contingencies in general involves equilibration between schemes. Mastery at the network of habits scale involves the equilibration between networks, which leads to progressive integration and adaptation to each other. Going the classic example of seeing the voluminousness of the tomato, in this act the know-how of what would be the case were I to change my angle of vision or were to grasp it is highly relevant. But why do these schemes and not others like the fact that I can smash it or hammer into the wall? The answer here is that the angle of vision and what would be present were I to grab it belongs together to a scheme that is part of a large set of activities that organized our habits. Being highly visual animals, the *looking scheme* is part of most of our clustered networks and is strongly integrated into our sensorimotor lives. Making a salad is not a scheme featured so prominently. The mastery of sensorimotor contingencies is also regional. In the case of general acts like looking and general properties of the sensorimotor environment like voluminousness, almost all (if not all) activities that one does with their eyes open further integrate the looking scheme into networks. The aforementioned openness of perceptual meaning is due to the multiplicity of networks of habits that constitute the sensorimotor agent, each network entailing a set of capabilities and sensibilities that can be complementary and sometimes be at odds with each other. Di Paolo et al (2017) make this point evoking Varela's (1992) work: 'we transit through microworlds of significance (walking aimlessly in the park or hurriedly to catch the train) in which we literally act as micro-identities. Enaction is the transit between microworlds, the time between moments' (Di Paolo et al 2017, 181). The sensorimotor agent as this "meshwork of selfless selves" can make sense of both the plurality of perceptual meaningful relations and of the inherent indeterminate or unfixed character of perception. In more positive terms, EA claims that there is an inherent openness in perception.

In the previous section, I have emphasized the unity with the Gaia of habits metaphor and the association with Varela's account of our subjective experience of an 'I' acting in the world. But the plurality emphasized by the idea of a selfless self continues to be a crucial aspect of the proposal. We are both one and not one. Humans are always immersed in a multiplicity of situated normativities tied to the multiple identities they inhabit. And those multiple identities modulate the perceptual meaning of our relation to the world in a variety of ways. The world is always open to new relations of meaning that come about as identities formed themselves and are maintained. However, not everything is permitted, our identities are self-organized through our life's history in certain hierarchical configurations (as in the example of pervasiveness of schemes such as looking), forming a globally coherent system.

The mere existence of sensorimotor contingencies is not enough to the habitual activity of perceiving, what does much of the work in action-based theories is the *knowledge* of sensorimotor contingencies. Perception is embodied know-how acquired in one's sensorimotor life, but what is know-how? The notions of "know-how", "conduct" and "behavior" are terms employed in the Enactive Approach in association with sense-making as part of the characterization of the meaningful relation between cognitive systems and their environment. Know-how or skill has to be part of the characterization of sense-making to account for the flexibility of sense-makers, and their capacity to adapt to novel circumstances:

> Cognition is behavior or conduct in relation to meaning and norms that the system itself enacts or brings forth on the basis of its autonomy. We have seen that sense-making requires more than minimal autopoiesis; it requires autopoiesis enhanced with a capacity for adaptivity or assimilation and accommodation. *Adaptivity in this context means flexibility, the capacity to change in relation to changing conditions in a viable (and not necessarily optimal) way*. (Thompson, 2007, 159, italics added).

For EA, know-how is pervasive, it is involved in all cognitive performance. Knowing-how is what allows one to adapt (not necessarily in optimal ways) to the changing situations one finds itself in. But such an assessment is not widely accepted. Enactivism in general follows Ryle (1949/2009) and rejects the intellectualist accounts of knowledge that aim to reduce it to propositional knowledge. They must do so or their view would entail that propositional knowledge is ubiquitous and that seems to imply the ubiquitousness of (representational) propositional content. But EA and REC (see Hutto and Robertson 2020; Robertson and Hutto 2023) are not in full agreement with Ryle's distinction between habits and intelligent or skillful behavior. For Ryle, skills 'are certainly second natures or acquired dispositions, but it

does not follow from this that they are mere habits. Habits are one sort, but not the only sort, of second nature' (2009, 30). Habits would be acquired dispositions of lesser complexity, while intelligent behavior (skills, knowing-how) are highly complex dispositions. Naturalistically speaking, the mind is for Ryle a complex set of dispositions of varying degrees of complexity. Not all dispositions are made equal. Habits and skills would belong to the same class, acquired dispositions or second nature, but are sufficiently distinct. Habits are similar to other dispositions of the natural world, like solubility, in the fact that they are displays of intelligence. Habits are exercised automatically, blindly, without 'care, vigilance or criticism' (ibid). Skillful or intelligent behavior would be more responsive to the situation, being flexible enough for adaptation, learning and subsequent improvement: 'It is of the essence of merely habitual practices that one performance is a replica of its predecessors. It is of the essence of intelligent practices that one performance is modified by its predecessors. *The agent is still learning*' (ibid, italics added). The idea of a "second nature" in Ryle's thought indicates that he subscribes tacitly to an innate versus acquired distinction that goes in the exact opposite direction of enactive thinking. An innate disposition, trace, or behavior would be something that an agent possesses independently of a developmental history, and independently of a process of self-individuation. What would explain the innate characteristic is something fixed and determined, in the 20th century the genome was thought to be something of the sort. At first glance, Ryle's idea seems to be that some "second natures" can be like first ones, fully automatic, fully determined and outside of rational control, correction or improvement. Those would be habits (acquired by conditioning). The quasi-innateness of habits would be what puts them closer to other dispositions found in nature, such as the meltability of ice. From an enactive perspective, the apparent distinction between simple habit and intelligent behavior is actually a continuum. There is no action whose instantiation is an *exact* replica of the past. There is a degree of spontaneity in all that human agents do because there is a sense in which the agent is always learning. The examples of learning how to walk from relatively stable crawling and developing and maintaining a suckling scheme as a newborn, as well as the account of sensorimotor agency provided, show that there is no meaningful distinction between first and second nature, between innate and acquired behavior (see also the discussion on babies' face recognition capacities in the next chapter). There is a ghost of distinctions past in Ryle's account, the ghost of the nurture/nature distinction.

But even some of Ryle's examples are against strong distinctions between habit and skill. He uses the example of the habit of smoking to highlight that habits, as is the case for all dispositions, have an unlimited variety of instantiations. A disposition refers to a tendency that might become actual in a myriad of ways, depending on factors of a particular situation. There is inherent flexibility in dispositions due to the fact that their instantiation is context-dependent. His point seems to be that one should not confuse this with intelligence. Let's first consider a very simple disposition, breakability. A breakable object might break in half or in a million pieces, depending on the force applied and the angle from which impact occurs. Depending on the material, it can break in a very particular configuration (as it happens with car windows, for example). Something might also never come close to breaking and still be breakable. None of those considerations favor considering a glass breaking as an indicator that glass displays intelligent behavior or know-how. More complex dispositions, as he takes habits to be, form an even more open space of possible instantiations. A smoker might not smoke at a funeral out of respect for the ceremony, they might smoke more under stressful periods, less when there is a newborn living in the household (even if the situation is new and very stressful). But they are still a smoker, due to the fact that there is a propensity to smoke when certain conditions are met. However, if part of what determines the space of possible instantiations of the disposition to smoke is the volition of the agent, it is strange to deny that there is some form of control or regulation in their doing. The actions of smokers are not as automatic as the idea of a replica of past actions suggests. Being of the same class, acquired dispositions, Ryle at the same time distinguishes habits from skills (knowing-how) and puts them in a continuum between dispositions of varying degrees of complexity: 'Knowing *how*, then, is a disposition, but not a single-track disposition like a reflex or a habit' (2009, 34, italics in the original). He seems to suggest that the flexibility in the smoking habits of smokers is due only to the inherent context-dependence of dispositions' instantiation. EA does not have such strangeness because it argues for substantial complexity all the way down[39]. There is no single-track disposition in living systems, dispositions in living systems are very

39 Empirical research in animal behavior also is against Ryle. Considered a problem for some accounts and a central feature of animal behavior by their alternatives, animals display what is called motor abundance (Latash 2012). There are a variety of equally effective ways an animal can act to complete a task and animals tend to engage in "repetition without repetition": animals' movements follow prototypical patterns required for the completion of a task, but the exact sequence of actual movements does not overlap. Rigorously speaking, their actions are never replicas. For some accounts this happens because of small but significant differences in initial conditions of the particular action. Alternatively, some have suggested that there is no optimal concrete action, to any task there are sets of equally able solutions that are selected based on time constraints and the actual state of the particular system (the history of the individual animal).

different from dispositions in non-living systems. In both life and mind, nothing is simple. Even the simplest habit exhibits some degree of flexibility and is part of the ongoing process of assimilation and accommodation characteristic of behavior. The naturalization of teleology proposed in the previous chapter helps make the case that dispositions in autonomous systems are radically different from how they operate in other types of physical systems: 'By accepting the fact that the organism itself modifies its milieu according to the internal norms of its activity, we have made it an individual in a sense which is not that of even modern physics.' (Merleau-Ponty 1963, 154). The relation between life and non-life is similar to the relation between mountains and hurricanes, two different structures of the natural world whose understanding demands different concepts and methods of inquiry. Rather than abstracting away the physical-chemical complexity of the living, EA aims at understanding how cognition comes to be as a result of it. For that reason, the concepts that account for life (self-organization, viability boundaries, self-individuation, normativity, goal-directedness) show themselves as crucial for an account of mind. Autonomous systems are intrinsically teleological systems whose defining activity consists in being responsive to the viability boundaries of their own existence. Since their self-individuation happens under precarious circumstances, they need to skillfully change in adaptive manners to not disintegrate, even if their changes are not optimal. The accounts of adaptivity and agency implicitly introduced the idea of skillful engagement. The dispositions of autonomous systems are goal-directed, goal-structured and hierarchical in a way that is not present in other physical systems. Habits in open-ended sensorimotor agents like us are a complexification of intelligent behavior[40] already present in single-cell organisms. Ryle was wrong, habits are knowledgeable, skillful or intelligent to some degree. But Ryle was also right, there is a continuum of complexity between deceptively simple habits like brushing our teeth and bonafide intelligent behaviors, such as writing *Pride and Prejudice*. Therefore, meaningful engagement with the environment is knowledgeable, practical and word-involving all the way through. The simplest network or interrelated sensorimotor schemes possible is flexible, context-sensitive, and display adaptivity. Therefore, all forms of sense-making display know-how. The previous chapter focused more on the relational aspect of sense-making, to avoid an overly idealistic reading of the term and to connect to the also relational account of agency entangled with it. But the question of what exactly is to be understood as know-how for EA remains open. In this

40 See Thelen and Smith (1994) and section 5.3 for an embodied characterization of intelligence.

chapter, knowledge in the practical sense, as know-how, has been associated with mastery. This association is also explicitly made in *Sensorimotor Life* (see Di Paolo et al 2017: 78) and in later work (Di Paolo 2019: 212). The authors do not delve into systematic characterizations of know-how, in the following paragraphs I begin to flash out the enactive notion of know-how drawing on the observations made about mastery and on my previous work (Rolla and Huffermann 2021). The idea is that mastery is the closest thing to an enactive account of know-how. And since know-how also figures in the other domains of embodiment, a deflated notion of mastery generalizes. Both the accounts of agency and of sensorimotor schemes are rigorously relational, it would be wronger than wrong to say that bodies *possess* them. However, the convenience of predicating habits, competence and skills to agents is undeniable (notions that according to the enactive account of sensorimotor life entail agency and sensorimotor schemes). There are going to be no inconsistencies in this manner of referring if one understands that the description of an organism's habit or capability is a shorthand for the enabling bodily conditions for the concrete enactment of sensorimotor schemes. The knowledge in question is equally dependent on the enabling conditions outside of the concrete physical body of the agent. In the context of referring to the possessed knowledge of the agent, one is focusing on their enabling conditions without forgetting that they need to be coupled with the environment for actual instances of skill and knowledge. The shorthand will be employed here to make sense of know-how as mastering.

Summarizing, the embodied know-how that characterizes perception will then refer to ‘powers and sensitivities required for action’ (Di Paolo 2019, 212), because mastery is ‘the know-how our bodies have that certain patterns of movement will induce certain sensory changes’ (ibid). But for our bodies to have that particular knowledge, some capabilities and sensitivities must have been acquired, they became sedimented (habitual) and organized into a coherent whole. Together with that, the capabilities and sensitivities must be open to new acquisitions and the reorganization of the overall abilities of the agent. That is what is implicit in the idea of past and ongoing equilibration of both sensorimotor schemes and in between sensorimotor schemes. Equilibration is what allows agents to avoid, recover and overcome unexpected breakdowns and disruptions. The dynamical interpretation of Piaget’s theory of equilibration serves EA precisely because it accounts for this capacity for adaptation displayed by sensorimotor agents. However, it does not make sense to characterize know-how as powers and sensitivities required for action without further elucidation because know-how

entails action, but not all actions entail know-how. It is common and reasonable to think that to be an instance of knowledge (in any of its modalities), cases of mere luck must be excluded. Otherwise, the emphasis on know-how would be empty, if it would simply mean power or sensitivity to act, it would lack any relevant distinction to the already used term "Enaction". Know-how can be further specified as sensitivities to and powers required for *certain* actions. Thompson (2007) and Varela (1999) are explicitly anti-intellectualists. But an analogy with propositional knowledge can be useful in analyzing the conditions of instantiation of know-how. One general assumption of traditional epistemology about propositional knowledge is that it entails true belief, I cannot know what is false and if I know, then, by definition, I believe. But propositional knowledge cannot be true belief because arriving at a true belief by luck or happenstance is not knowledge (acquiring knowledge would be too easy). On the other hand, we have been discussing the notion of meaningful engagements with the environment relative to different precarious networks of schemes and their entailed normative framework. I propose to expand this notion and think of similar criteria for know-how: successful action relative to the metastable habits under consideration. But successful action is not going to be enough for an action to be an instance of know-how, actions can be successful by happenstance (a favorable, but not anticipated or controllable change in the environment can be the cause of success). Following Rolla and Huffermann (2021), I propose that know-how rests on a reliable or stable success:

> [know-how] implies *stability*, that is, regularly achieving successful results in varying situations and under similar constraints (for a similar idea, see Rolla, 2019). To know how to do a somersault, for instance, is to successfully perform a pattern of acts that result in the full rotation around one's horizontal axis. And this can be done across a wide range of conditions —but naturally not across all conditions. (Rolla and Huffermann 2021, 8).

For the purpose of avoiding confusion with the stability condition of assimilation of sensorimotor schemes, I will use *reliable success* from now on .Keeping the ties with some assumptions of western thought, knowledge is still being understood as an achievement of the knower. A crucial effort is being made in enactivist thinking to connect "cognition" to the relative control one has over their situation (agency understood pre-theoretically). The connection between knowledge and relative control, practical knowledge is enabling of such control, is in a sense a further elucidation of the conceptual connection between complex forms of autonomy and cognition Going back to the idea of mastery as the know-how the body possesses (with the caveats previously mentioned), the capabilities and sensibilities

required for action count as know-how when they reliably enable the successful enactment of an action according to a goal. My proposal is not to correct the enactive sensorimotor theory of perception, but to flash out the meaning of expressions like “required for action”. This notion of know-how maintains the idea of gradation present in the account of mastery, as one can be more or less reliable in doing something successively. It also maintains the precarious nature of mastering, to be able to perform the act in similar circumstances and under similar constraints is part of the reliable success condition. Maintaining precariousness, this conception of know-how maintains the embodied and situated normativity of action. Acts are correct and incorrect depending on the agent's goals, bodily morphology, acquired styles and environmental circumstances. Normativity, thus conceived, is *immanent normativity*. Not out there or pre-given, the normativity arises as the agent is responsive to the correct ways of acting in a situation, it is their responsiveness that enables them to improve and adapt in changing environments. The norms are not the assessment of an external observer analyzing the system, they are agent-dependent features of the situation to which the agent is responsive to without being determined by the agent, since they are also dependent on personal history and environmental factors. The characterization of know-how also fits well with the notion of habit as sedimented (equilibrated) networks of actions (sensorimotor schemes), since one can talk of the sedimentation of know-how and the gain of expertise. And finally, know-how thus conceived maintains the idea of mastery as the ongoing effort by agents to continue to have relative control over their own situation. The ongoing effort is both what mobilizes and generates new practical knowledge. I propose that the dynamical interpretation of Piaget’s theory of equilibration accounts for know-how (mastery) at the perceptual scale of sensorimotor life. But the more general notion of responsive bodily processes and structures that enable reliable successful action (the know-how our bodies “possess”) accounts for the main features of mastery and provides an enactive account of know-how that generalizes to all the cognitive domains. The know-how of organismic agency, for example, can be understood as the powers and sensibilities, the abilities, that enable the self-production of the living system in the environment that supports self-production. This is the epistemic aspect of basal cognition. Something already described by the classical examples of sense-making in single cell organisms, cases such as chemotaxis, explored in the previous chapter. The know-how is taken to be the responsive bodily processes and structures that enable reliable successful action when the agent finds themselves in the relevant environmental

circumstances. The conceptual framing centers the agent but also leaves space for the other half of the story, the environmental structures relative to that cognitive domain. There are material conditions for know-how. In organismic agency the cognitive domain is the energy and matter flow required for self-production and in sensorimotor agency what I referred to as "sensorimotor flow". In the next chapter we look into the domain of intersubjective interaction through this lens. The conceptual move of characterizing know-how in terms of success conditions opens a parallel path to a unified enactivist account of cognition, especially if Myin and van den Herik (2020) are correct in writing that '[a]ll forms of cognition, irrespective of whether they are basic or content-involving, are a matter of the exercise of abilities, competence and know-how'. I would like to highlight how this characterization of know-how creates a parallel path for the approximation between EA and Ecological Psychology, similar, but yet distinct, from other attempts (Segundo-Ortin 2020; Carvalho and Rolla 2020). Keeping the same caveats as before and moving the focus from the agent side to the environment side, the environmental conditions that enable the enactment of sensorimotor schemes have to be something at least very similar to what ecological psychologists labeled ecological information. Remember, ecological information is behaviorally relevant structured patterns of the ambient energy array. To say that the bodily powers and sensitivities of the organism for reliably guiding the success of action by exploiting behaviorally relevant patterns of energy seem to summarize the core aspects of the approach quite nicely. Ecological information might not be the complete description of the cognitive domain relevant for sensorimotor life, but it seems to be a core component. Segundo-Ortín (2020) argues that enactive theory can gain a lot by incorporating the well-tested theoretical and empirical methods that identify the ecological information exploited in different perceptual tasks. Ecological psychologists have been constructing a body of theoretical and empirical evidence that can very much inform the EA's sensorimotor account, a good example is the literature on "time-to-contact" (Lee 2009) and "dynamic touch" (Cancar et al. 2013). If the enactive theory is correct, the ecological information would be the environmental conditions for the enactment of a sensorimotor scheme and would be part of the scheme description. Another substantial gain for enactive theory is the research on perceptual learning as the education of *attention*, a view championed by Eleonor Jack Gibson (E. J. Gibson 1988; E. J. Gibson and Pick 2000). According to this view, what learning really requires is that the agent attends to the relevant (perceptual/ecological) information that will support their actions.

Attention to this information is not passive but active, the information is partially created by the performance of the task as it unfolds in time and space. Ecological information is not static, to attend to it, specialized motion is required. To be attuned to the environment is to move according to the information that unfolds. What distinguishes novices and experts is this responsiveness to the proper environmental cues. One interesting consequence of the view is their account of the transfer of skills, such transfer only happens in cases where the same environmental information unfolds itself in the performance, which is why much of our learning is highly task and context sensitive. The research also connects learning to development, learning is a component of ontogeny, not something outside or external to it (Adolph 2019, see also section 5.2). Attention to different opportunities for action has previous enabling conditions, on the side of the agent and on the side of the environment. The substantial gain for the enactive theory is once again the anti-representationalist empirical work already done in ecological psychology. Perceptual learning as attention to ecological information framework has also been studied in infants, showing how learning relates to development and behavior flexibility (learning how to learn) (Adolph 2019). What EA could offer in return to the ecological psychologist is an understanding of "attention" that connects the phenomena to precise notions of know-how, mastery and agency.

3.5 Knowing-how to perceive

In the context of theories of perception, EA can be classified as an action-based approach to perception. The major takeaway of action-based theories of perception is the notion of the primacy of action in perceptual research. Perceptual research should study perception through the complex, dynamic and emergent interactive patterns known as sensorimotor contingencies. My argument is that the primacy of action needs to be extended to our understanding of skillful activity in general. EA's account of cognition supports an action-first account of knowledge, where practical knowledge permeates all of our activities and is characterized as the responsive bodily processes and structures that enable reliable successful action when in the relevant environmental circumstances. On conceptual grounds, I argue for the expansion of the concepts of agency and autonomy introduced in chapter 2 to the sensorimotor domain, focusing especially in the understanding of perception as the mastering of sensorimotor contingencies. I then show that the notion of mastery is the account of know-

how provided by the Enactive Approach. Since know-how is present in all cognitive domains, a deflated notion of mastery generalizes. Skillful or knowledgeable engagement with the world is always required to continue to have relative control over their own situation. My proposal is to consider know-how as bodily sensitivities and capabilities relative to the cognitive domain that reliably result in the success of action. The success of action is relative to goals and normative frames related to an autonomous, adaptive and precarious organization under consideration. Since humans are open-ended and in a continuous process of becoming, know-how is knowing-how, it is a continuous process. Knowing-how to perceive is the never-quite complete gain of control over situations by an organization of bodily processes and structures for the successful enactment of sensorimotor schemes. As I'm going to explore in chapter 5, the account of knowing-how provided puts perception and other forms of cognition, including the so-called higher forms of thought, reasoning and judgment in a continuum of different ways to meaningfully relate to different environments. My proposed characterization of knowing-how introduces a relational, action-first, view of knowledge that complements action-based approaches to perception by expanding the centrality of action to all epistemic life.

4. Language as shared know-how

When you speak a word to a listener, the speaking is an act. And it is a mutual act: the listener's listening enables the speaker's speaking. It is a shared event, intersubjective: the listener and speaker entrain with each other. Both the amoebas are equally responsible, equally physically, immediately involved in sharing bits of themselves.
[…]
Words are events, they do things, change things. They transform both speaker and hearer; they feed energy back and forth and amplify it. They feed understanding or emotion back and forth and amplify it.
Ursula K. Le Guin, 2004

In this chapter I show how, according to a enactive account of language, linguistic cognition rests on the shared know-how of linguistic communities. Languanging is understood as a type of mastering or knowing-how where one is *acquiring and (re)organizing dialogical shared know-how*. The exposition draws primarily on the book *Linguistic Bodies: The continuity between Life and Language.* (2018), written by Ezequiel Di Paolo, Hanne De Jaegher and Elena Cuffari. Language, as they understand it, emerges from the social interaction between sensorimotor agents. The phrase "linguistic bodies" and the abbreviation *LB* used throughout refers not only to the book, but to the theory as a whole[41] as it appears in a few publications of the last ten years (Di Paolo, Cuffari, and De Jaegher 2018; E. C. Cuffari, Di Paolo, and De Jaegher 2015; 2021). The chapter relies on my previous work on the linguistic bodies theory as it compares to other versions of enactivism (Huffermann 2019; Huffermann and Noguez 2020; Rolla and Huffermann 2021). Here I expand and revise aspects of those works. To introduce the idea of an embodied approach to language and linguistic cognition I provide some methodological observations about the study of language (4.1). The linguistic bodies theory is a radically embodied approach better appreciated having the methodological distinctions provided in mind. LB subscribes to an intersubjective view of linguistic cognition, for that reason their account of intersubjectivity and social cognition is brought forward (4.2). LB explains the emergence of linguistic engagements from social interactions of sensorimotor agents, maintaining the continuity between life and mind explored in previous chapters. The properly specific domain of linguistic agency is introduced as one advances to the enactive notions of *dialogue* and *utterance* (4.3). The role of know-how is shown exploring how the deflated notion of mastery introduced in the previous chapter also applies to linguistic engagement (4.4).

