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Enactivism and the Hegelian Stance on Intrinsic Purposiveness

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Abstract
We characterize Hegel's stance on biological purposiveness as consisting in a two-fold move, which conceives organisms as intrinsically purposive natural systems and focuses on their behavioral and cognitive abilities. We submit that a Hegelian stance is at play in enactivism, the branch of the contemporary theory of biological autonomy devoted to the study of cognition and the mind. What is at stake in the Hegelian stance is the elaboration of a naturalized, although non-reductive, understanding of natural purposiveness.

1 Introduction

Since its inception at the end of the twentieth century, embodied cognition has established itself as a valuable alternative to mainstream computationalism, notably by ascribing an active role to the organism in determining cognitive phenomena. In this paper, we assess the place occupied by enactivism within the landscape of embodied cognition, by bringing to the fore the specific way it conceives of the relation between intrinsic purposiveness, agency and cognition. In doing so, we submit that what we

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label as the "Hegelian stance" on intrinsic purposiveness constitutes a relevant and fruitful philosophical reference for the enactive approach, – understood as a branch of the theory of biological autonomy, and therefore in the specific sense of 'autopoietic' or 'autonomist' enactivism.

The problem of purposiveness is one of the longest-standing issues in the history of the life sciences. As argued by Mayr (2004), purposiveness[1] and function are precisely what marks the difference between physicochemical and biological phenomena. Yet, conceived as 'teleonomy' (Mayr, 1974), teleological notions are in principle translatable into non-teleological language. Purposiveness is a shorthand for an evolutionary-mechanistic explanation of biological phenomena in terms of a historical, intergenerational process of natural selection operating on blind variations among individuals. Teleonomy usually goes with the notion of genetic program (Jacob, 1970), which is supposed to account for the ontogenesis of each individual system. Evolution "writes" the program, which in turn governs developmental and behavioral processes.

As Walsh (2006, 774) puts it, however, in doing so "contemporary biology has responded to the problem posed by the natural purposiveness of organisms by the simple expedient of ignoring it." Teleological explanations – the criticism underscores – cannot be replaced by mechanical explanations without explanatory loss: natural selection does contribute to explain the evolution of organismal form and function; yet, in order for this process to unfold, purposive organisms must exist and be struggling for existence in the first place (see also Walsh 2015). We maintain, in particular, that the teleonomic perspective overlooks the distinction between *extrinsic* and *intrinsic* purposiveness: while evolution by natural selection naturalizes the former (notably by providing an alternative to intelligent design), it leaves the latter untouched.

By relying on this distinction, the theory of autonomy argues that references to teleological notions are not just heuristic shortcuts and that, instead, biology and cognitive science should integrate a naturalized account of intrinsic purposiveness into their theoretical framework. A convergence between the Hegelian stance and the theory of autonomy with respect to their understanding of intrinsic purposiveness has been increasingly emphasized in the literature (Michelini, 2012; Michelini et al., 2018; Gambarotto & Illetterati, 2020). In fact, some recent contributions portray Hegel as endorsing an account of biological functions consistent with the "organizational" account stemming from the theory of autonomy (Cooper, 2020; Maraguat, 2020). We aim to go a step further, and argue that such proximity holds between Hegel and a *specific* branch of the theory of autonomy, namely enactivism.

Within the theory of autonomy we distinguish two different research directions, that correspond to two different routes to the naturalization of purposiveness: organizationism and enactivism. We suggest that these two routes mirror the attitudes upheld with regards to intrinsic purposiveness by Kant and Hegel, respectively. Kant's approach is characterized by the tension between his scientific commitment to mechanism and the manifest purposiveness of organized beings. By facing this

[1] We use the term 'purposiveness' to refer to the phenomenon of being oriented toward an end, and 'teleology' to designate the philosophical account and scientific study of such phenomenon.

tension, organizationism attempts to understand how intrinsic purposiveness is realized by the organization of biological parts into a whole. Hegel's approach, in turn, is epitomized by the infamous claim according to which teleology is 'the truth of' mechanism. We interpret this claim as suggesting that purposiveness should not be construed as an *explanandum*, but rather as an *explanans* of scientific discourse, i.e. something that science employs to explain. Accordingly, the focus is shifted from how purposiveness emerges from the organization of the parts to how it manifests itself in the agency of the organism as a whole, which in turn paves the way to a case for the continuity between life and mind.

The characterization of enactivism as 'Hegelian' does not amount to a simple myth of the precursor, and rather serves a twofold philosophical objective. We propose, at the same time, a Hegelian reading of enactivism and an enactive reading of Hegel. On the one hand, a careful examination of the Hegelian stance vis-à-vis purposiveness can contribute to strengthening the philosophical foundations of the enactive approach. In fact, the Hegelian stance on agency and cognition as emerging features of organismal purposiveness allows marking the specificity of enactivism with regard to other approaches to embodied cognition. On the other hand, reading Hegel in light of the enactive approach supplies an original ground to address debates on Hegel's alleged naturalism. Insofar as enaction strives to provide an account of cognition which is consistent with philosophical naturalism, the Hegelian stance can also be qualified as a form of (non-reductive) naturalism.

Our argument goes as follows: Sect. 2 discusses how both Hegel and the theory of biological autonomy meet the requirements for naturalism; Sect. 3 focuses on intrinsic purposiveness, and stresses its different declinations by Kant and Hegel; Sect. 4 draws the distinction between organizationism and enactivism within the theory of autonomy, by locating them in the more general context of current organicism and embodied cognition; Sect. 5 discusses the central themes of the Hegelian stance on agency, cognition and the mind, and their elaboration by the enactive approach.

2 Naturalism and autonomy

The place of mind in nature is one of the central issues in current debates over philosophical naturalism, the latter being broadly polarized between 'scientific' and 'liberal' attitudes. While scientific naturalism proposes a reductive account of mindedness as the result of mechanistic processes, often with an emphasis on the role of evolution by natural selection (e.g. MacDonald & Papineau, 2006; Millikan 2017; Neander, 2017), liberal naturalism aims to safeguard the *sui generis* nature of human cognition, which is considered as being both anchored in nature and yet discontinuous with it, as a pragmatic, inter-subjective, cultural phenomenon (e.g. McDowell, 1994; De Caro & MacArthur 2004, 2010; MacArthur, 2019).

The enactive approach advocates for a halfway position according to which the mind is neither understood as the mere product of mechanical processes (such as natural selection), as argued by teleosemantics, nor as a prerogative of the human 'space of reasons,' as argued by liberal attitudes such