41 Figueiredo (2020; 2021) refers to the theory as "linguistic enactivism".

4.1 Studying Language

What do we study when we study a specific language or language in general? Which phenomenon is linguistic? Fred Cummins (2021) identifies three distinct root senses of the term "language" that are pervasive in everyday life and sometimes conflated in academic discourse. Language can refer to a structured system or code that enable the exchanges of messages between senders and recipients (language-as-system); language can also refer to modes of coordination and affiliation, similar to others in the animal kingdom, but so specific to the human species that it is what enables the typically human social orders (languaging); and language is sometimes also understood as the co-defining characteristics of a community or "people" (~~language~~[42]). In this chapter I use this distinction to refer to the different aspects of language and the word "language" is used to refer to language in the broader possible sense, which includes the three root senses. In several Romance languages there is a difference between a countable sense of language and a mass noun (in Portuguese this is captured in the *língua/linguagem* distinction). English, French, Portuguese and Nheengatu[43] are different countable languages that a person can learn and use to transmit messages to other individuals. One aspect of those languages is a formal system, the articulated sets of rules that we find in textbooks on grammar and syntax, but also in writing and speaking manuals. Each formal system (or language in a restricted sense) has constituents that vary from context and the particular case in question, gestures and facial expressions in sign languages, morphemes, syllables, phonemes, and other possible signs. One can separate situated circumstances relevant to considerations about the meaning of sentences (the pragmatics of a language) from more strictly formal aspects of the construction of signs and their meaningful combination (syntax and semantics). With this knowledge it is possible, for instance, to show that well-formed structures like "Green ideas sleep furiously"[44] can be nonsensical despite being grammatically correct and structures like "More people have been to Russia than I have"[45] can sound meaningful but be grammatically incorrect. Strictly speaking, notions like *translation*

42 ~~Language~~ (with the erasure over the word) for the third sense of language to allude to being a use that resists the conventional and unreflective connotation present in academic settings.

43 A indigenous language originated from the ancient Amazonian language *Tupinambá*, it is spoken throughout the Northern region of Brazil, specially in the state of Maranhão.

44 The famous Chomskyan example of the combinatory power of language. Ideas are not the types of things that have colors or sleep, there is nothing wrong with the sentence from a syntactic point of view, but aside from some poetic interpretation, the sentence is meaningless.

and *transmitting a message* apply only to languages-as-systems because they assume already formed and somewhat stable formal systems in which a message can be codified. Grammar is a feature of language-as-system, but to which degree is present in the other root senses is an open question (addressed in section 4.4) The verbal term *languaging*, in opposition to the noun, has been used by several authors with different purposes (Maturana and Varela 1987; Madsen, Karrebaek, and Møller 2016; Love 2017; Di Paolo, Cuffari, and De Jaegher 2018; Cowley 2019). Usually, its use is to highlight coordinative or affiliative forms of interaction typical of humans and that somehow relate to language as an activity. The activity has been a neglected aspect of language when compared to the emphasis on a more static and formal conception of language (here captured by the notion of language-as-system). Languaging is also thought to be the activity that enables the rise of a common ground, a shared social domain or even a shared social order. I go back to languaging when examining the linguistic bodies theory.

Finally, language in very broad terms is sometimes used to identify groups of people that might share one or more of the following: shared history, culture, ethnicity, form of assembly, genes, geographical localization. This use is employed when the more familiar concepts of nation, race or community don't do the required classificatory work. It is the vaguest and most elusive use of the term. The historical processes of imperialism, colonization and globalization made several languages-as-systems lose the sense in which they were characteristic of a "people", so it might sound strange to use language in this sense. However, let's see some contrasting languages to better grasp this notion. First, English: now spoken in several of the former colonies of the British empire and it is the global academic language, for those reasons it does not co-define a specific community, it is a feature of many. With the possible exception of some very specific regional dialects, it is not a ~~language~~ anymore. Often a considerable size of the academic writing of someone that does not have English as their first language is written in English. The situation is radically different for a language like Nheengatu, that unifies a group of speakers, amongst other things, due to genetic heritage, geographical proximity and a shared history of resisting the efforts of colonizers against the Amazonian Tupi languages and its speakers. Another elucidative example is given by

45 The sentence is an example of a 'grammatical illusion' or an 'Escher sentence' (Phillips, Wagers, and Lau 2011). The main clause subject *more people* requires a comparison between two sets of people, usually readers fill the gaps of meaning and read the sentence as "More people have been to Russia than I *would* have *thought*" or other meaningful and grammatical constructions like "More people have been to Russia than just me".

Cummins (2021). The Yaghan or Yamana people lived in Tierra del Fuego for about 10.000 years before the British colonizers arrived, and in less than 100 years were exterminated in the 19th century due to diseases and slaughter. They did not have a written language, which created several difficulties for missionaries trying to convert them to Christianity and allegedly save their souls. Salvation requires communication and learning their speaking language proved itself hard due to difficulties in the differentiation of sounds. The constituent phonemes that formed their speech were particularly hard to grasp to the English speakers that came into contact with them (Bridges 2007). Nowadays there are no Yamana people, but we find a dictionary of English-Yamana, translations of christian texts and one sung chant of the Yamana without records of the context and ritual on each it was performed. Did the Yamana language survive? Perhaps as a language-as-system, if the translations were correct. The "written Yamana" is a translation of speech into written language made by people outside of that community of speakers. The situation is different from the study of ancient written languages, whose formal systems were formalized and used by a living community of speakers at some point in time. This raises interesting questions about the relation between those three central aspects of language. Contrary to how it is treated in most of academia, language is not exclusively or primarily a formal system, that can be understood when one attends to the fact that "[s]aving a language-as-system does nothing to further the continuous creative activity of languaging, and does less than nothing to help the survival of ~~language~~" (Cummins 2021, 4). At least in terms of temporal progression, language-as-system require languaging to be constructed. The linguistic bodies theory claims that this dependency is strong to the point of being the ground on which the other root senses of language stand. The deed precedes the word, both historically and conceptually. Languaging is the process of interaction that enacts languages-as-systems and allows for the formation of a group identity or ~~language~~ under certain conditions.

4.2 Bodies making sense (together)

To understand the linguistic bodies theory we need to keep in mind that the body is re-conceptualized by EA. Bodies are networks of activity, in the underlying ontology *being* and *doing* are interwoven, *what something is* is co-defined by *what it does*. In chapter 2 I looked at how some processes individuate the living body. In chapter 3 I looked at how some

processes individuate the sensorimotor body; in this chapter the intersubjective body is looked at in order to understand language and linguistic cognition. So far I have been bracketing the fact that we are highly social animals, even the simplest sensorimotor pattern enacted by us is embedded in a cultural world, it has history and it is constrained by social or intersubjective normativity. Removing the bracket, a enactive account of language is given. In this section I introduce the notions of *social agency* and *participatory sense-making*, linguistic agency is a form of social agency and linguistic cognition is a form of participatory sense-making. The topic of social cognition itself has received increased attention on enactivism. Hutto and Myin's (2017) also appeal to sociality to explain linguistic cognition. RECers revive the Vygotskian notion of sociocultural scaffolding. De Jaegher and Froese work (2009) have shown how social interactions can shape the individual agent on which they depend. But the main culprit of the "social turn" in enactive studies is the notion of *participatory sense-making* first introduced by De Jaegher and Di Paolo (2007). All bodies (living, sensorimotor, linguistic) are sense-makers and for that reason enact meaning. However, not all bodies are linguistic. Languaging becomes an ever more dominant phenomena as one integrates a linguistic community. (see especially Di Paolo et al., 2018, chapter 9). Linguistic bodies are in continuous development or in a continuous state of becoming, more so than in other forms of embodiment (for reasons later explored). As organisms exhibit different levels of organizational complexity, new adaptive coupling strategies with their co-specified environments take place in a continuum of organizational complexity. In this continuum we encounter proper sensorimotor agents with norms constraining habituation and skills. But how do we go (conceptually) from sensorimotor agency to linguistic cognition without smuggling in representations?

The linguistic bodies theory proposed that social interactions constitute a new domain of interaction and it is at this new domain that linguistic agency takes place. Whereas sensorimotor agency minimally involves individuals as a meshwork of interrelated habits interacting with the environment, social interactions are understood as the interaction of at least two sensorimotor agents. For LB, a social interaction is the co-regulation between agents for their joint coupling by following social norms in a given environment. Social interaction thus occurs as at least two sensorimotor agents make sense together, or following the more technical vocabulary, are engaged in participatory sense-making. To illustrate the difference between simple sensorimotor engagement and participatory sense-making consider the

following cases. Imagine that a caretaker puts a toy in the field of vision of a toddler who then starts to play with it. So described, that would be merely a case of perceptual interaction, where the child either takes or ignores the object made available in their vision field. It is an interaction between the toddler and her toy. A genuine case of social interaction would be the similar situation in which the caretaker offers a toy to the toddler by holding it closer to them, and the child either accepts or denies it. In the second scenario, sensorimotor agents *act together*; the relevant action is the *offering* of a toy, a partial act that becomes a joint act when the child responds to the caretaker's offer to play, either positively or negatively. As the example suggests, the theory employs a very broad meaning to the term "social interaction". Most of the examples are dyadic interactions, it is recognized that interactions between more than two participants might have their own characteristics, but many of the general features of social interaction are already present in simple dyadic interaction, making the analysis of those interactions valuable to us. One feature already present in two-person interaction is the *materiality* of social interaction. The actions performed and the environmental features that constrain their performance make it so that the social interaction always produces its own internal dynamics. The by now classical example is the familiar situation in which two people coming from opposite directions have to cross each other in a narrow corridor and they get stuck in alternate lateral movements that prevent them to carry on walking (De Jaegher and Di Paolo 2007, 493). Both agents want to pass (or to let the other to pass) but for a few seconds they engage in an awkward 'dance' given the constraints of the environment and a lack of complete control over the consequences of their movement. To facilitate the coregulation, portable regulatory acts emerge in the interactions (gestures indicating things like 'you go first'). Such acts are portable because they can be used recursively in similar situations and gain broadened regulatory powers.

The materiality of social interaction also helps us explain the *autonomy* of social interaction in relation to co-interacting agents. In the social domain the interactive process gains a life of its own: 'patterns of coordination can directly influence the continuing disposition of the individuals involved to sustain or modify their encounter. [...] And *the particular unravelling of these dynamics itself influences what kinds of coordination are more likely to happen*.' (De Jaegher and Di Paolo 2007, 492, italics added). It is important to note that autonomy is being used in the technical sense, as an operationally closed organization. The operationally closed organization is a very fleeting one, with the duration of the encounter. Being an autonomous

organization does not mean that social interactions are agents of any kind. Agency is the main feature of cognitive systems and autonomy is a precondition for cognition, but not all autonomous organizations are cognitive systems. It is in the encounter itself (sustained by the agents) that we have the co-emergence of *interactors* (in the social sense). For that reason the analysis of social cognition cannot be reduced to the behaviors of the individual agents, those behaviors become social *in* interaction. Finally, a further requirement for the interaction to be properly social is the retain autonomy of the interactors. The social domain of interaction where social agency is exercised is the interactive domain in which the agents maintain their autonomy and the interaction itself acquires autonomy relative to the goals and purposes of the participants. Summarizing:

> Social interaction is the regulated coupling between at least two autonomous agents, where the regulation is aimed at aspects of the coupling itself so that it constitutes an emergent autonomous organization in the domain of relational dynamics, without destroying in the process the autonomy of the agents involved (though the latter's scope can be augmented or reduced). (De Jaegher and Di Paolo 2007, 493)

Understanding the domain of social interaction is crucial to assess what is the impact of social interactions into the participants' sense-making. Participatory sense-making is sense-making of the our intersubjective form of life: 'the coordination of intentional activity in interaction, whereby individual sense-making processes are affected and new domains of social sense-making can be generated that were not available to each individual on her own' (De Jaegher and Di Paolo 2007, 497). One important aspect of the definition is that participatory sense-making is not necessarily sense-making about something regarded as social. All forms of sense-making performed in social context or that are enacted as a shared practice fall under the category. The influence of the interactive context in a participant's sense-making varies in a *continuum of participation*. In one end of the spectrum one finds sense-making that remains largely (but not absolutely) individual and in the other end where what characterizes the activity is a joint process of sense-making (a choir chanting would be one example). It is not the case that humans are sense-makers first and most of the time and participatory sense-makers when in social interaction in the technical sense. Paying attention to human development shows how participatory sense-making and the type investigated here, linguistic sense-making, are pervasive. For starters, explicit recognition of others is not a necessary condition of participatory sense-making. In many cases the individual agent in participatory

sense-making relations experiences a special sort of engagement where 'agent's regulations are contingently thwarted, extended, challenged, or simply changed by the interaction dynamics, following certain enduring pattern' (Di Paolo, Cuffari, and De Jaegher 2018, 139). One can be constrained by social normativity without being fully aware of the social character of such normativity. At least in the human case, there are probably very few cognitive capacities that are not somehow connected to social experiences. Humans are born fragile and highly dependent on the care of others of our species and the social interactions with our caregivers seem to impact in the development of so-called higher mental functions like reasoning, abstract thought and decision making. Arguably, even prior to birth there is social interaction (or proto-social interaction) between the pregnant person and the fetus. Our encounters with the world (not only with other agents) are encounters of bodies *ready to interact* with others. As Di Paolo et al (2018) puts it: 'Readiness to interact is the default mode with which we approach any situation, whether others are present or not' (78). As the sensorimotor body develops, so does the intersubjective body. Evoking the vocabulary of the previous chapter, *our habits are not only to act, but are also to interact*[46]. The networks of interrelated sensorimotor schemes are not only occasionally modified by social interaction, they are shaped and reshaped in a constant background of sociality. Consider the scenario of a child having dinner at their grandmother's house with all the extended family. Everybody has to sit at the table to eat together, the adults must serve their plates first and then serve the children. Another rule, this one never spoken, is that conversation must be kept light, no taboo topics. The otherwise uneventful act of eating dinner can become a moment of tension where the child has to wait for the adults to start eating and has to do their best to conform to complicated social dynamics that are completely alien to them. Eating dinner becomes an uncomfortable experience that they are incapable of describing.

Considering larger times-scales of social influence on one's sense-making, another characteristic of humans that relates to the domain of intersubjective interaction is our obsession with faces. We are so good at seeing faces that we overdo it and project faces onto all kinds of objects with similar and not so similar features. It is also true that we are very much interested in faces, having a preference to look at faces when compared to other stimuli, that is the case even when we are newborns. Babies prefer to look at faces within one minute

46 In *Linguistic Bodies* "interaction" is used as a synonym with "social interaction". By paying attention to the context in which "interaction" is used in this chapter one can (hopefully) understand when it is used to talk of social interaction and when it is used to talk of interaction more broadly.

after birth. Experiments show that recently born babies spend more time looking at faces or face-like objects than at things that don't resemble faces (Johnson et al. 1991). Do humans have a present at birth bias towards faces? Not exactly. Studies (Cassia, Turati, and Simion 2004; Simion et al. 2007) suggest that babies prefer a geometrical configuration present in faces, not faces per se. In an experiment babies were shown geometrical configurations that had "top-bottom asymmetry", where the top had more geometrical elements than the bottom. There is nothing particularly facelike in the display of objects apart from this geometrical feature, the contrast in the experiment was with how long the babies look at bottom-heavy configurations. The preference for top-heavy displays persisted when "scramble faces" were introduced, faces in which the features (nose, eyes, mouth) were in the wrong placement. The babies also had a preference for scrambled top-heavy faces compared to a normal bottom-heavy one. The most interesting fact is that they showed equal interest for top-heavy, Picasso-like scramble faces and normal top-heavy faces, so it was not the faces themselves that were keeping their attention. The research suggests that the remarkable human ability of recognizing faces at a very young age is fine-tuned by the baby's interactions with their caregivers from their first weeks up to the first 3 months of their lives (Simion et al. 2007), not something ready since birth. But such ability can only be so rapidly developed because of a prenatal bias explained by reference to the natural history and evolution of our species; once again we see shortcomings in a narrow version of the nature/nurture distinction. The more general point that I would like to make concerning the intersubjective dimension of bodies is that even the more "built in" or "innate" abilities of a human being seem to also require a process of honing that happens in a social context. There is an irreducible participatory dimension of human cognition, but that does not mean that all normativity is social. What we find in beings like us is an interplay and interwovenness of norms constraining cognition that pertain to individual (sensorimotor and organismic) and social domains of embodiment. As it was stressed in the Introduction we are not talking of neatly separated realms, but of spiral structures coupled with each other and with the environment. Language is not itself a new domain of embodiment, but it alters significantly how the domains operate and intertwine.

But how do we go from participatory sense-making to language? The first step is to understand the *primordial tension* of participatory sense-making. participatory sense-making does not require awareness of the presence of others, what makes the engagement special and phenomenologically distinct is the tension between two forms of autonomy at play in

participatory sense-making: *individual autonomy* and *interactional autonomy*. Individual autonomy is the general label for the normativities of the organismic and sensorimotor domains of interaction. Interactional autonomy 'results from the sometimes fleeting, sometimes enduring patterns that self-organize and sustain the interactive encounter' (Di Paolo, Cuffari, and De Jaegher 2018, 140). Individual norms and social norms generate a primordial tension, from the partial resolution of this primordial tension new tensions come to be and in the resolution of those tensions other new tensions arise. The primordial tension is transformed but never gets fully resolved[47]. The social interaction of the narrow corridor is an example where two people get stuck in lateral movements marked by *dissonance*, a negative tendency between the individual agent and the interaction, a mismatch of sense-making. But the 'life of its own' of social interactions can also generate *synergy*, that is, a positive tendency between agent and interaction in which agents try to sustain the social encounter, like in the dialogue of smiles case. Synergies occur when both individual and interactive normativities are satisfied, for that reason our ready-to-interact disposition is to try to maintain synergy and recover from the eventual breakdowns in the social interaction. Dissonance and synergy refer to interactive and individual normativities, not to presence or absence of coordination.. Dissonance can lead to breakdowns, but it does not necessarily do so, Coordination can happen while in dissonance. The simple completion of a joint activity can also end the social interaction. Now, imagine that you are on a date and you say something that ends up being insulting or hurtful to the other person because, unbeknownst to you, it triggers a past experience of theirs. You notice something is wrong, you apologize and try to amend. It is to correct this kind of mismatch between individual sense-making and patterns that emerge in the interactive dynamics that agents exercise their *social agency*:

> a specific kind of participatory sense-making whereby the agents not only regulate their own couplings and influence other agents, but they also jointly regulate the mutual coupling following norms that pertain to the interactive situation, such as being sensitive to interactive breakdowns and attempting to recover from them jointly with other participants. (Di Paolo, Cuffari, and De Jaegher 2018, 146).

47 It is important to notice that the tension is not between participants, because it is present even when we engage with others not as others or when the intentions between the participants match perfectly. The materiality of social interaction is such that actions performed and the environmental features that constrain their performance are messy and produce their own tendencies outside of the control of the participants, and those tendencies can also drive the direction of the encounter.

The domain of social interactions requires *coregulation*: ‘some acts are performed together—that is, their enactment requires the organization of individual sensorimotor coordination patterns into a *jointly regulated* sensorimotor scheme’ (ibid, 145). The social agent is this agent ready to act with others, ready to enact joint sensorimotor schemes and habits related to social interaction. One can reintroduce the notion of habit here because in the history of encounters self-maintaining metastable sensorimotor patterns emerge, as was the case with sensorimotor agency. We have habits to act and habits to interact with others. One example is the micro-interactions between long term romantic partners: in a party one of the partners can signal with one look their tiredness and desire to go home, while the other with a supplicant smile suggests that they stay just a little longer. The meaning in such interaction is only possible because of the shared history of the individuals, the same movements convey very little outside of this context.

How the criteria of agency (individuation, normativity and asymmetry) is instantiated in social agency? In this regard social agency is very similar to sensorimotor agency. The processes that individuate the social agent are the social acts. Sensorimotor schemes for coregulation organize themselves in complex networks, those networks develop and change. The sensorimotor "Gaia of habits" (chapter 3) includes social habits, we are not only runners and bartenders, but also we also are partners in a romantic relationship, friends and we belong to families of different kinds, chosen or bonded by blood. As with the other forms of agency, the environment is always defined relative to a system; here the social environment[48] consists of social norms and conventions, pre-establish social relations, other agents and the actual material constraints of the social interactions (narrow corridors and football fields). Normativity comes almost free, with the pre-theoretical understanding of social norms. In EA account of social normativity the *precariousness* of the interplay between individual autonomy and interactional autonomy is the explanation of normativity in the domain of intersubjective interaction. In social interaction we navigate between the normative pulls of our embodiment as living and as sensorimotor agents and the normative pulls resulting from the fleeting or enduring patterns that self-organize and sustain social encounters. The asymmetry condition of agency refers to being able to modulate the coupling with the environment as to resist some of the tendencies and pressures of their milieu while initiating some trajectories of the interaction[49]. In social agency this corresponds to the abilities to be sensitive to interactive breakdowns and to try to recover from them jointly with other participants. In the date example, noticing that something is wrong, apologizing and trying to amend exemplify the asymmetrical modulation of their coupling with the social environment. We also asymmetricaly modulated our coupling with the social environment by changing it, the creation of formal systems of communication (language-as-systems) is but one example. Social agency helps us to see more explicitly the centrality of the notion of know-how in the linguistic bodies theory. Social agency pertains to the individual participant, but it can only exist as one aims to act with others. For LB, it requires a shared know-how of the interactive

48 I do not give the full deserved attention to the sociomaterial environment in this chapter (I do explore possible directions in section 4.5). But it is important to have in mind that the term "environment" in enactive thinking always refers to the set of processes to which a system (cognitive or not) is coupled with. The same is true of the sociomaterial environment, it is all the processes we affect and are affected by as social agents.

49 It is interesting to note that one of the impacts of oppressions like gender discrimination, class exploitation and structural racism is to hinder the capacity of some bodies to direct their trajectories of interaction in our sociomaterial world, in this sense those sociomaterial structures are impediments of agency. It follows that the elimination of those forms of oppression are an increase of these bodies' agencies, the "self-actualization of their freedom".

situation, i.e., the sensitivity to breakdowns and the skills to recover from them (as in the date scenario above). Crucially, shared know-how is taken to be irreducible to the individual know-how of the participants: 'shared know-how does not amount to the sum of the individuals' know-hows nor does it strictly "belong" to any of the participants.' (Di Paolo et al., 2018, 75). The reason for this is that the performance of a *social act* necessarily depends on the enactment of acts of different interactors as they unfold in a given environment. Accordingly, the coordination of individuals is jointly enacted in a way that there is no completely independent social agent. The successful production of the social act, therefore, relies on the participants' know-how in relation to the interactive dynamics that emerge in that context.

Consider the example of scoring a goal in a football match (adapted from E. M. de Carvalho 2021). In this case, the interactive dynamics that interfere in goal scoring opportunities involve what the other participants from both teams do. They also indirectly depend on how the participants are affected by the weather conditions, the quality of the field, the reactions from the coach, the cheering from the supporters and so on. To put it in other words, no individual agent strongly regulates the social act *alone.* In Carvalho's example, the shared know-how mobilized for scoring the goal is not reducible to the individual players' know-how. Instead it emerges in the interactive domain and it "belongs" to the teams in action. The experience team also creates their own dynamics based on previous interactive experience, this own dynamics also creates a know-how shared between the players that 'gradually turns into a *pragmatics of interacting*' (Di Paolo, Cuffari, and De Jaegher 2018, 151). The example also elucidates how social acts are much more precarious than individual acts. In individual acts we can have obstacles and lacunas that get in the way of enacting sensorimotor schemes and are the drives of assimilation and equilibration. In social acts, even in the absence of obstacles and lacunas, the interaction can be such that something goes wrong. More than that, it is not always obvious to the participants why. Coregulation requires a more direct participation of others in one's sense-making activities and letting the interactional situation itself influence our actions. The way things can go wrong grows exponentially. Similar to the metastable sensorimotor patterns discussed in the previous chapter, in social coordination we have the emergence of more or less stable patterns of joint sensorimotricity, they are *partial acts*. But the enactment of a partial act can fail or the conditions can change, so *spontaneous social acts* can be necessary in particularly novel situations between interactors. We can think again of the football match, to score a goal the players have to navigate between a Scylla of doing exactly as trained and the Charybdis of trying something novel to adapt to particular characteristics of the unfolding game. The primordial social tension of participatory sense-making thus reappears transformed at the level of social acts. A similar tension is also present at the level of *coordination of social acts*. We have been counting "scoring a goal in a football match" as one social act, but actually we have a coordination of several social acts happening, social acts involving only players in the offensive and social acts possibly involving the whole team. Here the tension is between the recursive use of social acts that worked in the past and the creation of new social acts (that may or may not be recursive after the first creative use). In the coordination of social acts we also see how some *partial acts* become *regulatory acts*

that modulate, select, reject, project or encourage other particular partial acts of a shared repertoire of interactors. They are acts one employs to guide the flow of interaction. It is at this level that we see the emergence of a normativity of social acts. On one hand, some social acts belong to *local pragmatics* or to sets of actions that are regulatory in local contexts. On the other hand, some social acts are *portable* to multiple contexts of interaction. Holding the palm of our hand outward at the chest level is an act that signals to participants a desire to stop and it tends to work in several contexts (making someone stop approaching or stop talking). In *communities of interactors* with a shared history of interaction there is a new tension between regulatory *roles* and *regulated roles*, that is, the tension between letting others conduct the direction of the participatory sense-making activities and using regulatory acts to change or enforce or promote the current trajectories. The team of futebol players is one example of a more local community; in an experienced team, one look or gesture to a teammate can be a regulatory act and shift the strategy. But a player that always wants to be the one regulating the joint performance inevitably ends up hindering the team.

4.3 Linguistic bodies

According to the theory 'Linguistic bodies are precarious dynamic processes of navigating the primordial tension of participatory sense-making in dialogic contexts' (Di Paolo, Cuffari, and De Jaegher 2018, 215). For starters, participatory sense-making gives rise to tensions that are never fully resolved. In the simplest social interaction we find a tension between individual and social norms. Dissonances between these orders of normativity occur independently of interactors being in conflict or in agreement. To maintain ourselves in social interaction and manage the dissonances joint action is required, it is by coregulating our actions with others that we have social acts. In a history of encounters 'interactive know-how builds up between frequent coparticipants, partial acts become increasingly projective about their expected complementary responses' (Di Paolo, Cuffari, and De Jaegher 2018, 161). Some partial acts regulate other partial acts, in some of those are so effective that they are recursively used as regulatory acts, as acts that aim at directing the social interaction. The framework points to an ever-growing rise of local pragmatics, sets of acts that make it easier to coregulate action, it is quite possible (and often the case) that different groups develop different local pragmatics. However, some regulatory acts are so strongly normative that they are portable, they can be

used in different interactive situations. Holding the palm of our hand outward at the chest level is ultimately an impediment for someone walking towards you, that makes it a portable act for stopping (talking or moving). One can already note at this level some characteristics typically associated with language-as-system, such as recursivity and normativity. Another highlight is the importance of know-how shared in a history of encounters for the coregulation between two or more agents. *Linguistic agency* is a specific kind of social agency whereby the participatory sense-making involved requires increasingly more sophisticated forms of shared know-how by the social agents. The first thing to notice is that there is a sedimentation of novel sensorimotor schemes through the activity of participatory sense-making, an entrenchment of know-how that was originally applied to particular contexts of interaction. Accordingly, the relevant know-how is increasingly shared by the members of proportionally enlarged groups. It is by paying attention to the tensions that emerge in the participation of these ever-growing groups of interactors that we can understand the linguistic nature of our bodies.

There is a tension inherent to being a member of a community of interactors between assuming a regulatory role or letting yourself be regulated in a social interaction. There is no middle-way or golden-mean resolution of this tension. Portable acts can be bridges between different local repertories, but that alone is not enough. The portability and availability of some regulatory acts introduces asymmetries into the model. The asymmetry of strongly normative portable acts adds to the more material asymmetries present in interactions (size, age, gender, race, class). The interactions of participants happen in the back and forth of this exchange of roles. Letting yourself be regulated by others is not yet a loss of autonomy and it is required for successful coordination in many contexts. Role asymmetry over time is structured in reciprocal arrangements. Participants are sensitive to their and others overstepping, for example. As suggested with the empirical example of the babies' face obsession, the engagement in social encounters alters the specialized repertoire of actions available to an agent, thereby altering their sensorimotor structure. It is through this process of the sedimentation of practices and development of sensitivities for appropriated interaction that paradigmatic acts look increasingly more like our typical grammatical structures. Social interaction is in this sense “dialogical”. LB does not assume that all social interaction is dialogic. Dialogs is one particular and increasingly widespread organization of social interactions (Di Paolo, Cuffari, and De Jaegher 2018: 171-172). Dialogues are introduced into

the linguistic bodies model ‘as a way to handle the interactional asymmetries introduced by community-sanctioned, strongly normative acts’ (ibid, 172). Dialogic organization involves the agreed upon allocation of contextual roles among participants in interaction. It is a form of organization that supposes a regularity in the participation of those involved, only this way agreement about the roles can be obtained. Dialogic organization can take the form of rigid turn taking (like in a political debate), but it does need to necessarily. What is characteristic of dialogues in the LB sense of term is the presence of *dialogic turns*: ‘periods in which one participant enacts a role that asymmetrically brings together and orients the sense-making of other participants who accept and support this configuration’ (Di Paolo, Cuffari, and De Jaegher 2018, 172). In concrete cases of social interaction nondialogic aspects of the interaction occur concurrently with dialogues. They can support current dialogue (adjusting our posture in a chair to hear better) or run in parallel with it. Expanding on Bakhtin’s (1986) work, in *Linguistic Bodies* the activity of an agent holding a turn in a dialogue, while holding it, is called an *utterance*. The introduction of this concept allows us to go from considerations about social interaction more broadly to specificities of linguistic interactions. In the Introduction I mentioned the Cultural-Historical Activity Theory (CHAT) developed in the Soviet Union as one of the ecological projects for the study of cognition emerging in the 20th century. The label was coined by Cole (1989) and refers to a school of thought in Psychology led by Vygostky (1978). CHAT analyzes the relation between human minds and human activities inspired by the marxist analysis of the production and social reproduction of labor relations under Capitalism. One of CHAT's main ideas was that we cannot understand human consciousness, thought and language without taking into account the mediation of cultural entities in the cognitive process of individuals; the already mentioned idea of human cognition being strongly dependent on sociocultural scaffoldings. In the absence of such cultural entities that scaffold our development such forms of cognition would not be available to us[50]. CHAT’s marxist or cultural-historical framing was part of a pervasive intellectual shift in the Soviet Union. From economy and social planning to formal sciences like symbolic logic and mathematics, a marxist framework was heavily employed (to varying degrees of success).

50 There is a debate about how to conceptualize this scaffolding. Some interpretations of Vygotsky suggest that once humans pass a certain developmental stage, we “internalize” the external structure of mediation in such a way that it becomes irrelevant or only causally relevant for the account of any given cognitive performance. Regardless of Vygotsky's position, I take linguistic skill to be conceptualized as habits; therefore, as metastable, self-sustaining networks of sensorimotor schemes that are constituted by the environmental features required for their enactment.. Therefore, linguistic skill is strongly dependent on a sociocultural environment.

There is work in philosophy and linguistics using such framing that predates Vygostky's use of it in psychology. The linguistic bodies' approach to language draws on work of such orientation, their views on the enactive character of language are in dialogue with the so-called “Bakhtin Circle”, specially the work of Bakhtin himself and Voloshinov’s *Marxism and the Philosophy of Language*. The Bakhtin Circle was a school of Soviet Russian thought which centered on the work of Mikhail Mikhailovich Bakhtin (1895-1975). Their main concerns were literary theory and criticism, ethics and philosophy of language. One of their major themes was how language is formed *dialogically* in material social interactions, and therefore is in many ways itself a register of the existing power asymmetries and conflicts between social groups (Brandist n.d.). Having dialogues as the model of linguistic social interactions and as the bases of language lead to a view of language not centered on language-as-system; *language as stream of living activity*:

> Language cannot properly be said to be handed down—it endures, but it endures as a continuous process of becoming. Individuals do not receive a ready-made language at all, rather, they enter upon the stream of verbal communication; indeed, only in this stream does their consciousness first begin to operate. (Voloshinov 1973, 81)

What I have been calling language-as-system is not something detached and independent from the ‘stream of verbal communication’ of communities of linguistic bodies, it is something in continuity with our living activity. The stream of verbal communication is one interesting way of conceptualizing languaging, the sense of language that I did not fully investigate in section 4.1. The metaphor of a stream highlights its nature as an ongoing process, this ongoing process being of verbal communication highlights their fundamentally communal or shared dimension. There are yet two problems with this account. The first is the emphasis in “verbal” communication, Voloshinov’s work was very much concerned with speech in a way that we don’t need to follow. The second is the notion of communication, that like the notion of information, is polysemic and often has representational undertones. We can understand languaging as the more broad ongoing communal activity of a community producing and interpreting utterances. One can even go back to the example of the Yamana people and gain a new understanding of the relation between language-as-system and languaging. The efforts of translation to a written language of the Yamana spoken language by the colonizers didn’t take into account that any effort of translation is a reification or objectification of an ongoing creative activity of communities making sense and meaning of the world together. This reification demands consensus, choices and negotiations that an anglican priest is unable to do as someone just entering the stream of living activity of the Yamana people[51]. According to LB, our beings are constantly languaging: producing and interpreting utterances.

51 Another aggravating factor is the strongly normative task of “salvation” that may have led to several coercive situations wherein the autonomy of the interactors was violated, generating a dissolution of the social interaction.

Utterances are not being conceptualized here in the typical way, the term does not refer only to sentences spoken or written in a particular language-as-system, or gestures in a sign language. All those cases can be utterances, but also many others actions, even refraining from action in the proper context can count as an utterance. The technical definition of utterance is 'A dialogic act, enacted asymmetrically through the actions of a mutually recognized producer and an audience' (Di Paolo, Cuffari, and De Jaegher 2018, 332). An utterance as whole action is a social act enacted as such not only by their producer, it may fail if the audience does not play an active role by engaging with the producer in the proper way. The acts of a producer become an utterance in interaction with an audience (what can be a back and forth of roles in a single agent, as seen below). Notice, moreover, utterances are not necessarily verbal. They are social acts, which also includes gestures, smiles, face expressions, intonations. Utterances are also usually directed to someone. The turn-taking nature of dialogues makes utterances have varying durations and structures, they can be quick gestures or long sequences of actions. They also have person-constituting powers: in incorporating utterances in your linguistic life you incorporate styles, voices, types of reasoning and values, they become to some extent your own. Utterances are not merely indicative subjective attitudes of the speakers (approval, disgust, assertion and so on), having what the authors call *pragmatic* and *expressive* aspects. Utterances are expressive in the sense that it reflects intentions and affects, they express such intentions and affects to all the participants in the dialogue, including the producer (you can be surprised by our own anger or distrust, expressed in the tone of our voice). The pragmatic aspects are the ones related to sustaining the coregulation of the interactive encounter, they serve individual and common goals. When we think of portable acts as portable acts we are emphasizing a pragmatic aspect of those acts. In concrete interaction utterances we have these both aspects intertwine and one aspect is not reduced to another, an audience can understand the pragmatics of an act (the communicated need for picking up a toy from the floor) without being sensitive to the affective tonality enacted (angry at the fact that the toys are always on the floor). In the dialogic organization of social interaction partial acts are recognized as particular to an agent's style, the way they act and move. Expressive aspects of utterances disclose the experience, motivational state and sometimes prior history of the producers, it is to navigate this double meaning of utterances that there is always the need for their *interpretation*. Production and interpretation of utterances are codefined, the production of an utterance

implies their interpretation. Utterances are always open to possibilities of meaning beyond their pragmatics.

The coupling by means of exchanges of utterances is only successful if both the producer and the audience are sensitive to the *participation genres* they are in. For instance: a seminar, a Zoom meeting and an encounter with a friend are material contexts that constraint the possibilities of interactions in a myriad of ways. In the last chapter I introduced the notion of habits being organized in clusters of activities or behavior genres. This notion can be expanded to all kinds of clustered sensorimotor networks, in this way participation genres relate to the practices and situated social norms that constitute the different kinds of social interaction (Di Paolo, Cuffari, and De Jaegher 2018: 179). In concrete activities, linguistic bodies transit on a spectrum of participation. More technically, participation genres refer to metastable, self-sustaining *social patterns* of interaction. Participation genres are potential frames that structure both utterance production and modes of audience participation available in dialogical interaction of communities of interactors. But to actively be considered participation genres they should not be ubiquitous or "universal". The capitalist mode of production and social reproduction is a sociomaterial constraint in perhaps all of our ways of participatory sense-making in the 21th century, but it makes more sense to say that it is a background condition than a genre in itself. On the other hand, participatory genres cannot be exclusive of some individuals, they are potentially shared by linguistic communities (even if only available to certain subset of members at any given time). Know-how takes center stage in this account in different ways. Know-how is clearly crucial for cases in which we need to adapt "on the fly" to new participation genres. Imagine a situation where you suddenly encounter a former partner in a social event and you need to decide how to engage—a light conversation, a more intimate talk or no conversation at all. Successfully adapting one's action in circumstances like these can only be done smoothly if one is well-versed in the relevant know-how. We also transit between participation genres effortlessly in many of our everyday interactions. One example is a phone call between colleagues that, after discussing work, becomes a social call. Topics of conversation, tone, vocabulary, expected duration, all that changes without the interactors losing the grip of the encounter. Nowhere in *Linguistic Bodies* the authors specify exactly what *know-how* is (for a commentary, see Carvalho 2021). I look into this question more carefully later, for the time being let's assume that know-how involves sensibilities for what 'feels right' in a given social encounter and the powers to act

accordingly. Know-how of participation genres helps the exercise of social agency in dialogic interaction but can create dissonances of its own. The present situation may be ambiguous concerning the participation genre best suited for it or an agent may be unable to successfully transition between genres in ongoing dialogue. In several situations we can have ‘failures in producing utterances consonant with the situation and audience support’ (Di Paolo, Cuffari, and De Jaegher 2018, 183) (misproduction of utterances) and ‘failures of interpretive sense-making where the utterances of participants are not clearly consonant with their expressed intentions, affective states, motives, and so on’ (ibid) (misinterpretation of utterances).

To avoid misinterpretation and misproduction we can engage in acts of mutual interpretation, where the interactors recursively interpret each other trying to lock in a participation genre, for instance. We can also try to self-interpret the utterances that we produce and in this way engage in a self-regulation of utterance production, to use our know-how not directly to the utterances of others, but to apply it to our own utterances. This is what the authors call *social self-control*. In this stage of the model we start to see how linguistic bodies develop skills to engage linguistically with themselves, what would explain inner speech and other "internal" linguistic capacities (that emerge in interaction with others but become part of our readiness-to-interact complex set of dispositions). In self-control, unlike self-regulation at the sensorimotor level, the norms to which we submit can be *displace* norms in two senses: they can be norms related to concerns beyond the here-and-now and can be norms that go against the immediate demands of individual normativity (of organismic and sensorimotor normativity). Being capable of assuming the role of producer and audience of our own utterances introduces yet another feature typically taken to be central to language, the *reflectivity* of language. What we have here is a description of sophisticated agents capable of metaregulation of their action. The metaregulation of action allows participants to create more stable pathways in dialogic interaction because makes possible reflection and repetition of one's own utterances and the utterances of others. Utterances can be taken as the focus of the interaction, as objects of mutual interpretation, we can then better grasp their expressive and pragmatic aspects, what is useful not only to the utterances of others, but in some cases is specially useful for understanding our own meaning making acts.

Utterances and participation genres frame dialogues but they are very elusive framings, it's not the case that they eliminate tensions and the possibility of dissonances. They are not random, what enables the acquisition of the community's shared know-how and successful interaction. With the introduction of the notions of social self-control and mutual interpretation we can understand how the community's shared know-how also includes utterances that refer to aspects of other utterances and even make use of those other utterances; those are *reported utterances* that 'echo, reflect, refract, or somehow make use of other utterances, the producer's own or those of others. A reported utterance documents, brings into the open, the producer's interpretation of the utterances it repeats or reflects' (Di Paolo, Cuffari, and De Jaegher 2018, 187). One of the features of dialogues is authorship, the dialogue turns have a clear regulator and regulated role attributed to the different participants at different stages. In reported utterances, however, we have the reenactment in new contexts of productions of the past. The current dialogue is modulated not only by the producer and audience of that dialogue, but also by the flow of dialogues of the past and how the producer interprets their relevance to the present moment. Reported utterances can be recursively used, sedimenting some shared meanings into a community. But with each reenactment those meanings can be slightly shifted due to the nature of utterances, social actions that involve active participation of producer and audience. Utterance production and interpretation are always creative acts, by recursive use of reported utterances we can broaden the participation genres wherein they operate and even create new participation genres. Through use of reported utterances we can redirect dialogues because their use brings forth past dialogues. Some reported utterances can unambiguously indicate a desired change to a particular participation genre, for instance. They also allow previous dialogues to be thematized and analyzed, in this way allowing revision and reframing of previous interactions and of broadly shared meanings. Our dialogues might also thematize other nondialogical forms of social interaction (the coach and the players analyzing the game after losing it), what makes those forms of interaction susceptible to transformation through mediation of dialogues. The processes of potentially transforming the shared know-how of the community (reported utterances, portable acts, participation genres and so on) by this revision and reframing of dialogues puts forward the final tension of LB's conceptualization of languaging: the tension between transforming one's mind and/or transforming social relations by enacting dialogues using reported utterances. The terms "linguistic bodies" and "linguistic agency" more

precisely refer to the ongoing and never finished embodied management of this tension. The linguistic bodies in dialogues, as described so far, are immersed in two distinct (but coupled) flows of activity: the dialogues themselves and their own individual flow of utterances in the activity of social self-control. They are distinct but are coupled because self-control is required for mutual interpretation and, therefore, crucial for skillfully navigating successful interaction. The self-control is not composed of individual or isolated utterances direct at oneself, it is a self-organized dialogue where the agent enacts the roles of producer and audience. If we assume the fuzzy boundaries provided by the enactive notion of individuation we see how at this level emerges a new form of autonomous closed organization, a new form of agency.

Similar to the domain of sensorimotor coupling with the environment, we saw briefly in this chapter how social agency meets the criteria for agency and now we can better grasp the notion of linguistic agency as a form of social agency. The processes of individuation in the case of linguistic agency are the social acts of dialogues, utterances. Utterances are acts, consequently, production and interpretation involve complex networks of sensorimotor schemes for dialogical coregulation. Also, in enactment and reenactment of utterances those networks of sensorimotor schemes develop and change. The development of the sensorimotor body is also the development of the intersubjective body, our development is one of habits to interact with others. We can go two steps further, our sedimentation of habits involves linguistic habituation and our linguistic habits can structure and modulate other habits that are not properly linguistic. In our human condition, language is central in how our dimensions of embodiment intertwine. Environments are always defined relative to a system, in this form of agency the environment amounts to the linguistic communities that we participate in and their material realities (writing systems, social institutions and so on). Normativity and asymmetry are features of dialogues that we discussed extensively. In using reported utterances, for example, we can strongly regulate dialogues and change the genre in which they occur. This is an exemplification of both normativity and asymmetry. In dialogical exchanges we are sensitive to and enact social norms and we do that to asymmetricaly modulate our coupling with the linguistic environment and direct the interaction in aimed trajectories. The linguistic agent is constituted by a flow of utterances. Some of those utterances are re-enactments of past utterances, those can be ancient and in many times are without something like an identified "original producer" or "original meaning". There is an ongoing process of *appropriation of utterances of others* in the processes of bodies becoming linguistic, this process is the *incorporation* of utterances of other linguistic agents into one's being. I mentioned early the person-constituting power of utterances, the topic now gains more precise meaning. In living with others we incorporate some of their utterances in our own linguistic flow and with that we incorporate beliefs, desires, styles of reasoning, voices, modes of expressing themselves, identities and a lot of others characteristics (the "others" here also includes others of the distant past and geographically distant locations made present in reported utterances). But obviously the process of incorporation is not random or automatic, is not all the experienced utterances that are incorporated. Incorporation occurs differentially due to factors such as relations of power, affiliations, affectivity with other participants,

sensorimotor habits, material conditions, health. The model always refers to linguistic bodies (plural) to emphasize: *every single linguistic agent contains a multitude of agencies made anew in a particular configuration*. In incorporation of utterances we have processes of assimilation and accommodation similar to what occurs in sensorimotor life where through processes of adaptation linguistic bodies coupled with their environment in challenging situations assume a trajectory back to a stable situation or develop a new reliable way of interacting. There are, however, two major differences in relation to sensorimotor life. First, the inherently social aspect of linguistic agency. All incorporated utterances are reflections of past incorporations, they are the creative and transformed endurance of the stream of living activity. The embodiment of language in a communal achievement. Secondly, sensorimotor life is open to the formation of different sensorimotor individual styles, the preferred organization of networks of sensorimotor schemes that is instantiated in each sensorimotor agent. Linguistic bodies are tremendously and radically more open.

Because utterances are dialogically structured by acts and people, they have embedded in themselves relations between people (remember Bakhtin circle's idea of language as registering power relations). As Di Paolo et al (2018) puts it: 'The traces of others (concretely experienced others and others entailed by wider community patterns) are not erasable from the processes that sustain the identity of a linguistic agent.' (193). To incorporate utterances we have to be open to *incarnate* others. Linguistic bodies necessarily open themselves to processes where they reenact dialogues with other agents, those not incorporated utterances of others gain an opening to possibly modulate their present and future interactions and an opening to be possibly incorporated. In self-directed utterances, the "virtual audience" can take the form of concrete others or of more abstract and yet specific kinds of producers and audiences with their own framings. One extreme example is the bracelets with the initials "W.W.J.D" (What Would Jesus Do?) used by some christians. There is what a follower of Christ of Nazareth should and should not do and sometimes that is not immediately clear to a devout. Trying to figure out what is the proper tone and style of academic writing, how lively it can be without being obnoxious is also another case where virtual dialogues are enacted and incarnation takes place. Linguistic bodies have a paradoxical existence where the acts of utterance incorporation constitute a linguistic agent, but incorporation entails incarnation of other linguistic agents, it entails letting yourself be constituted by gestures, personalities, motivations, affects, desires of others. Our existence as linguistic bodies cannot be

disentangled from other linguistic bodies. In the life of a linguistic agent it is very difficult to distinguish in acts of social self-control if our intention reflects an original intention or traces back to the intentions of others from which utterances we incorporated. Linguistic bodies live in an inherent tension between reasserting their current identity as a flow of structured utterances or opening themselves to the incarnation of foreign agencies embedded in those incorporated utterances. Humans alive today are linguistic bodies and the process of becoming linguistic bodies is inherently social, the mastering of our skills, be it linguistic or not, is heavily linked to our modes of sociality. Human linguistic bodies also embodied an unresolved tension between incorporation and incarnation of utterances. There is no superseding form of agency that regulates this tension. This walking contradiction is what we try mastering in daily activity.

4.4 The shared know-how of Languaging

In this section I revised the root senses of language previously mentioned in light of the linguistic bodies theory and explored the question of how know-how operates in it. First, we see how the objectification or reifiction of embodied know-how is at the basis of language-as-system. Secondly, I bring forward an account of linguistic knowing-how relying on the deflated notion of mastery employed in chapter 3. Since knowing-how is world-involving, some considerations about enlanguage environments are brought forward to further elucidate the notion of linguistic know-how.

I have outlined the linguistic bodies theory of language. The theory anchors language in the enduring activity of dialogical exchanges of communities in a transgenerational flow of living activity. The activity is the production and interpretation of utterances. Going back to Cummings's (2021) three root senses of language, LB may look like it is just an account of languaging. That is not the case. When the example of the Yamana people was brought back I already indicated how the theory connects languaging and language-as-system by pointing to the fact that community practices can be made into an object by well-situated community members. The objectivity of a mental attitude is often conceived as involving a referent state of affairs or propositional content to which a thought, assertion or claim must relate to. The mental states of the subject must correspond to the object in question for objectivity to be in

place. Objectivity is not understood in this way here. Shifting the focus to the interaction of agents, the linguistic bodies model allows us to see the emergence in being like us of an *objectifying attitude* that consists in 'the practice of regulating other practices and experiences in a mutually constraining relation with sociomaterial conditions' (Di Paolo, Cuffari, and De Jaegher 2018, 203). Being mutually constrained by each other enables us to bring practices under shared awareness, appreciation, scrutiny and other critical attitudes. Our utterances can be about other utterances, how to use and how not to use them. Obviously, the objectification of our practices impacts subsequent linguistic exchanges. We can jointly act as a result of jointly regarding our practices, we can make our doing a *thing* and make *things* based on our reified doing. A shared community of practices appears here as the basis of objectivity. The translation of the Yamana language to English now can be seen as lacking objectivity, the translators could not be regarded as full members of that community of linguistic practices, many of their choices of translation most likely reflect the community and the flow of activity to which they were first immersed. The contrast to ancient written languages elucidates once more; according to the linguistic bodies theory what happens when we translate and interpret the texts of those languages is the reenactment of those agencies, a dialogue with that mode of being of the past, their concerns, motivations, knowledge. It involves letting yourself be regulated by the sense-making activities of the past and that is possible because traces of their agency are literally materialized in what they left behind. There is an inescapable indeterminacy in this activity, but that is true of language as whole. Utterances are acts and therefore are subject to transformations and changes in every single instantiation.

Intentions, motivations, thoughts and other related mentalist terms should not be conceived as in-the-head of agents, but as acts in the world that might involve different materialities and leave in the world different traces of their agents. One often neglected aspect of language is that 'no symbol exists except as realised in sound, projected light, mechanical contact, or the like' (J. J. Gibson 1966, 26). But also neglected and sometimes even denied is the fact that materiality has traces of other agencies. There can be different levels of indeterminacy (univocity maybe only in symbolic logic), but rarely we find randomness. A dictionary or a grammar textbook are but one type of material manifestation of our collective skills of linguistic agency. Who's traces are made into objects is a very pertinent concern. Language is not representing 'absent targets', it's making others sense-making present. LB approach to language-as-system, therefore, considers that such systems are the reified result of our living

practices. Of course, this realization is not without consequences for our collective theorizing and intellectual practices of studying language. The realization demands of us an effort 'to retill earth so that it may be dwelled in anew.' (Di Paolo, Cuffari, and De Jaegher 2018, 280). It is not the case that we are able to "scale up" to our widespread understanding of grammar, semantics and written language. Distinctions between basic (non-linguistic) and higher-order cognitive abilities don't seem to be of much use according to LB's model. The linguistic bodies approach uses both scaling up and scaling down strategies for their particular conceiving of linguistic phenomena. But if the basis of language-as-system is the sensitivities and powers shared between members of linguistic communities (their shared know-how), then we should consider words, syntax and symbols in a manner that is different from our usual understanding. However, LB can be said to be in conversation and 'compatible with research that links grammar to a logic of practices, material structures and social relations' (ibid). A similar reflection is found in van den Herik (2022), where he argues from an ecological-enactive perspective against the need for a general theory of reference and against the common assumption that 'reference' is a explananda required for explanations of linguistic behavior. For him, language is at its core what he calls *co-action* and what is allowed by language is not the attaching of meaning to words (the typical mentalistic understanding of reference). What language enables us to do is to extend our current situation to attentional objects beyond the here-and-now (something very similar to what I describe in terms of 'making it present' in the paragraph above).

Let's continue the exploration of the theory with the concept of grammar because the enactive notion of *grammaticalizing* facilitates developing and advancing my overall goal of examining the role of know-how in language and linguistic cognition. Grammar is understood by academics in a myriad of ways. Chomsky (1957), for example, famously argues for the innateness of language by arguing that newborns are born knowing the most fundamental properties common to all natural languages, a 'Universal Grammar'. Learning a mother tongue would be the comparatively simple task of taking this antecedently possessed knowledge and elaborating it according to the stimuli of that newborn linguistic community. Typically, the most technical and theory neutral use of the term 'grammar' refers to standard rules of one specific language-as-system that constrain the formation of basic units of meaning (words, phrases and sentences). For this reason, the study of grammar usually relates more directly to the phonology, morphology and syntax of natural languages, the areas of

study that directly deal with such units. Linguistic agents well-versed in a language variety are commonly described as having effectively internalized the constraints or rules of a particular grammar. Even in the narrow sense of grammar there is an opening to enactive thinking. Grammatical learning is all about sensitivities and accompanying powers to act to be acquired in shared communities for *coregulation* of our activities. We don't need to assume an innateness to grammar in LB's model. The primordial tension of participatory sense-making shows the tension between individual and interactive norms and the regulating patterns that emerge from this tension. There is an unresolved tension between sedimentation and spontaneity in the linguistic bodies theory, first we explored the tension as it appears in social acts, as the necessity of navigating between partial acts and spontaneous acts (the soccer players example). We also saw the emergence of strongly regulatory acts that could be recursively used to modulate the interaction and that are portable to multiple interactive situations. We noted how the sedimentation looks more and more like our typical grammatical structures, now I can expand on that further. Regulatory partial acts sedimented into a community of interactors bring forward virtual relations. In the shared know-how of that community of interactors we find a '*living embodied grammar*' (Di Paolo, Cuffari, and De Jaegher 2018, 283), shared know-how that is not reduced to the know-how of the participants. We have *a way we interact here* that does not need to and indeed often is not explicitly recognized by all the participants.

The mutual accommodation of repertories and the normative regulation of interactive encounters dynamically organize as the tension between incorporation and incarnation. Sedimentation of enduring know-how is a crucial operative aspect of the theory. The navigation between participation genres in dialogical interaction, for instance, requires utterance self-interpretation, employing the know-how not to the utterances of others, but to our own. This metaregulation of mutual interpretation and social self-control allows participants to create more stable ways of directing the trajectories of dialogic interaction because it makes possible utterances' reflection and repetition. The rules constraining the formation of meaningful linguistic units are not something external to be internalized by agents, but are anchored in the concrete exchange of utterances. Regularities and rules for linguistic behavior emerge from this history of interactions: 'Grammar gets sedimented as reusable solutions to coordination problems in dialogic practices' (Di Paolo, Cuffari, and De Jaegher 2018, 288). The grammatical rules studied by linguistics and philosophers of

language are the objectification of sedimented know-how shared by members of a linguistic community. The shared know-how of emergent grammar is also crucial to understand our sensorimotor development. Skills like knitting, preparing a recipe, fixing a roof, playing sports, are all facilitated by the organization of action provided by learning grammatically structured practices, the '*embodied know-how for conjugating complex sequences of sensorimotor schemes is learned in participation'* (Di Paolo, Cuffari, and De Jaegher 2018, 292, italics added). There is a 'grammar' for meaning making activities involving complex sequences of sensorimotor schemes, a grammar of cooking, a grammar of carpentry and so on. What we usually classify as linguistic behavior is not the only grammatical behavior, a more broad conception of grammar as grammaticalizing proves itself useful for the articulation of the mutual coupling or entanglement between linguistic bodies and their sensorimotor lives[52].

But how and what is mastering grammars? One of the main ideas captured by the notion of mastery is the ongoing effort by agents to maintain relative control over their own circumstances. In chapter 3 I argued that mastery not only involves know-how, mastery is the acquisition and (re)organization of know-how, where know-how is understood as the enabling bodily power (or capabilities) and sensitivities for reliable success of the agent's action. In the intersubjective domain of interaction these powers and sensitivities are for the jointly enactment of sensorimotor patterns, a very precarious situation where the success of the agent's action, their relative control, is dependent on others. The social agency that bodies display in social interaction is the navigation between two types of normativities, the individual sense-making of each participant and the patterns that emerge in the interactive dynamics (interactional autonomy). Developmentally, we are always learning how to act with others, how to enact joint sensorimotor schemes related to social interaction. One aspect of this developmental process is the acquisition of know-how pertaining to interactive situations, this know-how is shared by a community of participants with a shared history of encounters,

52 LB suggests that a better word for language is 'languaging' to emphasize the fundamental connection between language and our doing. The same move is suggested for linguistic categories like grammar, being better understood as 'grammaticalizing', symbol as 'symbolizing', reference as 'referencing' and so on. I prefer to adopt a vocabulary that recognizes both the structuring person-constituting practices from which reified abstract structures emerge and the practices themselves. For this reason in this chapter I incorporated Cummins's (2021) distinction between three root senses of language. The distinction captures and allows precise examination of the most fundamental features of languaging according to LB: the social and communal aspect of language (their social enactment and embodiment); the connection between language and becoming (personhood, selfhood and identity); and how we get to "language as we know it" or language-as-system by objectifying processes

the know-how also quite literally changes the individual participant, where they increasingly project expectations about their interactions based on the new acquired sensitivities and powers for interaction. The becoming of social agents is tightly connected to the participation in communities. This process of learning to interact with others is never finished; it is the ongoing process of becoming linguistic bodies.

In any community of interactors there is an inherent tension between assuming a regulatory role or a regulated role. Dialogues are a form of interactive organization available to interactors that regularly interact that enables allocation of contextual roles among participants in interaction. Dialogues have turns, periods of time where one participant asymmetrically directs the trajectories of the sense-making activity of others who accept and support the arrangement. All forms of sense-making (including linguistic) 'requires by definition both *sensitivity* to and *regulation* of the virtual field of possibilities' (Di Paolo, Buhrmann, and Barandiaran 2017, 229). In the case of linguistic bodies, both sensitivity and regulation have an inescapable social dimension 'At behavioral timescales, languaging is one form of participatory sense-making that becomes ever more dominant with increasing participation in a linguistic community' (Di Paolo, Cuffari, and De Jaegher 2018, 217). From an epistemic standpoint, that amounts to acquiring and changing shared linguistic practices. It requires shared know-how. The acquisition of shared know-how is already present in situations like the previously explored social honing of babies' skillful attention to faces. Similar to sensorimotor development, the becoming of linguistic bodies can be seen as a learning (acquiring know-how) that unfolds in time without an identifiable initial moment. Therefore, contemporary humans are such that 'children even at or before birth, experience full linguistic engagement' (Di Paolo, Cuffari, and De Jaegher 2018, 258). Another significant reason for that is that linguistic environments and linguistic bodies are co-constituted in the social interactions of languaging (especially when we consider transgenerational timescales). The practices of participatory sense-making framed by linguistic communities constitute linguistic bodies and in turn the activities of linguistic bodies constitute the linguistic communities. This navigation is shaping and being shaped by the enlanguage environment, which is what allows talk of co-constitution. Since my account of mastery is world-involving, let's examine more attentively the enlanguage environment we navigate. Several questions emerge from this model regarding it, concerns about how to give better fine-tuned

descriptions and about who participates in such environments (only humans, not our pets?[53]). Another set of questions regards when did languaging come to be a reality and how? Was it a transition that happened suddenly (natural history as the timeframe of reference), or was it a gradual process that led to an activity that is only present in contemporary humans? Some of these questions are addressed by the theory, some are left unanswered.

LB's model of language and linguistic cognition provided brings forward a conceptual continuity between life and language, but as Gastelum (2020) correctly points out, LB does not engage in evolutionary reflection or considers a natural history approach to such continuity. It relies mostly on a view of the organism and its relations with the environment as the source of different domains of interaction and novel forms of cognition. The only diachronic timescale examined is individual development. But why narratives about larger transgenerational timescales are necessary in the first place? If we are historically constituted linguistic bodies, we need to be able to tell that history, and this involves considering larger transgenerational scales (as well the developmental one). For contrast, Maturana and Varela's (1987) account of languaging and the linguistic domain that we inhabit does consider the hypothetical role of some facts of our natural history. They consider the possible connections between bipedalism[54], the groupings containing adult males, adult females and children living together and changes in the reproductive cycles of females as possible contributors for the increasingly sophisticated forms of social coordination that lead to languaging in animals of

53 The authors put forward the hypothesis that the difference between humans and other animals we engage linguistic with, like our pets, is that while other animals can be linguistically '*invited* into participating in human linguistic communities' (Di Paolo, Cuffari, and De Jaegher 2018, 259) and respond in interesting ways to such invitations, contrary to ours, their 'becoming does not *necessitate* the sociohistorical engagements' (ibid).

54 Bipedalism is a feature of our ancestors that goes back 3.5 million years (our last common ancestor with chimpanzees dates back to about 7 million years). One fascinating fact about it is how it changes childbirth and childcare (DeSilva 2021). Bipedalism leads to changes in the hominid's pelvis, which constrain possible head size (and brain size) of offspring and makes babies in the majority of cases born head first in a process involving a rotational motion in the birth canal (Stansfield et al. 2021). It is a dangerous idea for the birthing person to help the baby out. Their help does risk breaking or damaging the baby's neck. The most safe mode of assistance is relying on others. Childbirth and Childcare differences are also noticeable in comparison with chimpanzees. A chimpanzee birth does not involve the aforementioned rotation, which makes relying on others less essential. The birth happens usually at night with the birthing chimpanzee in isolation from their group. In the case of the newborn chimpanzee, the infant stays attached to the mother's back in the first six months of life, having virtually no direct contact with other adults of the species. Due to anatomical differences on the toes that increase our ability to walk on two feet and the lack of hair on the back of hominids, the mode of early childcare of chimpanzees (and probably similar to the one of their ancestors dating back 3.5 million years) was not possible to our ancestors of, say, two or three million years ago. The current hypothesis is that, unlike chimpanzees and their ancestors from the same period, childbirth and childcare in the first months of life was shared between the community of adult hominids dating back millions of years. For these reasons bipedalism is quite possibly another driver for increased sociality.

the hominids line. Humans are the only hominid species alive today, which leads us sometimes to see ourselves as special and apart from nature, but that is not the case. There is evidence that suggests that at least one other hominid, Neanderthals, had complex coordination behavior. They made jewelry, painted caves and could accomplish complex multistep tasks that took preparations of several days (they made birch tar and used to craft tools) (Niekus et al. 2019). Beyond a conceptual continuity between life and language, a natural history and evolutionary narrative would help us with truly understanding our place in the living world. LB doesn't provide such a narrative. It is hard to know what it was like to be human 200.000 years ago or even 40.000 years ago. But their experiences led to us. If they were like us in a substantial way they also lived in a enlanguage environment, even if very different from ours under some aspects (one can remember the changes resulting from the printing press or the popularization of the Internet). Their children would also be in a full linguistic engagement situation. But if they were not like us in the relevant way and the linguistic bodies theory is an appropriated account of language, somehow their collective activities of making sense transformed into the navigation of the primordial tension of participatory sense-making in dialogical contexts characteristic of us[55].

In discussing sensorimotor lives in the previous chapter I first approach perceptual learning and then move to the perception of "very learnt" agents. One can proceed similarly here, but with extreme caution. The first caution is to not adopt a default uniform monolingual middle-class approach to linguistic development. In many countries people live in multilingual communities, throughout human history that was also very common and only changed drastically with the rise of the nation Estate and its official languages. Even communities that are not multilingual *per se* can have members participating in several linguistic varieties or linguistic subgroups. One example is the phenomena of code-mixing, the spontaneous use of two or more languages or dialects in conversation. Some forms of code-mixing can even sediment into a dialect. One example of code-mixing that is also a dialect is *pajubá*, originally a cryptolect or secret language used by both the candomblé (an afro-brazilian religion) and the LGBTQ communities, the dialect mixes brazilian portuguese and african languages like and Umbundu, Kimbundu, Kikongo, Egbá, Ewe, Fon and Yoruba. It also includes words

55 Another possible ally in the exploration of the enlanguage environment is the Skilled Intentionality Framework (SIF) (Rietveld, Denys, and van Westen 2018; Kiverstein and Rietveld 2021).When scaling-up their framework to language, Kiverstein and Rietveld (2021) recognized a similarity language as participatory sense-making (see fn. 1).

borrowed from Spanish, French, and English and when used by trans people and *travestis* (a transgender identity from Latin America) usually accompanies an exaggerated and unmistakably queer body language and tone (Aquino 2014). The idiosyncrasies of linguistic bodies is the norm in linguistic development, not the exception. One of the chapters of *Linguistic Bodies* applies the theory to autistic linguistic bodies, a type of linguistic agency often neglected. I would not discuss this application here. Suffice to say that autistic linguistic bodies are as idiosyncratic as any other type. Types of literacy and vocabularies vary quite substantially in the same community of people, some reasons for heterogeneity are economic wealth, family history, formal education and chosen profession. It is not uncommon to incorporate in daily life a vocabulary relative to an expertise and an "institutional culture"—a way we do things in this professional setting, or the vocabulary of the religious group one is part of. The particularities of linguistic environments are not 'noise' that prevent the internalization of external rules belonging to the "official" language-as-system, they are crucial because it is in being responsive to these particularities that individuals learn what it means to be a participant in those communities. This learning process of how to be a participant in a community is never finished, one is always becoming a member of communities, be it conforming or transforming them. People always engage in participatory activities of constructions of new mediations and novel participatory arrangements, resulting in distinct forms of collaboration. There is not only a diversity of communities where linguistic bodies navegate, but also a boundless diversity of personal *linguistic styles* from which to engage with them. The second caution with "very learnt" linguistic agents connects directly with the diversity of linguistic styles and communities. The becoming of linguistic bodies is never fully achieved. The questions of language acquisition are not simply about how individuals learn a series of skills in a flow of experiences. In this sense, there is no "very learnt" linguistic agent, only more and less mature relative to some frame of evaluation. One adult learning a new language-as-system is not more mature than a child born into a community that speaks that language from the perspective of vocabulary and combinatorial-expressive capacities. But the same adult might be more attune to some non-verbal social cues in the interactions of other adults about topics to which the child has no experience. The cues are also part of languaging exchanges, there is a frame in which the adult is more mature than the child.

Due to the similarities between linguistic agency and sensorimotor agency, *languaging can be understood as a type of mastery or knowing-how where one is acquiring and (re)organizing dialogical shared know-how*. This is the novel contribution of the current chapter, an elucidation of what is the shared know-how of languaging. The process of becoming a linguistic body is the learning of the shared know-how which pertains to the linguistic communities one is in. However, the possibilities of linguistic interaction are always expanding, so both linguistic bodies and linguistic communities are dynamic and open-ended processes of becoming. Like organisms and environments, they are codependent and they co-evolve over time. Novels utterances and participation genres (larger metastable sociomaterial patterns) are bound to happen given the "life of its own" which is inherent to social interactions. Consequently, the shared know-how of linguistic interactions is not reduced to the sum of the know-how of the participants in at least two senses. First, in several concrete cases of interaction (like the football match example) no individual agent strongly regulates the interaction alone, so the shared know-how mobilized in it is not reducible to each participants' know-how. Secondly, and more generally, since always we are becoming linguistic bodies and, in this process, not only we become members of linguistic communities, but also transform them in turn, the shared know-how of different linguistic communities is in ongoing processes of change and therefore cannot be reduce to the know-how of the participants. As it was highlighted in the previous chapters, agency is rigorously relational, it is inappropriate to say that bodies possess agency and predicating habits, competence or skills to an organism must be taken as a shorthand for the enabling bodily conditions for concrete enactment of sensorimotor schemes. Being consistent, the same applies to linguistic agency. Therefore, we must understand the know-how of a linguistic agent as the enabling bodily conditions to the concrete enactment of sensorimotor schemes involved in utterance production and interpretation in dialogical contexts. Since utterance production and interpretation are social acts, those bodily enabling conditions are necessarily connected to a responsiveness to others. In the sensorimotor domain the know-how we "possess" are the powers and sensitivities related to how certain movements will induce certain sensory changes. In languaging the know-how has to be constructed as sensitivities for what 'feels right' in a given dialogical encounter and the powers to act accordingly. Linguistic know-how is the sensitivities and powers related to how some forms of dialogical action will maintain the synergy between individual and interactional autonomy. In the linguistic domain that

includes sensitivities to participation genres and the ongoing navigation between incorporation and incarnation of utterances. But in many concrete circumstances the agent cannot avoid, recover and overcome unexpected breakdowns and disruptions alone due the social nature of this cognitive performance. What is true of both participatory sense-making in general and of linguistic sense-making in particular. Linguistic mastery is therefore much more precarious than sensorimotor mastery. It includes sensorimotor schemes that are jointly enacted and sensorimotor patterns that are but one aspect of shared practices that are collectively enacted (other aspects include sensorimotor patterns of other agents and features of the enlanguage environment). In social interaction the know-how of each participant is crucial for its successful unfolding, which in turn affects how social agents enact their respective parts. In linguistic knowing-how, acquisition and reorganization of powers and sensitivities to the situation of social interaction is one where 'there is no completely independent social agent, nor a single individual regulating alone the social interaction, the social agency and the shared know-how must be in some way anchored in the participant's skills without being reducible to them' (Carvalho, 2021). In other words, the ongoing interplay of social agents regulates the dynamics of their social acts in ways that are not reducible to the know-how of each participant individually. In the case of languaging, this is well captured by the idea of an enduring stream of meaningful activity wherein we participate. We join a language as much as we make a language. I also proposed that know-how rests on reliable or stable success. In languaging what guarantees this condition is the relation between shared know-how and linguistic communities. It follows from LB's account that an individual linguistic agent can only be a linguistic agent in a community with shared practices. There is a paradigm shift here, the broader category of analysis of language and linguistic cognition in this enactive framework is the different groups of agents co-regulating their sense-making and its different linguistic practices, i.e., the linguistic bodies that we have been referring to collectively as a linguistic community. Languaging in this approach is not something simply handed down from one generation to another, it is a shared set of paradigmatic actions that endures in a process of continuous transformation. But which sets of paradigmatic actions end up resisting the test of time? At least a significant part of the enduring ones are those that afford reliable successes in the coregulation of the members of the linguistic community.

4.5 Knowing-how to language

In this chapter I argued for an account of language where shared know-how is at its core. To do that I first examined the three root senses of language identified by Cummins (2021), languages-as-systems, languaging and ~~language~~. I then looked closely at the linguistic bodies theory of language. At first, the theory looks like an account only of languaging, but that is not the case. Languaging precedes the other two senses not only temporarily, but also conceptually, that is the major takeaway. LB does account for the emergence of languages-as-systems with the idea of objectifying attitudes and for the relations between language and identity with the notion of the person-constituting aspect of utterances. ~~Language~~ is the most elusive aspect of language because it points to the connection between language acquisition and the formation of identities. A particular language can be characteristic of a people insofar as becoming them is acquiring that language. The model explains how coregulation creates ever-growing sets of local pragmatics. Geographical proximity and isolation from other groups, as well as behaviors and shared history can contribute to the creation of a precarious identity tied to particular forms of linguistic agency. Both *Pajubá* and Yamana are in a continuum that includes all languages. The same continuum explains code-mixing and linguistic phenomena related to linguistic interaction sensitive to groups' dynamics. LGBTs (specially *travestis*) from Brazil and the indigenous people of Tierra del Fuego, in different circumstances and moments in time, created "the way we do things here", which included highly specialized ways of interacting with one another and with the potential other, forming a distinctive group identity. But such distinctiveness is dependent on factors such as the actual existence and reinforcement of the difference between members and non-members of a community, the distinction maybe be based on more directly linguistic features (as the capacity for production and interpretation of certain phonemes in the Yamana speech) or on aspects such as sexuality, place of origin, race, hierarchical social organization, class or gender identity. In most cases it is a combination of multiple intersecting factors. Language-as-system and ~~Language~~ are aspects that could and should be better explored by developments of the theory.

My focus here was the role of know-how in general, and shared know-how in particular, in the enactive account of language and linguistic cognition. I emphasized the role of know-how in several of the steps of the theoretical model of languaging. Not necessarily optimal, cognition is the adaptation of a precarious agent to an always changing environment. In a

dynamical description, cognition is the skillful transition between states, the different trajectories and attractor landscapes the system finds itself in due to their own activity. Cognition being what it is, it rests on know-how. Linguistic cognition is a type of social cognition and we are social creatures all the way down. The study of babies' "innate" interest in human faces illustrates how inherently social our becoming is. The more "built in" capacities of a human being require a process of honing that happens in a social context, human cognition has an irreducible participatory dimension. The life cycle of humans typically happens within linguistic communities. Our becoming is also linguistic. The skillful and not always optimal trajectories of linguistic bodies are precarious solutions to the never fully resolved tension between individual and social normativity, as it develops into the tension between incorporation and incarnation of utterances in dialogical contexts. The know-how of a linguistic agent is the enabling bodily processes and structures to the concrete enactment of sensorimotor schemes involved in utterance production and interpretation in dialogical contexts. Know-how that was originally applied to particular contexts of interaction is increasingly shared by the members of proportionally enlarged groups. The process of the sedimentation of practices and development of sensitivities and powers (capacities) for appropriate social interaction organize themselves into dialogues, creating community-sanctioned contextual roles among participants. Sedimentation of enduring know-how is crucial for facilitation and improvement of the reiterated interactions. Shared know-how is also crucial to understand our sensorimotor development. Dancing, camping, playing soccer are grounded in know-how for conjugating complex sequences of sensorimotor schemes learned in dialogues. In linguistic knowing we have the acquisition and reorganization of powers and sensitivities to the dialogical situations in ways not reducible to the know-how of each participant individually. A shared set of paradigmatic actions endures in a process of continuous transformation. Linguistic know-how is how we skillfully maintain the synergy between individual and interactional autonomy, joining and making community in the process. I also showed that knowing-how to language is an unfinished continuous process that can never result in fully developed experts. Contemporary humans are "since always" in a situation of full linguistic engagement, but the multiple linguistic flows and communities that co-constitute linguistic bodies and those flows and communities are inherently messy. Knowing-how to language is knowing-how to be in dialogue with plural (constituted by many agencies, real and presumed from community patterns) and idiosyncratic (combined in unique

and always changing linguistic styles) identities while being both yourself. Idiosyncrasy and plurality are the norms in linguistic becoming. Concrete human bodies are the way they are because of it, not apart from it.

5. Knowing-how: an action-first enactive epistemology

In traditional cognitive psychology, knowledge is a mental thing*, like an encyclopedia on the shelf. When faced with a task, one pulls the appropriate volume off the shelf and then brings that information to bear on the task at hand. This traditional framework is replete with dualities: structure vs. process, long-term memory vs. working memory, competence vs. performance. Our view of knowledge as dynamic activity does away with all these theoretical dichotomies…*
Thelen and Smith, 1994

In the Introduction (chapter 1) I said I was after the underlying naturalization of epistemology tacitly present in the Enactive Approach. Highlighting aspects of cognition and know-how argued for in the previous chapters and expanding on them is what I do to present to the reader an enactive action-first epistemology where knowledge is relational all the way through. Knowing, I argue, is perspectival, historically situated, and intertwined with affect. Section 5.1 looks briefly at the post-theory of knowledge epistemology to point to the different directions epistemology can go beyond the conceptual analysis of knowledge. Section 5.2 explores the idea of an action-first approach and finds its roots in William James' radical empiricism. Section 5.3 explores how an enactive action-first epistemology understands the relation between knowing and development, emphasizing how knowing-how is historically situated and how it is intertwined with some developmental processes. Section 5.4 explores Hanne de Jaegher's (2021) account of human knowing as a sophisticated form of interactive know-how, where skillful or knowledgeable interaction between knower and known rests on an open-ended relation of *letting be* (Maclaren 2002). Section 5.5 argues for affectivity in knowing; affectivity and knowing are always intertwined and one is mistaken to think this is a problem, there are demonstrable ways in which affect (emotions such as care and love) boosts knowing.

5.1 Post-Theory of knowledge epistemology

Epistemology in an analytical philosophy tradition in the 20th century was, for the most part, the conceptual analysis of knowledge or a philosophical *theory of knowledge*. The concern of most authors was boundary demarcation, it was specifically in finding a threshold separating knowledge from mere true belief[56]. Enactive epistemology is not a theory of knowledge, it has

56 A definitional approach to knowledge was not always the way to go in philosophy. According to Pasnau (2013): 'the overriding focus of epistemologists over the centuries has been, first, to describe the epistemic ideal that human beings might hope to achieve, and then go on to chart the various ways in which we ordinarily fall

some similarities and points of intersection with virtue epistemology, standpoint theory and feminist epistemology. In this section I show the reader some alternatives in epistemology to the conceptual analysis of knowledge. But the more direct theoretical kinship of enactive epistemology is with other action-first approaches, so I look into them in section 5.2.

A move away from epistemology as theory of knowledge has been happening in different directions in philosophy. The knowledge-first account brings (Williamson 2000; 2022) theory of knowledge closer to reflections about the nature of the mind, even if still in an intellectualist framework[57]. Social epistemology is also a departure from more traditional epistemology, the conceptual analysis of knowledge is supplemented by reflections about social dynamics[58]. Another distancing is made when one shifts the attention to epistemic agents, communities, and the subjectivity possibly present in knowledge. In feminist epistemology, Code (1993) is a good example. Her assessment is that attempts to find the necessary and sufficient conditions to "S knows that p" have traditionally been too narrow, they hastily neglected how knowledge is produced by significantly distinct cognitive agents embedded in significantly distinct social practices and social groups. The identity, interests and circumstances (i.e, the subjectivity) of epistemic agents matters. She argues against 'ideals of pure objectivity and value-neutrality' (Code 1993, 16). Her view

off from that ideal' (987). What philosophers did was to first describe the ideal knowledgeable situation one can find oneself in, and then examine the reasons why agents fall short of the ideal. Less concerned with the precise boundary between true beliefs and knowledge, such epistemology draws on other normative domains for an account of 'the ideal epistemic position for a human being, given the powers we have available to us and the kind of world we live in' (Pasnau 2013, 989). Idealized epistemologies do have substantial theoretical commitments, but the primary function of their theorizing would be to present ideals capable of guiding knowers to better epistemic positions. The grounds for the guiding recommendations are reflections coming from other normative domains (philosophy of mind, ontology, ethics), those domains are intertwined with knowledge. An enactive epistemology also assumes that other normative domains intertwine with knowledge, it is developed from a perspective on the human being, the powers we have and the world we live in. The differences are a closer connection to other academic disciplines and the refusal of fixed and static epistemic ideals; it rather focuses on the improvement of our ongoing engagement with the world.

57 Knowledge would be a basic mental state not reduced to other components. Williamson's knowledge-first approach is a form of intellectualism: 'knowing-how is a kind of knowing-that' (Williamson 2022, 478). Knowledge (not belief) is the good case for mind-to-world direction of fit. In this mental state, the mind accurately represents the world. The mental state characterized by the good fit between mind and world is mobilized in diverse ways when the direction is the other way around (in action, desires' formation, performance of a skill). For the intellectualist account of knowledge in skill, see (Pavese and Beddor 2022; Stanley 2015).

58 Social epistemology concerns itself with both positive and negative epistemic roles of social factors. Specific social interactions and social structures might pose threats to knowledge acquisition and transmission. Conversely, the right kinds of social organizations and institutions may enhance our prospects of knowing and understanding. Inquiry into how collective agents (juries, panels of experts, business corporations) make knowledge claims and justify them, and reflections about how to identify reliable experts are examples of discussions on social epistemology. See (Goldman and O'Connor 2021).

'requires epistemologists to pay as much attention to the nature and situation—the location—of S as they commonly pay to the content of p' (ibid, 20). Against the fact/value distinction and a "view from nowhere" (Haraway 1988), feminist epistemologies also move away from theory of knowledge in arguing for the deep implausibility of epistemological individualism (see also Longino 1990). Knowledge cannot be exhaustively understood as 'the mental activity of individual knowers grasping the one objective truth' (Addelson and Potter 1991, 12). For instance, Nelson (1993) argues for the recentering of epistemology from epistemic agents to epistemic communities: 'communities are the primary loci—the primary generators, repositories, holders, and acquirers—of knowledge' (124). The claim is not that individuals do not know, but that their knowledge is strongly dependent on a coherent and recoverable account of their experiences that rely on publicly shared conceptual schemes, methods of inquiry, theories and standards of evaluation[59]. The knowledge that "I" have is derivative of some "we" I participated in. Knowledge acquisition is mostly a social process, making trust in one's community epistemically relevant. I'm highlighting these tenets of feminist epistemology because the action-first account of knowing I provide in the next sections goes in the same direction. The main intersection between the approaches is the deep reconceptualization of the knowing subject. Those diverse epistemologies arrive from different arguments in similar accounts of the situatedness and historicity of knowers. The topic of situatedness is also the core of standpoint epistemology. According to Toole, standpoint theorists claim that '*social identity* is a central feature in assessing the epistemic status of an agent' (2021, 338). A task central to epistemology should be the explanation of the relation between a standpoint and the knowledge the standpoint makes available. Notice the standpoint is not individual, but pertains to a social identity. But the standpoint is an *achieved* epistemic position, being of a social group is a necessary but not sufficient condition for it. Standpoints are developed through a process labeled consciousness-raising (Wylie 2004), which involves increased sensitivity and comprehension of one's own material and social conditions. The realization of one's positionality in broader culture patterns and social structures makes new ways of interpreting one's experiences and engaging with the world available. The basic idea is that struggles for emancipation can lead to the creation of publicly shareable conceptual schemes devoid of some of the domination-enabling underlying

59 Who creates the conceptual schemes, methods of inquiry, theories and standards of evaluation and why they do it influences their content. The lack of participation of oppressed groups reinforces their oppression and creates a self-image of the oppressed in the terms made available by the oppressor.

assumptions of currently shared conceptual schemes[60]. I show in section 5.5 how love is a helpful affect in the collective construction of conceptual schemes potentially free from the shackles of domination.

The last deviation from theory of knowledge I would like to discuss in this section is virtue epistemology. Virtue epistemology also put primary focus on epistemic agents and communities rather than on the conceptual analysis of knowledge, vindicating the primary role of intellectual virtues[61] on improving one's epistemic position or intellectual well-being. But virtue epistemology is divided between two main approaches, those that ground epistemic virtues in human faculties like reliable memory, perception and attention and those that ground them on character traits like intellectual humility, perseverance and open-mindedness. The first group is the reliabilists and the second one the responsibilists. The two approaches are somewhat compatible, one could see the two kinds of virtues as two distinct contributions to intellectual flourishing, excellency in skills and excellency in character traits contribute to truth, understanding and wisdom. One possible misconception about virtue epistemology is that it is individualistic, it focuses on abilities or character traits of individual agents. I'm going to follow Candiotto's account on the topic: 'epistemic agency, … is by definition embedded within the social dimensions of our interactions with the world.' (2019, 240). Just like our everyday perception, cognitive virtues' acquisition is socially enabled, even if most of the virtues in questions are enacted individually. Since I'm going to discuss the argument that love is an intellectual virtue in the responsibilist sense (Carvalho and Andrade 2022) in section 5.5, it is important to elucidate what are intellectual virtues for responsibilism: 'a virtue is … an acquired excellence of the person in a deep and lasting sense … the more enduring of a person's qualities, and they come closer to defining who the person is than any other category of qualities' (Zagzebski 1996, 135). Cognitive virtues are closely related to one's own idiosyncratic style as a human knower. Human knowers have particular character and personality traits beyond abilities like perception and memory. Those idiosyncratic traits

60 There is yet an even more contentious claim in standpoint epistemology: knowledge coming from marginalized standpoints is epistemically better positioned than knowledge coming from the dominant one (see Kukla 2006). Marginalized standpoints are more objective. Toole summarizes the position as: 'those who occupy marginalized positions must possess greater epistemic resources – those needed for knowing the social world from the dominant perspective *and* those needed for knowing the world from their own marginalized perspective' (2021, 343). The oppressed has a vantage point of view, specially in subjects related to oppression. The classical example is the argument that black women inhabit a social position that makes available to them privileged access to understanding the contradictions of race and gender (hooks 1984).

61 "Intellectual", "epistemic" and "cognitive", as qualifications of virtues, are used as synonyms in the literature. I will also use the three interchangeably when talking about virtues.

can be beneficial (virtues) or inimical (vices) to improving one's epistemic situation. One can also talk of virtuous communities, communities where most agents are virtuous and virtue is incentivized. In the next section I advance further considerations about the role of real-life experiences on knowing through the work of William James and show how the primary of action becomes a primacy of knowing-how in an enactive epistemology.

5.2 Action-first approaches — from radical empiricism to the enactive understanding of the primacy of knowing

An action-first approach to knowledge would be one that takes the primacy of action referred to in chapter 3 as the refocusing of perceptual research away from sensors' stimulation and brain-centric research to the study of complex, dynamic and emergent interactive patterns between sensing and movement in the environment and generalizes it to knowing in any domain. Action-first approaches are much more process-oriented than theory of knowledge. They focus on the interplay between how acting in the world shapes our knowing and how knowing shapes our acting and the world in which we act. Rather than a thing, knowledge is understood as an unfolding process. Having significant differences among themselves, action-first approaches include Pragmatism, Ecological Psychology, Carvalho's actionist account of the justificational role of perceptual experience (2016), Thelen and Smith's (1994) dynamical approach to cognition and action, Chemero's ecological dynamics (2009), enactivism in general and the Enactive Approach in particular. Rączaszek-Leonardi and Zubek (2022) put the philosophical foundations of action-first approaches in William James' radical empiricism. To understand why, one can look at his account of the interwovenness of what he calls percepts and concepts:

> 'Things' are known to us by our senses, and are called 'presentations' by some authors, to distinguish them from the ideas or 'representations' which we may have when our senses are closed. I myself have grown accustomed to the words 'percept' and 'concept' in treating of the contrast, *but concepts flow out of percepts and into them again*, they are so interlaced, and *our life rests on them* so inter-changeably and undiscriminatingly, that it is often difficult to impart quickly to beginners a clear notion of the difference meant (James 1987, 1007)

James does not deny the difference between what he also describes as the immediate flow of conscious life and the mediating resulting from conception (concepts' production) as an act:

‘The great difference between percepts and concepts is that percepts are continuous and concepts are discrete’ (ibid). He claims that concepts have single and discrete meanings while percepts would mean nothing in the sense that they immediately are what they are, no mediation required. Radical empiricism’s approach to meaning is very similar to REC’s account of content as semantic content (satisfaction or correctness conditions). For James, we categorize parts of lived experience in discrete and distinct classifications, one can think of concepts as providing something close to necessary and sufficient conditions to be satisfied by different percepts or other concepts in the case of more theoretical and abstract concepts. Those conceptual carvings are abstractions in the sense that they select some features while ignoring others, giving order to the ‘big blooming buzzing confusion’ (James 1987, 1008) of perceptual influx. Concepts are what is abstracted and expressed in words like “beach”, “night”, “pride”, “verbose” and so on.

Nonetheless, James goes further than RECers in accounting for the relation between what nowadays would be called basic and higher-order cognitive abilities. Percepts and concepts are mutually enabling and constraining of each other, they ‘interpenetrate and melt together, impregnate and fertilize each other. Neither, taken alone, knows reality in its completeness. We need them both, as we need both our legs to walk with.’ (ibid, 1010). The same way that he marks a distinction, he also points to their interwovenness. Perceptual knowledge and conceptual knowledge interpenetrate, it is not the case that knowledge is the storage or retrieving of information to be later used in action. Agents attuned themselves to their situations, what generates changes in percepts by influence of concepts, and vice-versa. Therefore, the boundary between basic and higher-order cognition is messy. Thinking and perceiving mutually influence each other, where one ends and the other begins can be fuzzy and undetermined in some actual instances. James is very clear in claiming that concepts are the discrete *result* of an act of conception, of producing those abstractions, so in terms of our being, there is only the influx of living activity. Incorporating the vocabulary of the linguistic bodies theory, concepts would be the results of objectifying attitudes, of bringing shared awareness and critical scrutiny to our experience, be it in actual collective engagement between humans in epistemic communities or in “solitary” activities of individual social-control where one enacts dialogues with oneself. Concepts also can be more or less directly connected to lived experience. Concepts can be abstractions of abstractions in paths created long ago, already a great distance away from ordinary perception (God, infinity, truth and

absolute beauty are some of his examples). Conceptual knowledge can be self-sufficient knowledge in the sense it can be about how different discrete abstractions relate to one another, but the 'full *value* of such knowledge is got only by combining it with perceptual reality again' (ibid, 1012). One obvious way concepts relate back to percepts is by enabling and constraining new percepts, by enriching experience. They enrich particular experiences but also life as a whole, giving us new frames of evaluation for action, new values, goals and collective projects. From the mutual transformation of percepts and concepts we get epistemic communities, we get new forms of knowledge production. But also new communities in general, new forms of life. All human affairs —science, religion, politics— rebounds to lived experience. James' empiricism is in fact extremely radical, all knowledge in the preferred adjective —perceptual, conceptual, linguistic, scientific, logical, ethical— comes ultimately from real-life, world-involving experience and gains its full value when it comes back to the lived world. His position is developed against what he calls the intellectualist creed among philosophers, the tendency 'to treat conception as the more essential thing in knowledge' (ibid, 1021). According to the intellectualistic creed, knowledge would be ultimately about producing the appropriate concepts. If one combines the creed with a representational view of concepts, knowledge is about representing adequately what a given agent aims to represent. The intellectualistic creed permeated cognitive sciences and analytic philosophy of mind in the 20th century and it is alive and well in several accounts, epistemology included. According to an old-school objectivist view tied to the intellectualistic creed, the trajectory of knowledge is understood as the development of increasingly correct categorizations where the correctness conditions are given by what is becoming known. The correctness can be given in absolute or probabilistic terms, depending on other prior assumptions about knowledge and about the object being known. In perception, the view assumes that to perceive is to correctly represent the physical structures we have contact with using our sensory systems. In intentional action, how to move in the way that makes the intended non-actual state of affairs actual. More generally, minds represent reality by structuring the internal in a way mirroring the external structures of the world, or in a way that effectively informs us about important features of it, given some goal, desire, or framework of evaluation. In the old-school objectivist view, there is an ascending scale of knowledge, where one goes from the knowledge of percepts of here-and-now reality in the direction of knowledge of concepts transcending particular individuals, moments in time, places, situations and contexts.

Knowledge goes from beastly concrete perceptions to heavenly abstract thoughts. The closest to the divine we can get, the better. Knowledge of universals is better or more refined than knowledge of particulars (treated as opinion rather than knowledge in some accounts). The idealized epistemology that comes from this picture is that we might never be epistemic angles, but striving to be is what we should do.

But are there alternatives? Rączaszek-Leonardi and Zubek (2022), for instance, claim that action-first approaches have the potential of offering new paths of inquiry in empirical and theoretical research about concepts. Action-first approaches would provide an account of concepts as:

> [...] *possibilities for selection from the experiences of an agent in a social environment*. Percepts and concepts are located on a continuum rather than on the opposite sides of an imaginary wall. Both percepts and concepts are *skills of differentiation based on histories*: evolutionary, developmental and interactive. The factor that varies between them is perhaps the degree to which those differentiations are based on individual, bodily, experiential histories or histories of social interaction that are mediated by routines and linguistic and material structures that evolve in cultures and populations. (4, italics added)

In their account, the diverse modes of skillful differentiation are the diverse perceptual and conceptual capabilities of human knowing. The histories behind the skillful differentiations are the crucial factor for differentiating them. Acting, perceiving, remembering, thinking are ways of being in the world while selecting different historical and situated associations and relationships between events. Strong dependence on certain histories of sociolinguistic interactions (in a transgenerational timescale of cultures and populations) are what marks a skill as more conceptual, rather than perceptual[62]. Once again one notices similarities with REC. Radical enactivism provides an account of content-involving cognition as resting on

62 Is it all perception permeated by concepts in action-first approaches? The topic varies across accounts. (Noë 2015; 2021) claims that the sensorimotor knowledge characteristic of perception *is* conceptual knowledge. Concepts are reframed as abilities of a larger kind, what he calls skills of access. Perceptual knowledge would instantiate a form of understanding conceptual-and-yet-not-representational. Assuming that Radical Enactivism views concepts as contentful in their preferred sense of the word, for RECers concepts are not part of perception. Contentful concepts can change the skills acquired ontogenetically in one's development, and in doing so, they would alter ur-intentionality (see section 1.3). But perceiving itself and other forms of skillful engagement are not conceptual (Robertson and Hutto 2023). The EA's notion of sense-making cuts through the distinctions between basic and higher-order cognitive capacities, in both scaling up and scaling down strategies. The theory of linguistic bodies takes language to be a feature of human becoming strongly responsible for the interwovenness of what EA refers to as domains of embodiment or domains of interaction (see section 1.2). In this sense, perceptual activity is permeated by skills related to the social domain of embodiment and to linguistic agency. Typical sensorimotor life is enriched by languaging and social interaction at large. I show one example of this in the next section when exploring EA's account of the abstract perceptual attitude of object's transcendence.

abilities to engage in truth-telling practices: ‘For content to arise, what is needed are truth-telling practices, understood as reflexive, or meta-linguistic practices, that consist in abilities to talk about talking’ (Myin and van den Herik 2020). Truth-telling practices have the pursuit of truth as their goal, there is an intersubjective standard of evaluation guiding the practices and the correctness conditions of semantic content are resulting from such practice. If concepts are content-involving, truth is their standard of evaluation, so concepts also strongly depend on truth-telling practices. On the side of EA, sense-making as differential responsiveness to the value-laden environment fits perfectly in this picture. Concepts and percepts are ways of sense-making, both are manifestations of knowing how to engage with the environment adaptively, even if not optimally. Conceptual skill would be sensitivities and powers to act and enact social acts relating to a larger field of virtual conditions of viability, they might go way beyond the here-and-now, they might have truth or other intersubjective and community-sanctioned standards of evaluation as the goal orienting the activity. Regardless, the general characterization of sense-making still applies. As with James, concepts and percepts are in a continuum of activity and interpenetrate each other. Action-first accounts do not assume neither beasts nor angles in human becoming, the ascending scale of knowledge and the representational view of concepts[63] are rejected. What action-first approaches provide is a deep reconceptualization of the relation between action and cognition, perceiving and conceptualizing and a new understanding of knowledge as a whole. Rather than correctly representing the world, such accounts claim that the most basal aspect of knowledge is how knowers relate, contact or engage with what is known. The primacy of action is the primacy of the act of *knowing*.

But how does the Enactive Approach understand the primacy of knowing? Knowledge is primarily ‘not so much about how to obtain the available information, or prove that it exists and is accessible, but about how sense-making is organized as an ongoing, world-involving activity’ (Di Paolo 2016, 253). Perhaps in some aspects more radical than James and other action-first approaches, EA does not take neither the knower nor the known as primitive, rather, it understands them as in constant transformation as they exist in the interaction with each other. The knower is the agent, and as we saw, the agent is self-individuating in interaction with the environment and concrete systems display different forms of agency

63 The claim is that not all concepts or conceptual activity is representational. To represent is one of the things that one does with concepts.

under different scales of analysis. The self-individuated agent itself is not a thing, but the metastable entity in an ongoing process of agency. The known, on the other hand, are environmental structures related to a precarious identity maintaining itself, the known is the known in relation to the knower. In other words, knowledge is not pre-given. If the accounts of the previous chapters are adequate accounts of cognition, to account for cognitive performance one has to also provide an account of the domain of interactions in which cognitive competence is instantiated. More than that, if cognition is the skillful and not necessarily optimal adaptation of a precarious systemic identity to an always changing environment, all cognition rests on know-how. Cognition rests on know-how in the sense that all cognition is understood in terms of skillful transition between states of a system struggling with possible disintegration. The skillful transition can also be described in terms of differential responsiveness based on the sensitivity to the viability boundaries or conditions of the system in question. The primacy of knowing, in enactive terms, can be said to be *the primacy of knowing-how*. To know how to engage appropriately with the world is possibly the most general description of what cognitive systems need to do, what for the majority of organisms and in an abundance of cases for human knowers, does not involve representations or propositional knowledge directly[64]. We are nested autonomous systems, each with their own endogenous activity related to certain features of the world. Knowledge is relational all the way through. Since the agent and their environment are understood as dynamical systems in constant transformation, many transformations are the direct result of their interaction. Knowledge as relational all the way through means that in several cases, the relation of knowing generates a dynamic of mutual transformation between the *relata*, the knower and the known. As often has been the case in this dissertation, the argument I make in this chapter relies on considerations about human ontogeny and the role of cognition into it. In the next section I look at how know-how acquisition is crucial for development in a sense that makes it indistinguishable from it in certain contexts. The tendency to treat experience and action as completely separated from developmental processes makes one neglect the role of knowledge in becoming. The cases illustrate how knowing is perspectival and historically situated.

64 Linguistic knowledge enables skill's acquisition and metastability in a myriad of ways as they modify sensorimotor structures. Not all linguistic knowledge is propositional, but even the knowledge of propositions can be enabling whiteout being constitutive. Sports performance can be enhanced by instructions, but that does not make the performance propositional in nature.

5.3 Knowing in development

Learning (acquiring and reorganizing know-how) does not merely contribute to development, it is in significant ways a crucial aspect of the development of agents. Learning happens in development and some developmental transitions rely on learning. Development, as almost all of the concepts explored in this dissertation, is polysemic and theory-laden. The preferred approach to development is an ecological approach (see Adolph 2019). I am employing a broad notion of development where it describes changes in the organism-environment system significant in the context of the progression of their lifecycle, changes happening in different timescales in the entirety of their life. Those changes are commonly shared between similar organisms living their life-cycles in similar environments, but they don't need to be, organisms with uncommon traits (the absence of a limb, for instance) also develop. The important feature of the changes is that they matter for the organism in question. Changes in the organisms can be changes in the size of the limbs, bone density, muscle mass, neuromuscular coordination, in neural architectures and skills[65]. Changes in the environment are both changes in accessibility, new access to surfaces, objects, mediums (as amphibians going from a perceiving in a context where sound and light travels through water to a new context where it travels on both water and air), as well as the actual modification of environmental structures, as in the construction of tunnels and nests. Development 'alters the landscape of possible behaviors' (Adolph 2019, 182). The interest of this section is in how knowing entrains, enables and constrains development. Development constrains experience and it is constrained by it, learning and developing are not parallel processes, they both rely on ongoing skillful contact with the environment; they both rely on knowing. Human infancy is an excellent place to study development because it involves a series of changes that are significant for us. Human researchers can see clearly why those changes matter, what they enable and what is enabled by it, due to happening in analysable timescales and in the same sociolinguistic environment they find themselves. The topic of how knowing shapes infant development was already touched on the developmental cases brought forward in chapters 3 and 4. In chapter 3, the infant sensorimotor transition from crawling to walking was brought forward to illustrate the idea of sensorimotor agents as always attuning themselves to the environment in a dynamic involving learning the new, but also relearning the old. As it was

65 Understood as metastable interrelated networks of sensorimotor schemes, which includes changes in both organismic and environmental structures.

discussed, the study of Kretch et al (2014) showed the differences in field of vision of 13 months old crawlers and walkers. Their visual experiences were intimately tied to their posture. Walkers' gazed more directly at their caregivers and the horizon at large, while the crawler's field of vision was more limited to the floor. To look at higher elevations crawlers often have to stop crawling and adopt a sitting up strategy. The room is much more readily available to the walkers. The visual world of the infant when they go from crawlers to walkers opens up exponentially. But the transition is not smooth. Novice walkers have to learn new ways of interacting with the environment and re-learn how to perceive some features of it. Infants need to re-learn to specify if something is a step or a cliff/drop off (Adolph and Tamis-LeMonda 2014). They need to interact with the environment as walkers to regain a previously acquired perceptual capacity. The process of learning is one of attending[66] to ecological information supporting action. And ecological information is not static or ready-made, it is not about objects but for action, so it unfolds in the enactment of sensorimotor coordinations and cannot be decoupled from it. What distinguishes novices and experts is responsiveness to task-related environmental cues. The recent walker has to explore the environment as a walker to pick up the relevant features. Transfer of skills only happens in cases where the same environmental information unfolds itself in the performance, much of our learning is highly task and context sensitive. Such considerations highlight the context-specificity of basal forms of knowing. Thelen and Smith (1994) make the argument that the origin of knowledge is context-specific by focusing on the context-specificity of knowing how to move. They look at research investigating how particular infants move in a flat horizontal plane and in up and down inclined planes. The experimental work (Adolph, Eppler, and Gibson 1993) suggests that infants learn how to move in those diverse surfaces task by task, without transfer of skills from one form of locomotion to another. Knowing to crawl up and down slopes does not transfer to knowing how to walk on them. Traversing inclined planes can be relatively novel to the infant and ascending and descending are biomechanically quite different tasks. Ascending is less risky, infants can catch their fall relatively easily and there are no huge consequences in trying and failing to go uphill. Descending is more challenging, the deeper the hill, the more advanced must be the capacity to match their movement to the properties of the inclined plane. Falling from uphill is costly. Longitudinal data indicates that crawlers with regular experiences with slopes learn how to crawl downhill and when doing so

66 Attention is understood as a relation between agent and environment. Different opportunities for action have previous enabling conditions, on the side of the agent and on the side of the environment.

is impossible or too risky. Access and exploration of slopes is crucial. But as in the case of learning to see cliffs, the ability has to be regained when they learn how to walk. Thelen and Smith take such facts as illustrating that 'Knowledge has its origins in the real-time details of the here and now' (1994, 222) and that 'knowledge is a trajectory of activity that depends on both the past and the current.' (ibid). To emphasize the activity part of the statement, I prefer knowing instead of knowledge. In account for knowing this way, they claim to bring forward a new perspective on intelligence:

> Intelligence does *not* mean less dependence on the here and now. Intelligence does *not* mean dependence on the same rigid structures across task contexts. Intelligence means the ability to adapt, to fit behavior and cognition to the changing context. A smart system seems unlikely to ever do exactly the same thing twice. Rather, a smart system would shift its behavior slightly to fit the nuances of the particular context or would shift radically—jump to an all-new state—if the situation demanded it. Our dynamic system is inherently smart. Because its activity is *always* dependent on the here and now, the just-previous activity, and the history of the system as a whole, it will always incorporate—always bend—to the demands of both history and immediate experience. (Thelen and Smith 1994, 244)

I agree with Thelen and Smith in considering the pinnacles of intelligent behavior as not based on symbolic structures, highly abstracted and general thought, reasoning and context-free knowledge, but based on richly detailed, context-specific know-how. Intelligence as a responsiveness to the now that incorporates the history leading up to it. The know-how of intelligent behavior consists of bodily processes and structures for differential responsiveness according to both normativity related to the present situation of its instantiation and to norms pertaining to the history of interaction, historical norms whose incorporation characterizes the knower as a systemic identity. My proposal here is that attention to developmental processes allows the scaling up of know-how by ways of scaling down intelligence.

Another aspect of the transition from crawling to walking highlighted in chapter 3 was the role of sociality in motivating and directing the transition. The hypothesis is that one of the central factors entraining the developmental transition from crawling to walking is the easier visual availability of the caregiver's faces. Infant's obsession with faces was a topic discussed in chapter 4 to illustrate the continuum of participation in humans' sense-making activities. All forms of sense-making performed in a social context or that are enacted as a shared practice are to some degree participatory. Being highly social animals, even the simplest sensorimotor pattern enacted by us is embedded in a cultural world, it has history and it is constrained by social or intersubjective normativity. One could be tempted to say that

intersubjectivity and sociality are part of human nature and, therefore, hardwired in our development. Enactive thinking is not so straightforward and challenges the nature/nurture distinction itself. Let's remember the example of chapter 4. Recently born babies do spend more time looking at faces or facelike objects than other objects (Johnson et al. 1991). So, one question arises: are we hardwired to like faces? Not quite. The studies on the topic (Cassia, Turati, and Simion 2004; Simion et al. 2007) suggest that babies prefer a geometrical configuration present in faces, not faces. When shown geometrical configurations that had "top-bottom asymmetry", the top has more geometrical elements than the bottom, and infants prefer the top-heavy display. There was nothing particularly facelike in the displays. The preference for top-heavy persists with "scramble faces", faces whose features (nose, eyes, mouth) are arranged in a non-human configuration. Additionally, infants prefer scrambled top-heavy faces compared to a normal bottom-heavy ones. But there is no notable distinction in interest between top-heavy, Picasso-like scrambled faces and normal top-heavy faces. The faces themselves are not exactly what drives this early attention. The research suggests that the remarkable human ability to recognize faces at a very young age is fine-tuned by the baby's interactions with their caregivers from their first weeks up to the first 3 months of their lives (Simion et al. 2007), not something ready since birth. The ability can only develop because of prenatal previous stages of development, but as with walking, it unfolds in the exploration of the surroundings. In this case the surroundings involve more directly other social agents, coordination and bonding. The supposedly "built-in" or "innate"[67] abilities of human beings require *honing it*, which happens in real-time (here-and-now) in a socialmaterial and linguistic environment. The human environment is a social environment through and through. Human development has social-related learning as one of its components. Canonically, ontogeny is a physical-bodily phenomenon while knowledge is a mental and perhaps social. The lines here are blurred. Not all knowing is social in a strict sense, but in knowing there is an interwovenness of know-how related to individual domains of embodiment (sensorimotor and organismic) and know-how for co-action in bonefined

67 There is reason to believe that concepts like innateness and instinct are sterile in attempts to account for behavior. In the case of babies' face obsession, for instance, some experiences in utero possibly are part of the unfolding leading to the capacity found in newborns. Saying the ability is innate closes lines of inquiry instead of opening, since it gives a stop to the explanation of the behavior. The alternative route is to account for the behavior of a stage as resulting from aspects of the prior history of the organism, going all the way down if possible. Where the innateness researcher ends their questioning and takes the matter as settled, the anti-innateness researcher begins a new inquiry. This point was made more than 100 years ago in Kuo's (1922) critic of the concept of instinct in psychology.

social situations. Not neatly separated realms, those forms of know-how interpenetrate each other in day to day living. Wanting to see mama's smile is one of the things that drives us to walk. Notice that knowing in social contexts is still marked by richly detailed context-sensitivity. Facial recognition is fine-tuned from infants first weeks up to 3 months by interacting with their primary caregivers, intelligent behavior emerges from in real-time encounters, in attending to the particularities of the situation while carrying with it the transformations that occurred in previous interaction.

The final developmental consideration I would like to explore is Di Paolo's (2016) account of the participatory aspect of seeing objects in a non-instrumental, detached manner. Di Paolo is interested in the widespread and ordinary perceptual stance humans take where the objects we interact with are independent of our actual dealings with them. The hammer does not vanish when I put it back in the toolbox. According to him, most sensorimotor theories of perception have a hard time going beyond an egoic perspective, the framing does not lend itself easily to the transcendent notion of perceptual presence, i.e, to account for how agents perceive objects as transcendent, existing independently of projects, goals and the sensorimotor schemes enacting them:

> [...] if perception is so constituted by *my* enactment of sensorimotor schemes, *my* deployment of *my* skilful mastery of the laws of the sensorimotor contingencies that correspond to *my* body, why is it that I perceive a world that transcends my activity? Why, in other words, do I perceive objects as being out there, publicly present to me and to others? (Di Paolo, 231)

According to sensorimotor theories, engagement with the world is marked by breakdowns when something goes wrong in the enactment of a sensorimotor scheme. Chapter 3 introduces the notions of obstacles and lacunas as the types of disruptions a given agent faces. The chapter also explains how those are overcome in accommodation and assimilation towards equilibration. According to Di Paolo, a strictly sensorimotor theory provides resources to account for the experience of objects as having relative independence, as existing independently of each other (the toolbox as distinct from the hammer). Continuous breakdowns and their overcoming reveal what depends on what for the enactment of a particular sensorimotor scheme, revealing the dependency relations between objects and actions (the hammer can be put in the drawer and still be retrieved for later use, hammering is independent of toolboxes). But why don't we perceive the hammer as vanishing once inside

the toolbox or drawer and coming back into being when we use it? In other words, how do we go from a perception of objects as action-dependent (even if independent of other objects and events) to objects as detached from us, as action-independent? Remember, the meaning for EA is not ready-made or pre-given, but arises in the relation between agents and their environment. The perceptual salience of objects as independent of my actions and as transcending the here-and-now has to be explained, it does not come for free. Similar to the considerations made in chapter 2 about how the mind brings intentional objects into awareness according to Phenomenology, the idea is that the external objects or the "things-in-themselves" are disclosed to the mind as external and action-independent. The perception of the transcendence of objects is part of mind's activity. In the intentional act of perceiving, objects would be disclosed as such due to the conditions of possibility of the act of perceiving. In phenomenological terms, the concern is with the conditions of possibility of the disclosure of a non-instrumental reality happening in everyday perception. Intellectualism often evokes some idea of an innate structuring principle of experience or transcendental subject that makes the world come into view already as transcending a pragmatically oriented perspective. Action-first approaches, in rejecting intellectualism, do not have such a luxury and they need to account for how this perceptual attitude is developed through sensorimotor interaction. The answer is to go social[68], without careful consideration of how our sensorimotor becoming happens in a social environment it is hard to account for an object's perceptual presence independently of sensorimotor acts. Being truly developmental, the first step is recognizing how the world of infants is permeated by material culture and intersubjective normativity. Examples are toys, clothing, norms and practices to which infants are subjected (as in "don't put that on your mouth!"). The influence of culture in perception is highly suggested by studies that point to cross-culture differences in vision, such as the analytical tendencies of Westerners versus the holistic tendencies of East Asians (Jenkins et al. 2010; Miyamoto, Nisbett, and Masuda 2006). The cross-cultural differences fit well with sensorimotor theory, different cultures will have different general trajectories from which one goes about mastering sensorimotor contingencies. Perceptual learning happens in real-time and in actual situations, so some variability between diverging contexts is to be expected. However, in the case of the

68 This path is also the one followed by Husserl (1952). Not only do I have access to an object from different perspectives and sensory modalities, but also my perception of an object can be compared and contrasted with the one of other perceptual subjects. Husserl understands that as an intersubjective transcendental condition of possibility of everyday experience (Gallagher 2008: 172).

perceptual abstract attitude, this particular social shaping of perception must be something widespread and present in almost all (if not all) contexts in which ontogeny happens. The microscale of sociality where infants interact with primary caregivers is the one where the account for the perceptual abstract attitude of object transcendence starts to take shape. Di Paolo focuses on the dyadic interaction between mother and infant and the triadic interaction between infants, mother and objects such as toys. During the first year of their lives, infants are increasingly more sensitive to joint-attentional activities (Rossmanith et al. 2014; Striano and Stahl 2005; Striano and Reid 2006; Striano et al. 2007). They go from interactions where they share their gaze jointly with adults to the same objects or situations to engagements where they share their attention between particular objects and caregivers. They increasingly manipulate and grasp objects together or in joint-activities while being sensitive to the relation between the adult and the object (if the object is treated as something novel or if the object is one that the adult manipulates repeatedly). The basic finding interesting for this discussion is the fact that sensorimotor organization changes in direct correlation with the organization of social engagement (de Barbaro, Johnson, and Deák 2013). From engaging with objects in basically all the sensory modalities (touching, putting in the mouth, etc), infants increasingly decouple attention between sensory modalities, dedicating some modalities to the objects and some to their primary caregivers. Holding one object while looking at the mother is part of the infant's repertoire by 6 months of age, elaborate networks of sensorimotor schemes as looking at the parents while holding multiple objects is usually achieved by the one-year mark. One component of this unfolding is the fact that primary caregivers typically increase the complexity of the manipulation of objects in front of infants as they notice the augmentation of their attentional capacities. What I called the *continuum of participation* in the previous chapter is crucial for our typical everyday perception of objects:

> [...] the infant's attention and sensorimotor skills are 'educated' by context-sensitive scaffolding resulting in a socially guided mastery of attention and object manipulation (lab studies are compatible with this view, e.g. Parrinello and Ruff, 1988; Mendive et al., 2013). These changes go together with elaborate affective co-regulation, activity sharing, and the organization of social interactive structures such as turn-taking, including the beginnings of reciprocal social acts. (Di Paolo 2016, 241)

I have shown how turn-taking is fundamental for the enactment of dialogues and the display of linguistic agency in the previous chapter. The considerations above are another illustration of the claim that human beings are always in a situation of full linguistic engagement. Here

the emphasis is on how infants acquire a decentering perceptual attitude toward the world. The answer localizes the beginning of the process in the decoupling of sensory modalities scaffolded on social interaction with primary caregivers (the mother in the absolute majority of cases). The process unfolds more or less as follows. Coordination of attention in the first year involves resolving and dissolving tensions arising in this process: being able to look at the same details in an object, grabbing it in the same way, attending to something the way the caregiver wants, manipulating in the right order and so on. Remember, in the enactive account of sociality and social agency (section 4.2), it was stressed that social interactive patterns are autonomous and thus have their own dynamics and normativity that emerges as interactors interact. Social interaction comes with the primordial tension of participatory sense-making; there are no tension-free social interactions. Overcoming the eventual conflicts of the infant-object-mother interaction brings objects into view not only as the same under different sensory modalities, but as independent from other objects and independent from my and the caregivers' actions. Mastering sensorimotor contingencies *in* a social environment is part of the common perceptual development of human beings.

Going back to James, in EA concepts and percepts interpenetrate in the sense that the acquisition of sensorimotor perceptual skills is deeply tied to the acquisition of social and linguistic skills. The objective, volition-and-action-independent presence of objects is developed over time and it is socially constituted. The more abstract forms of contact with the world come from a path that starts with real-life experiences. In this case, from interacting with mothers and other possible primary caregivers, we came to see the world a certain way. The path is the same to explain open-contemplative practices in general. Contemplative actions are open-ended and an end in themselves. For this reason, they are usually contrasted with instrumental actions, sequences of means-end acts whose central characteristic is the fact they are completed, ending when the specific goal is achieved. So, how do we go from a purely instrumental stance toward the world to a contemplative stance where the world is independent of any instrumental consideration and always open to further exploration? Di Paolo suggests that while interacting with others, actions 'hardly ever closed on themselves since they also serve in sustaining the encounter … Playful interactions are especially open-ended, as meanings break loose from direct instrumental concerns' (Di Paolo 2016, 249). When playing, the enjoyment of play itself and other affective valences can break normative constraints of activities in a non-disruptive way, generating further activity. In hide-and-seek,

for instance, children might reveal themselves from hiding in an attempt to jump-scare the child looking for them. The play can even change midway, becoming a game of catch after the scare. Outside of competitive play, violations of sports rules can be permitted and even incentivized, insofar as they promote synergies and continuous joyful interaction. Playing would habituate us to expect action not to finish with the completion of a clear individual goal, it would habituate us to the reality that our actions go beyond their practical immediate ends, often facilitating further exploratory actions. The process starts with the interaction with primary caregivers and it continues with the reinforcement of social interaction throughout the lifecycle. Humans develop an open-ended stance towards the world in the social context of play and other similar activities, in a continuous process starting in the first year of their lives. But the open-ended stance becomes the default way of being in the world. The experience of the world as detached from us and everything that comes from it —and here I am thinking of all the practices of knowledge production often described as detached, neutral and so on— comes from the worldly engagement with others.

The developmental psychology cases explored above through an enactive lens complement the claim that the most basal aspect of knowledge is how skillful agents (knowers) contact or engage with changing environments (what is known). From starting points distinct from the ones of feminist epistemologies and standpoint theory, but to whom a great complementarity is found. One can argue in enactive action-first grounds that knowing and intelligence are perspectival, historical and situated. Knowing is perspectival insofar as it is characterized as how knowers engage or contact what is known, to be able to engage in certain knowing relations one has to become a certain knower. Knowing is situated insofar as it is primarily based on richly detailed, context-specific know-how mobilized to deal with actual here-and-now situations. But those situations are embedded in a history that constitutes knowers and knowns as such, which makes knowing deeply historical. Human knowing develops in a sociomaterial environment, individual knowers acquire social skills that are enacted individually. Those skills are not only for the strictly social interactions of knowers, they are responsible for reorganizing our sensorimotor organization as a whole and becoming part of our ready-to-act disposition. Not only the social self-control of enacting dialogues with oneself discussed in chapter 4, but also perceiving the world as transcending my direct pragmatic engagement with it and as open to further exploration and interrogation is a skill of this kind. Not only thinking, but also perception is socially scaffolded. Human knowing is

perspectival, but perspectives are socially constituted down to the simplest cases of perceptual knowledge. Those considerations allowed an approach to knowing that goes beyond individualism while very much situated in the first-person perspective. Human knowing is perspectival-and-yet-always-plural.

5.4 Knowing in-between over- and underdetermination

Thinking about knowledge from an action-first approach and as a process not happening parallel to development, but in development, has already yielded an extreme reframing of the concept. The primary and most basal aspect of knowledge is the relation between knowers and what is known by them. A refocusing of epistemology on the act of knowing. From close attention to research on developmental psychology, it has been argued that knowing is perspectival, situated and historical. I also elucidated how perspectives are socially constituted and develop over time in the exploration of the environment (i.e, are word-involving). The pinnacles of intelligent behavior are suggested to be the ones where richly detailed, context-specific know-how is instantiated when attending to both the demands of the here-and-now and to the demands historically incorporated by knowers. A similar argument is made in Hanne De Jaeher's *Loving and knowing: reflections for an engaged epistemology*. Using the resources of the EA and employing a comparison between loving and knowing, she claims that 'Our most sophisticated *human knowing*, I think, lies in how we engage with each other, in our relating' (De Jaegher 2021, 847). For her, the engaged knowing at the basis of the more abstract forms of knowing has as it's core characteristics 'personal involvement, concreteness, and mutual transformation' (862). What I characterized as 'perspectival' maps well with her description in terms of personal involvement, her characterization has a more affective connotation, but as I delve into the next section, affectivity plays a role in knowing. The concreteness of sophisticated human knowing is well captured by the notion of historical situatedness as developed in the previous section. The topic that requires further examination is the mutual transformation of knower and known, which will be the emphasis of this section.

De Jaegher conceptually grounds her account of human knowing in Maclaren's (2002) idea of "letting be". Colloquially, the phrase "letting be" has connotations of disengagement and disinterest in relating. The use made in the text has the opposite meaning and indicates a

profound way of engaging:

> For the thing-engaged-with to *be*, then, in this relation, the engager *lets* it be, always in a particular way that is directly tied to the engager's own mode of being. This precisely means not to abandon the thing one is knowing, but rather to engage with it, and one can only do that *as* the particular engager one is. (De Jaegher 2021, 850)

Her proposal is to reframe the thinking about the highest cognitive capacities of human beings, bringing the focus to interactive know-how present especially (but not exclusively) in relating to others. This sophisticated human knowing has been neglected by orthodox cognitive science and philosophy of mind. Typically the attention in these fields is given to perception and action as examples of basic cognition, and to planning for the future, mathematical reasoning and complex language use as examples of higher-order cognition. In between these examples, one finds other activities—preparing a carbonara that is not just good, but exquisite, knowing exactly how your partner is feeling just by seeing their face across the room, knowing how much water your house plant needs to flourish in a dry summer, knowing how to perfectly synchronize your breath, hip and leg movements with the horse's pace while riding it. What all these activities have in common are their rich particularities. What is happening in the room? A dinner party with relatives or drinks with friends? How much sunlight is the plant receiving? How is the soil? The horse is young and galloping in the tracks or old and running in the fields? Those activities unfold in contexts of higher uncertainty and ambiguity, demanding strong sensitivities to very specific details. Incorporating Thelen and Smith's (1994) account, one can describe it as occasions where intelligence is required. Good teachers, nurses, and therapists are examples of professionals mobilizing this sophisticated, intelligent human knowing. The epistemology to come out of a closer look through an enactive lens at the activities and professions mentioned is all about engagement and engaging-with, because it takes the approach of the interactor-while-interacting, in opposition to the approach of a third party looking in. What kind of knower do we have to become to transform and be transformed by what or who we want to know? What kind of knower do we have to become to sustain the interaction indefinitely and in open-ended directions? What kind of knower do we have to become to not destroy or be destroyed by what is known? An engaged epistemology is about knowing-while-engaging, in opposition to approaches that look at knowledge as something stored after an encounter or as something mobilized to begin the interaction. In section 5.2 I explored how social interaction enables us

to have more open and contemplative stances toward the world, this is also the direction taken by De Jaegher. The Enactive Approach to intersubjectivity is crucial to her argument, she characterizes human knowing as emerging from participatory sense-making activities. The way I understand it, she is also highlighting the social modulation and regulation of our individual modes of being. The notion of letting-be introduced in her account of human knowing also is formulated under this assumption about the human condition: 'it is only through our relations with others and the education that these relations can provide that we come to inhabit a lived metaphysics that would allow us to be Prousts and to let things be' (Maclaren 2002, 188). The account I provided of the continuum of participation in human sense-making activities is one where abilities acquired in a social context reorganize whole sensorimotor repertories, they become part of the default mode of being of agents and are thus enacted individually. Maclaren's 'lived metaphysics' refers to a stance towards the world grounded in the 'lived experience' of human knowers (as shown at the end of this section). The relevant point is that we achieved such a stance through social interaction. Me, De Jaegher and Maclaren are all agreeing on the core idea that we become *human* knowers *in participation*.

Also central to De Jaegher's argument is an analogy with loving relationships. The invitation is to look at knowing through the similarities with loving: 'both knowing and loving are existential, dialectic ways in which concrete and particular beings engage with each other' (2021, 847). Loving and knowing are being understood as relations between actual concrete particulars individuated under some criteria, "loving" more as it is instantiated in loving a person or a particular location, less as it is instantiated in "loving a country" or "I'm a lover of cinema". The relations are not thought abstractly, they are spatio-temporal situated relations between particulars of some kind[69]. In this sense, loving and knowing are existential relations between concrete beings engaged with each other. The dialectic ways in which they engage with each other refer to loving and knowing being characterized as in between the over- and underdetermination of the *relata*. Relating to something or someone involves motivations, aims and a perspective at large. Since both loving and knowing are forms of relating, the relation is going to be partially determined by the one that relates. But lovers and knowers have to let the loved and known be themselves to sustain the interaction with it or they risk

69 She briefly suggests that a proper phenomenology of love would reveal that '[o]ne cannot love abstractly' (De Jaegher 2021, 860). Since my focus is on knowing and in the highly context-specific kind often neglected in mainstream epistemology, this precise point about love does not affect the argument put forward.

overdetermination. They can project into the known and the loved unwarranted features or normative frameworks and as a consequence, they end up failing to relate. Maclaren (2002) example of a money-hungry horse trainer illustrates this point well. Reducing the horse to its money-making potential of it undermines the achievement of the goal. The horse trainer fails, for instance, to see 'the imperative to let this horse play once in a while instead of training' (188). Going into the relationship with money-making color glasses makes the trainer unable to see the horse as the being the horse is, with particular necessities beyond the trainer's desires, if the necessities are not provided for, the desire cannot be fulfilled. But knowers and lovers also have to engage with the known and the loved without losing their perspective, to lose their perspectives is to lose the motivations and purposes responsible for the relating in the first place. The horse trainer, failing to see the potential of the horse if he would just treat it better, can disengage with the horse. The disengagement can be in the form of failing to properly develop the horse to their full potential, or in a more severe form, the trainer can actually abandon the horse to find another source of income. Knowing and loving are always at the risk of underdetermination. This is the balancing act that mobilizes the introduction of the notion of letting be (Maclaren 2002) into the picture of human knowing. What the horse trainer needs to do is to learn how to let the horse be in its own particular horseness. Finally, the analogy with loving is warranted because the existential and dialectical tensions she claims to exist in both modes of relating are more directly apparent to us in loving relationships:

> In loving relationships, we move between being ourselves and, *as ourselves*, encountering an *other*—a different being, whom we cannot avoid trying to determine, but whom we cannot fully determine either (and should not forcefully determine, on pains of ending the interaction). This means: we should not overdetermine, nor underdetermine them. And the same goes for ourselves in this relation. In navigating these tensions, we all change. Loving is a never-ending balancing act between the ongoing being and becoming of lover and loved. It is in these relationships, I think, that we can begin to find a way to understand our most sophisticated human knowing. (De Jaegher 2021, 851)

Knowing-while-engaging is to know while actively avoiding the overdetermination and underdetermination of what is being known. As it is with loving, we engage as ourselves, from a historically situated perspective, in concrete encounters that can both change us and change those we love, oftentimes changing us both. In engaging with others one finds yet another complexity, we are knowers who want to know others while being what is known by the others engaging with us. In loving relationships (romantic or otherwise), to love also

requires letting yourself be loved. Something analogous happens in particular kinds of knowing, in which one has to let oneself be modulated and regulated by the demands of the known. Farming would be an example. The activity has one of the highest degrees of context-sensitivity, one has to know the soil, the seeds, the weather of the farm, and the history of harvests past, still needing to adapt as the process unfolds in real-time with the peculiarities of that particular harvest. All of that while being sensitive to the time-scale of plants, a time-scale much different from that of metazoans. The tendency to know things in an overly deterministic manner is inimical to sophisticated human knowing, this form of interactive know-how cannot be decomposable in discrete segments and it frustrates definitional efforts. Knowing something this way is going to demand different types of interacting at each stage of the knowing relation. The instantiations of this knowing are uniquely singular. To let things be is elusive, it is not automatic and cannot be reduced to an algorithm, it has to be learned in interaction. The way humans typically learn it is by letting others be.

Maclaren uses Merleau-Ponty's notions of intercorporeality and intersubjectivity to account for how one learns to let others be. Our relating with others is at the most basic level intercorporeal, meaning, it is boldly-affective and not the result of thought, explicit judgment or reasoning. Intercorporeality is 'a perception which consists not in an intellectual grasp of something that is other to us, but in a bodily mirroring … of an intentionality that we inhabit *over there* (Maclaren 2002, 190, italics in the original). Phenomenologically, the other and I are not always experienced as two distinct subjectivities. The classical example used to illustrate this is the audience of a soccer match. The audience resonates with the players in a significant way. When fully immersed in watching the game, the spectators don't experience the events as something happening to someone else, to a completely separated other, but as something intermediary between a first and third perspective; as something they co-participate in "over there"[70]. The phenomenological profile is part of what explains the investment and the intense emotional reaction to the game, such as the frustration when a player misses an

70 Perhaps empirical evidence for this claim can be provided. The empirical study of ritualized practices finds significant correlations between performers and spectators of ritual, both in reports and physiological data (Konvalinka et al. 2011; Xygalatas et al. 2011). In walking on fire rituals one finds synchronized arousal between heart rates of walkers and related spectators. The pattern of arousal during the performance mirrors one another. The agents are engaged in different actions and have different baselines, so it is not that they have the exact same physiological response, what happens is patterns' mirroring, synchronous increase and decrease of heart rates in the same patterns during the ritual. One important finding in these studies is that stronger bonds to the performer of the ritual is a good predictor of synchronized arousal, intercorporeality requires bonding. The subjects of these studies often relate a feeling of oneness, a plausible interpretation of the physiological data is as relating to the feeling described.

opening or the joy when they score a goal. This bodily resonance allows us to 'live *through* those actions … in their directness towards the thing' (ibid). What she means is that intercorporeality can augment the perception of the objects and events in contact with the bodies one is mirroring. The spectator's attention is not on the actions of the players, it is on the ball moving through the field and on the opposing team. However, this particular form of close attention the spectator has is enabled by their relating to the bodies of the players. A more detached relation to the players would not enable the rich perception the passionate spectators currently have. Using intercorporeality to learn about the surroundings is a common mode of exploring the world. She uses the example of learning about a friend's horses when visiting her farm. Seeing her interact with the horses reveals not just the information that would be available reading about it or listening to her talk about the farm: 'I see in the way she approaches the stallion on the field—for, although he is stepping towards her primly and in friendly manner, I can read in her own step and posture that readiness for the slightest breeze or sudden sound to send him wheeling and kicking' (Maclaren 2002, 191). The social scaffolding just described is also used in the manipulation of inanimate objects, it is not uncommon to mimic the way someone was holding an object when the object is delivered to us, especially when there is an unfamiliarity in relation to the object. One important feature of the resonance with the other's body is that although I do experience a certain indistinction between bodies, I do not experience total identification. Therefore, I am introduced to "this is how things are", a perspective to be taken. The stallion is dangerous or "you must hold this delicately". The perspective is not viewed as idiosyncratic and absolutely singular, otherwise, I would not have access to the meanings disclosed by bodily engagement. The stance in the world is one I can have because the world is presented that way to someone. But that someone is not me, therefore, in attending to an object through bodily resonance with another person I am invited to inquiry into those revealed meanings for myself: 'this meaning is not yet quite "found by me". So far, the meaning exists only virtually … This virtuality asks to be concretized; it solicits me to take it up and to *realize* it for myself, through my own bodily engagement with it.' (Maclaren 2002, 192). Intercorporeality instigates further environmental exploration for the consolidation in a first-person perspective of what was revealed in bodily mirroring. The contact that one has with things through this path is primarily affective, as a feeling of the possibilities of engagement with these particular things, describe it as 'a power of relating in certain ways, a unique style of being in relation to other

things, a solicitation to be taken up *these* ways, not in those ways' (ibid, 193). A feeling that you should approach the stallion carefully and hold the porcelain mug with both hands. The feeling or sense of the sphere of possibilities for engagement can deepen or substantially change in the interactive situation. To learn how to let others be we have to able to resonate with them in a bodily-affective attunement that makes us feel like inhabiting an action "over there", this way of letting others be also open up a way of letting things be in general. In the socially scaffolded interaction with things, we get a sense or feeling of want we can and what we cannot do in the form of solicitations to interact with them.

The other crucial idea for an account of letting it be is Merleau-Ponty's notion of intersubjectivity. While intercorporeality is a form of relating, intersubjectivity is the background of our becoming. The idea that we are always embedded in social relations and social normativity is one I have been highlighting since the previous chapter. Several accounts of interaction take interactors as primitives in a logical sense, as the basic units of consideration. Interactors then interact in a variety of ways, the interaction is secondary in relation to interactors. This is not the approach that Maclaren identifies in Merleau-Ponty. Intersubjectivity is something 'which we are in contact by the mere fact of existing, and which we carry about inseparably with us before any objectification' (Merleau-Ponty 2012, 362). Interactors and their interactions are both primitives that cannot be reduced to or derived from the other. We are since always in a world of subjects, who can express but also omit desires, intentions, can deceive and be deceived. The other crucial point is that others' particular modes of being as a subject are embodied in their actions. But actions have multiple intentionalities, especially in a social context (Maclaren 2002: 194-5)[71]. The human capacity of recognizing people as subjects with their own intellect, volition and affectivity is not manifested abstractly in most real-life encounters, but concretely, I don't interact with a person as a subject, I interact with a person as that particular subject. And although who is that particular subject is accessible through their actions, there is a high level of ambiguity involved. For instance, in distinguishing the frown of confusion from the frown of annoyance of my partener, one has to interpret that act as expressing a particular meaning. One way of describing it is as demanding a determination of that action. But my partner is not merely accepting the determination, if adequate, the determination can deepen our relationship, if

71 The materiality of social acts and how that creates meanings beyond the intentions of participants was argued for in the previous chapter (sections 4.2 and 4.3).

misguided, it can indicate to my partner that I do not pay enough attention to them. In general, my determination of others' actions generates a determination of my actions by them. Letting others be is marked by mutual determination: '[o]thers' actions never simply 'let us be' or leave us free to be who we are. Others' actions always situate and determine us' (Maclaren 2002, 196). Maclaren uses the example of learning a new skill from a condescending teacher. If the teacher gives me the instructions with extreme minuteness, as to suggest that I do not know any of the relevant skills necessary to learn the new one, the teacher is determining me as an extremely inexperienced novice. To follow their oversimplified instructions is to tacitly accept this vision of myself, in a sense, the teacher's actions are an invitation to accept a certain version of myself as more incapable than I am. The actions of others act on us, our actions act on others. The student might become resentful and fail to learn, the student can also act to demonstrate that they are not so green and change the teacher's vision of them. Our understanding of what we can be or do, our own sphere of possibilities, is mutually transformed in interaction. So the learning of letting others be is the learning of mutual letting it be. To be a good teacher is to invite the student to be something other, to change with the teachings. But that requires the teacher to being open to be changed by the encounter, it involves being open to invitations or solicitations that are embodied in the student actions, even if never fully made explicit. One can see in descriptions such as this how sophisticated human knowing involves richly detailed, context-specific know-how related to the here-and-now of the interaction and to the historical situatedness of the situation, which includes the historical situatedness of both knower and known.

The struggle between subjectivities is a path to educate us in a corporeal way to invite others to be while open to invitations ourselves. Struggles such as the one between the student and the condescending teacher do not need to elicit self-reflection on the part of either of them, they are many times felt as a 'vague and irksome tension' (Maclaren 2002, 198). The skillful relating required in this case is of 'a transformation of herself in such a way that she would then find a home in the other's formerly problematic manner of situating her' (ibid, 199). The student can try to put herself partially in the position the teacher implicitly suggested and follow the instructions in the minuteness in which they are given. But not being as incapable as the teacher thought, she advances fast and easily in the first steps of her learning journey. Changing the teacher's view (causing them to feel sorry for the initial mistake), she confirmed

to herself that the teacher's original assessment was misguided. In the case as just described[72], the teacher and student let themselves be. Letting themselves be was a process of mutual transformation, the student had to behave like a novice to become someone with the desired new skill. But transformation also happens as the teacher sees their misguided assessment, they change in the relation with that student and they might change in relation to teaching in general, being more attentive to the level of skill their students currently have prior to giving instructions. We are implicated in each other's actions. To learn to mutually let each other be is the ongoing and active rejection of what could be called stance monism or stance absolutism, the rejection of a static and limiting view of the sphere of possibilities of oneself and others. Discussing the case of the young child's jealousy of the newborn sibling, Maclaren asserts that:

> 'he [the child] needs to develop a *bodily* recognition that his "truth" is limited, and that others' modes of engaging him and the world are never simply an alien imposition upon him, but always an opportunity for him to learn new ways of taking up himself and the other. He needs to move from a metaphysics of absolutism and self-assertion to a metaphysics of dialogue and questioning (2002, 200-1).

What she is calling metaphysics is an attitude towards self, others, and the world, not an elaborate theory about the fundamentals of reality as such. The metaphysics or attitude of dialogue and questioning referred to in the passage is what I assume De Jaegher is after with her analogy between loving and knowing. In more corporeal ways of letting it be, what the attitude consists in is 'a more complex and sophisticated bodily recognition of relativity' (Maclaren 2002, 201). As in De Jaegher's general line of argument, it is in fact easier to see how the attitude unfolds in loving relationships. A complex and sophisticated bodily recognition of relativity or multiple possible stances on a situation is found in loving relationships when one expands their capacity to feel cared for and appreciated. One expands their bodily recognition of what care means when they *feel* an act of service, bringing a cup of coffee, or folding the laundry on the couch, as an act of love. In living with a person who has difficulties in verbally communicating their feelings, one can learn to feel loved this way. One does not have to if one does not want to. One can also be unable to and cease to love. Engaged loving (and engaged knowing) involves learning, and one can fail to do so even if they have the right motivations. The mutual transformation is also clearer here, the partner

72 Surely, the student can learn the skill without the teacher transforming in any way, but in this case she learns despite the teacher, not with them.

with communication problems, in a reciprocal loving relationship, tries to communicate the best they can. The act of service was an act communicating love, they love with acts of service, but also occasionally with words. In the mutual recognition that they are trying to connect, both partners change and remain in love. The way I understand it, De Jaegher and Maclaren identified a sophisticated form of interactive know-how that consists in reinstating one's positionality (concreteness and personal involvement) in a relation while being open to the possibilities of transformation. The knowing in question is familiar to us in the sense we all display it to some degree in particular kinds of social interaction, but it is highly elusive. Knowers in possession of this sophisticated know-how have a bodily awareness or an attitude that incorporates the fact that know-how comes from a socially constituted perspective. They act with the sense that interacting is inviting and being invited to transform. The attitude of taking others as inviting us and being invited by us to transform is a deep existential way of being that can be extended to the world. In the case of directing this way of relating to the world, the attitude is twofold: (i) it is the deep recognition that we lived in a world that is shared by multiple perspectives and ways of being deserving of appreciation and respect, from which much is to be learned; (ii) that the opacity of the world (the many unknowns and the not properly understood) be taken to be an invitation to explore the sphere of possible interactions with it, including an invitation to change ourselves in this exploration[73]. A metaphysics of dialogue with the world is to take nature not as something out there, as a realm completely separated from us, as something completely unaffected by our determinations of it, but as an ongoing process that we co-participate in "over there". The mutual transformation of knower and known is the consequence of "letting things be" becoming our lived metaphysics.

5.5 Affectivity in knowing

From loving and knowing I propose to move the discussion to loving *in* knowing. In this section, I look at how knowing and affectivity are intertwined. Knowing as a skillful relating that lies in between the mutual over- and underdetermination clearly has a motivational

73 I cannot refrain from thinking about this century's challegend, the global threat to life as we know it and the current annihilation of biodiversity caused by anthropogenic climate change. Knowing how to fight climate change is knowing how we have to be for the world to be habitable to all of us and not to just a few in a climate in the hospitable zones, where the rest of us face catastrophe. Knowing how all of us earthbounds can continue on loving the Earth.

component, we want to know without coercion or destruction of both ourselves as knowers and of the known as what it is. Affectivity plays a role not only as the motivation but as the relating itself. Knowing-while-engaging is achieved through emotional attunement, mirroring or co-regulation of hedonic values[74]. The bodily-affective attunement with others is crucial to some forms of contact with the world, as shown by the notion of intercorporeality. In ontogeny, the social component of complex sensorimotor organization unfolds synchronously with the development of complex affective co-regulation. The sophisticated interactive know-how of letting it be is very much an illustration of intelligence in affects co-regulation. Participating in the creation of shared moods, as the mood of security and openness to vulnerability that a therapist creates in psychotherapy, are crucial to the balancing act of under- and overdetermination. De Jaegher goes even further in the last section of her paper: 'Loving and knowing, for human beings, entail each other. To understand knowing only "coldly," abstractly, objectively is either not to see the loving involved, or not to know fully' (De Jaegher, 865). My own position is that knowing and affect are always intertwined with each other. The entanglement is not an obstacle to be overcome, on the contrary, some feelings boost knowing significantly. Affectivity falls under the characterization of sense-making as much as problem-solving of any kind. For humans and many other modes of being, what has salience or value also has valence (Thompson and Stapleton 2009). Values were naturalized in chapter 2 in terms of conditions of viability for the system, some environmental interactions are beneficial while others risk the breakdown of the systemic identity. Cognitive systems are sensitive to virtual possibilities of interaction given their viability conditions. Salience or significance was not directly identified with feeling[75]. In the case of humans, however, that which repels and attracts us, does it by motivating getting close or avoiding it at all costs. The skillful and not necessarily optimal ways human sense-makers adapt include acting on the basis of feelings, moods and emotions[76]. I'm arguing that in beings like us cognition and affect are not fully separable, there is no human action without motivation, thus,

74 Pleasantness, unpleasantness, pain, pleasure, care, disgust, awe.

75 It is unclear to me if the notion of sense-making itself entails a minimal notion of motivation (see Thomspon 2022, especially section 8). In general, EA follows the phenomenological philosophy of life of Hans Jonas in associating life with a basic existential structure of 'concern' (see Di Paolo 2018 for an example). Jonas (1966) argues that the process of metabolic self-production creates a mode of being. The mode of being is characterized by an 'absolute interest of the organism in its own being and continuation' (Jonas 1966, 69). A basic concern for self-continuation is the way of existing of living matter. Self-production generates motivation for preservation, thriving and flourishing.

76 For an enactive theory of affectivity see Giovanna Colombetti's work (esp. 2014)

there is no act of knowing without affectivity[77].

Humans have a feeling of being alive on the basis of their sense-making activities. I'm going to follow the work of Thomas Fuchs (2018; 2020) in characterizing it. I'm referring to the basal self-awareness related to being a living, animated being. Basal self-awareness would be pre-reflective and the background of consciousness. Fuchs (2020: 4-5) uses Demasio's work (specially Demasio 2010) to argue for an 'interoceptive loop' between brain and body formed in the interaction of different processes of regulation of the internal milieu of the organism, a minimal subjectivity as in a self-affection in the form of basic moods: pleasantness, unpleasantness, relaxation, tension and so on; the most basal form of interoception[78]. The feeling of being alive is part of the organism's sense-making activity, it is part of the processes of differential responsiveness to a value-laden environment. There is a basic existential structure of care tied to feeling attracted and repelled to features of the environment. For creatures such as us, minimal subjectivity entails a minimal motivation for self-preservation and flourishing in the form of basic self-awareness. But is caring a feature of our skillful engagement with the world a good thing? Affectivity is a broad category including moods, feelings and emotions, each one of them deserves its own particular treatment. They all have positive contributions on knowing neglected in mainstream work. To illustrate how affectivity has a positive role in knowing, I'm going to focus on the positive epistemic role of one emotion, love. Following Candiotto (2019), emotions are closely tied to motivation and intentionality, they are value-oriented states 'disclosing what we value most. Epistemic emotions, especially, display the value of truth, understood as the most important epistemic good' (242). According to de Carvalho and Andrade (2022), love is an emotion capable of

77 The work of Luiz Pessoa significantly helps in making the case for it. Pessoa (2008) challenges the still current view of the brain as having a considerable degree of functional specialization that allows it to be divided in 'affective' and 'cognitive' regions according to their function. Brain regions viewed as 'affective' play a role in 'cognitive' processes, as well as some 'cognitive' regions of the brain are also involved in emotional responses: 'behaviour is a product of the orchestration of many brain areas; the aggregate function of these brain areas leads to emotion and cognition.' (Pessoa 2008, 156). In Pessoa et al (2022), comparative neuroanatomy of the vertebrate brian is used to show no the lack of support for the division of brain regions or processes as cognitive, emotional, attentional, and so on. The terms, applied to the brain, are epistemically sterile. There is no "emotional brain" completely distinct from other regions. Neuroscience should be focused on the role of the brain on complex behavior responses: 'we suggest that the level of *behaviour* provides the appropriate language for considering the mapping between the brain and mind' (Pessoa, Medina, and Desfilis 2022, 10–11). There is no behavior without both emotion and cognition. The argument here is that even focusing on the brain shows that the distinction between the purely cognitive and the purely affective is troublesome.

78 Fuchs' approach is a RECtification in the sense radical enactivism advocates for (Hutto 2017). Damasio's work, even though heavily relying on the interaction or "resonance" between brain-states and states of other parts of the body, suggests a representationalist and brain-centric picture of basal affectivity.

contributing to more committed truthful descriptions of the world. Inspired by their characterization but deviating from it slightly, I will characterize love as an epistemic emotion insofar as loving communities display an appreciation for truth. The argument is that love creates committed or engaged communities. In the process of personal growth or flourishing of their members, if the members of the community care for each other in the appropriate way, shared interest in truthful descriptions tends to develop. Not just an emotion, love can be construed as epistemic virtue according to the tenets of virtue responsibilism. I follow Carvalho and Andrade in grounding my proposal on the work on love of bell hooks (2001) and the one on loving of Hanne De Jaegher (2021).

For hooks (2001), the individualistic and romantic characterizations of love misconstrue it: 'Worship of individualism has in part led us to the unhealthy culture of narcissism that is so all pervasive in our society' (214). How we enact love is dependent on the groups in which we participate (extended families, friendships, communities of worship and so on). Love presupposes community, the social structures permeate interpersonal relations and it is in interpersonal relations, or in participatory sense-making activities, that our becoming occurs, which includes how to engage in specific forms of affection. In the previous section, I gave an example of learning to give and receive love in a romantic relationship. The example was in a romantic relationship, but learning to love in interaction is a general feature of love. For hooks, love is communal in the sense that we learn to love in communities with their specific patterns of engagement and in the sense that communities foster loving relations to strengthen the healthy interdependence between their members. hooks (2001:130) identifies in Patriarchy and Capitalism the roots of the current misunderstanding about love that generates unhealthy communities, these structures of domination destroy the extended sense of kin fostered in more loving communities. Western societies are driven by 'the ethos of rugged individualism' (hooks 2001, 214). But what is the 'love' less present in unhealthy capitalist-patriarchal societies? hooks working definition of love is 'the will to nurture our own and another's spiritual growth' (ibid, 6), and in the path to achieving spiritual growth, one comes to acknowledge the 'basic interdependency of life' (ibid, 73). What she calls spiritual growth can be understood as human flourishing[79], it is the overall improvement of one's situation in the

79 The necessity of community building for individual self-improvement also appears in hook's reflections about the importance of the feminist movement (hooks 1984). Spiritual growth also pertains to spirituality in ways not tackled here. hooks believes that a lot of manifestations of spirituality in world religions stems from founders and practitioners' proper understanding of love. But as it is often the case, many organized religions

direction of a more realized life. The connection between love and will is made to deny the conception of love as something entirely passive, we are not so much struck by love as love is acted in 'acts of *care*, *respect*, *knowing*, and *assuming responsibility*' (ibid, 136, italics added). The association of love to care and nurture also has the function of dissociating love of any kind from harm and abuse. She argues that abusive power and oppressive relations do not instantiate love. Straightforwardly, love would have the cognitive function of enabling a practical understanding that one's well-being is tied to fostering the well-being of one's communities in a way inimical to causing harm or being abused. Not surprisingly, the case of romantic partnership is the one where this is more immediately salient. Partners are expected to rejoice in their personal achievements and to be negatively affected by the roadblocks in the life of their significant others, those are crucial events for a special community, *us*. Reciprocal participation in each other's growth lead hooks to also identify mutual transformation as a feature of love: 'when we commit to true love, we are committed to being changed, to being acted upon by the beloved in a way that enables us to be more fully self-actualized' (ibid, 185). In love one has to have accountability, one is responsible for how their actions lead others to change. Also, in love, according to hooks, mutual changes are voluntary: 'This commitment to change is chosen. It happens by mutual agreement' (ibid). Love thus creates a network of trust and a commitment to shared collective goals, the healthy interdependence previously mentioned. Love can have a positive epistemic role insofar as it can strengthen bonds and create communities of trust committed to truth and understanding. But love can create communities with shared scrutiny, intersubjective criteria of evaluation and other truth-conducting practices if truth and understanding are a common good.

Carvalho and Andrade (2022) pointed out two possible objections to the positive epistemic role of hooks' love. Collective well-being does not entail a shared interest in the truth. Also, the in-group trust coming from love can make agents trust the beloved when they should believe other credible epistemic agents. We trust those we love, but we might love those who are not well positioned epistemically. Unless one argues for a strong connection between communities' well-being and truth-oriented practices, not something hooks herself does, collective well-being falls short of truth. Collective well-being can be indifferent to the truth and worse, it can lead one to trust unreliable agents. De Jaegher's considerations about loving are used to respond to the objections. As I have shown, loving relations for her are a dynamic

succumb to less loving group dynamics and abuse of power.

engagement in between over- and underdetermination of the loved: ‘Loving is a never-ending balancing act between the ongoing being and becoming of lover and loved’ (De Jaegher 2021, 850). As I also have illustrated with the example of the condescending teacher, the stance others have on us affects us and our stances in response to it affect them back. Stances and other forms of determination situated agents in positions more or less comfortable, they also create feedback loops of reciprocal change. Carvalho and Andrade (2022) give an example of psychiatric diagnoses. Receiving a diagnosis from a mental health professional has rippling effects: ‘it is something that can alter profoundly the behavior of the patient, their subjective experience, their self-conception and the way in which other people perceive and relate to the patient’ (144). Diagnoses are both descriptive and prescriptive, it reorganizes the patient’s relation to themselves and others. For this reason, the mental health professional must do it responsibly, one suggested way to do it is with a “loving gaze”, according to the balancing act described as letting the patient be, not overdetermining the patient but also engaging with their concreteness. The professional would know how the general criteria for the diagnosis are instantiated in that particular patient while being sensitive to the impact of the diagnosis on the patient's self-identity and social life. As I have also shown in the last section, letting it be as engaging in a dynamic in between over- and underdetermination can be expanded to the world at large. One can have an open-ended attitude in inquiry where one avoids overdetermining the object of study and sees it as inviting engagement in its own terms. I highlighted the presence of this attitude in activities such as farming, but it can be thought of in relation to dynamic engagements of any kind. Since ‘letting it be’ is a feature of both modes of engaging, loving and knowing, both modes of engaging can be intertwined in concrete cases. Going back to the context of loving communities in hook’s sense, if their members are engaged in the never-ending balancing act of not over- or undertermining, they should at least in some cases, be able to identify the epistemic positionality of its members. To be gullible and believe in the beloved over the credible epistemic agent is to overdetermine the beloved, to see it as something that they are not. Remember, to love is to care, to nurture. Carvalho and Andrade (2022) suggest that ‘letting it be’ falls under Dalmiya’s (2002) characterization of care. Their claim is that care and love are intellectual virtues (or even the same virtue) in the sense of virtue responsibilism in epistemology. Love would be a stable character trait with a positive role in the acquisition and transmission of knowledge. In

general, intellectual virtues have two components, the motivational and the success ones[80]. The motivational components are the desire to bring about a certain epistemic goal. In the case of love, the desire is to keep engaging with a thing in its concreteness, as what it is. The success components of intellectual virtues are the reliable success of abilities in bringing it about the desired end. In the case of love, interactive know-how reliably enables continuous engaging. Love in hook's account is chosen and aims at the production of a certain desired end, so it has a motivational component. The end is to continue on engaging, but also it is the open-ended and never-fully finished end of flourishing, it is one of those aims that organize the overall life of an agent. But to achieve the collective chosen aim, skills of engagement are required. Learning to listen, to show affection, to receive affection, and so on. The notions of letting it be and intercorporeality put the emphasis on the success component of love as an intellectual virtue. How one achieves the goal of flourishing is by letting things be as they are, a form of active engagement between inappropriate projection and uninterested engagement. Remember, letting things be involves the refusal of what I called stance monism in favor of an attitude of dialogue and questioning. The openness to multiple stances requires a temporary displacement and eventual reorganization of oneself. The knower embodies different possible perspectives about the known, some perspectives under the direct guidance of it, so as to know the known for what it is. In a nutshell, if one cares about engaging skillfully, one cares about engaging with what something truly is at each particular encounter. In communities with members concerned with engaging skillfully with each other, one concerns itself with accuracy and truth. In the framework of virtue responsibilism, epistemic evaluation is made not only in terms of the beliefs of the agent and their evidence for them, agents themselves are evaluated according to abilities and the stable character traits they have. There is the introduction of ethical considerations into knowing. The loving agent, the expert in letting things be, is reliable for their community, the agent is attentive to the features of an object as disclosed in interaction, not forcing determinations not fit for what they interact with. An agent such as this one would not be gullible, they would listen to different testimonies with openness, but they also would have an acute sensitivity to the positionaly of those giving it.

In loving communities, one can see the regard for truth emerging. A community of loving agents respects pluralism but also values the importance of reinstating one's perspective, that

80 The term virtue 'is a success term. The motivational component of a virtue means that it has an end, whether internal or external. A person does not have a virtue unless she is reliable at bringing about the end that is the aim of the motivational component of the virtue.' (Zagzebski 1996, 136).

is what the attitude of dialogue discussed in the last section entails. To reinstate one perspective in an understandable way, intersubjective criteria and standards of evaluations are thought of. The community needs, for instance, to develop shareable conceptual schemes that do not cause harm to its members. Such a community is not one of perpetual cohesion and agreement, it is a community of intense dialogue and eventual struggles[81]. The growth characteristic of love relations, be it in the dyad of couples, polyamorous relations, friendships or communities of mutual support, demands sophisticated forms of interactive know-how to navigate disputes in a caring way. The know-how consists in sensitivity to the here-and-now of the situation and to the history of interaction. In cultivating a care for each other, groups of people can develop an attitude of dialogue, of meeting things where they are. In the words of Maclaren, they embodied the lived metaphysics of dialogue. This attitude is both a knowing and a loving attitude. Proper care for the other person involves caring for their "truth", meaning, one is concerned with assessing correctly the other's feelings, knowledge and overall situation. The attitude can be expanded to the world at large, but it isn't easy, letting things be never is. In caring for each other in the particular way described, communities can come to care for the truth. What I showed in introducing hooks' account of love in conjunction with the notion of loving as letting it be is the significant positive epistemic role of love for knowledge. Love as a virtue, as a profound excellency embodied as a character trait, contributes not only to personal growth in a wide sense, but also to improvement in the narrow sense of intellectual improvement as conceptualized by virtue epistemology. Intellect and intelligence are not necessarily in opposition to feelings and emotions. Love can lead to truth, the idea is not new. Candiotto (2020) has argued that in Plato's theory of recollection, erotic desire (one of the possible and yet not necessary components of love in the hooks/De Jaegher conception of the term) is the driving force of inquiry. According to her, erotic desire for Plato allows the identification of Ideas' traces in the physical realm through a form of trained visual perception of beauty in material objects[82]. Love leads to truth in a different way in the account just provided, it is by letting care for one another be the attitude from which one engages with the world. Communities then become engaged with shareable truthful

81 For the relation between social cooperation and the inevitable struggles and conflicts of living with others, see Di Paolo and De Jaehger (2021)

82 Visual perception *per se* would not be knowledge, but it triggers the process that leads to it. Candiotto (2020) sees in Plato an embodied theory of remembering. Not an internal process of retrieval of internal representation, remembering would be a motivated (desire driven) process of piecing together the past through its traces. In the context of the theory of recollection, however, the remembering is of the transcendent world of Ideas from where the soul comes from.

descriptions. The insights that our most sophisticated forms of knowing are instantiated in relating to others and that affectivity permeates our skillful engagement with the world accounts for the motivation for truth. In caring for each other in the appropriate way we can come to care for the world in the appropriate way. Communities of trust committed to truthful descriptions of the world are possible through affect, not by way of overcoming it. The Humean position proposed here is that certain feelings boost knowing. However, for the achievement of success, what is required is intelligence in the sense described by Thelen and Smith (1994) and incorporated here: sensitivities and powers related both to the particularities of the specific situations and to the history of interaction embodied in knowers' identities. Loving is intelligent and there is intelligence in loving. The know-how displayed in both "lower-levels" and "higher-levels" of cognitive competence is from historically situated, socially constituted perspectives. Radical enactivism and linguistic bodies theory agree that to account for linguistic cognition one has to go social. REC focuses on metalinguistic capacities (talk about talking) and LB focuses on dialogical interaction and its impacts on human becoming. The more simple ways we form community are affectively, it is by caring. Complexifications and enrichments of features of the simple case are instantiated in sophisticated forms of knowing. Echoing James, knowledge as aperspectival, value-neutral and pertaining primarily to individuals is an abstraction that took the wrong path, too far removed from real-life experience. Virtue epistemology, standpoint theory and feminist epistemology more broadly argued that other normative domains (philosophical anthropology, ontology, ethics, politics) are intertwined with knowledge, epistemic evaluation is not to be made apart from it. Canonically, truth, evidence, justification, and belief are *epistemic* while belonging to a certain social group or having certain emotions are not. One can understand the corollary of argument provided here in two ways: epistemologists need to be more open to "non-epistemic" features of situations that might be relevant in assessing the epistemic status of an agent, or they need to extend the list of epistemic features of a situation to include things such as caring for each other. The distinction between epistemic and non-epistemic is not straightforward. Knowledge is messy like that.

Navigating messiness

In chapter 1 I mentioned how the 20th century saw the rise of different traditions aiming at an ecological study of cognition. The result is a recentering of inquiry away from a brain-centric understanding of cognition. The last two chapters take the recentering even further, knowing-how is a communal affair through and through. An enactive epistemology assumes that normative domains not canonically thought as epistemically relevant are intertwined with knowledge. The communities we participate in and how we participate in them become significant. I have also proposed a refocusing of epistemology on the act of knowing. The basal aspect of knowledge is not to accurately represent, it is the relation between knowers and what is known by them. Contact with the world is ongoing, the quest for knowledge is the task for improving our epistemic situation. What might include improvement in other domains, such as relating to each other. The enactive epistemology argued for here is built from a position that states—most conceptual boundaries put in place in discussions about cognition and knowledge are epistemically sterile if one fails to see how fuzzy they are. That is what I progressively show with each chapter. Life and mind are not absolutely distinct, organizational properties of the mind are enriched versions of the organization properties of mind. Instead of action and perception, we should talk about the sensorimotor life of a world-involved agent. The roots of propositional knowledge and anything propositional are the dialogical interaction of linguistic bodies. Knowledge comes from the real-life experiences of situated agents, it plays a key role in ontogeny and the more adequate unity of analysis is the community of knowers, not the individual knower. The traditional distinctions between mind and world, innate and acquired, subject and object, perception and action, affect and cognition, basic and higher level cognition do not seem so bad if one takes how they demarcate fields of research, academic disciplines and subdisciplines as evidence of their validity. The relational perspective EA brings to knowing draws attention to relations in-between them and the disciplines they form. In chapter 3, for instance, the concepts of habit and sensorimotor schemes were brought forward to fill the gap between the physiological, morphological, ecological and psychological features of sensorimotor agents. An enactive epistemology can help with the lack of tools to deal with the gaps in-between disciplinary demarcations. To me, the best set of cases is how the nature/nurture distinction creates obstacles to the comprehension of phenomena. One example: it has been argued that gender is a social construction while sex is a biological category, the two would exist in separate realms

and should be of concern to different disciplines. Many take that to mean sex is really real while gender is less real or arbitrary (in general, phenomena said to be socially constructed face this misconception). This interpretation is rooted in an understanding of Nature as deterministic and therefore real or more real than Culture, understood as flexible due to its arbitrary nature. Fausto-Sterling (2020; 2012; 2021) shows how mistaken that is and proposes "gender/sex" as a category better suited for further inquiry. She shows how nurture can shape nature and vice-versa in the context of the development of gender identity in toddlers. She uses Varela's work on autonomy and relational identities to make her case, but she does not consider herself an enactive thinker. In my opinion, her work is incorporating an enactive epistemology into a practice. Her approach pays close attention to the messiness of concrete phenomena. What I think enactive epistemology provides is a way to understand how the world is disclosed to us at different scales, and how to connect the dots in-between them, given our current abilities and goals; a way to navigate the messiness of inquiry. The knowing-how of not knowing (Cuffari, Fourlas, and Whatley 2022), being open to uncertainty and ambiguity, is not only a matter of ethical consideration, it is also crucial for epistemic practices. The disciplinary boundaries constraining how phenomena are approached were settled by the theoretical articulation of intuitions and conceptual assumptions from long ago. The enactive epistemology I argued for is anti-foundational or groundless, knowing has no secure foundations outside or beyond *what we do* and *how we do it*. Human practices in the actual world are much more interesting than the ideal scenarios philosophers often come up with to articulate intuitions and conceptual assumptions. A good balance in relation to orthodox conceptual boundaries can be provided by looking at our own cognitive performances when searching for new embodied theories and modes of inquiry.

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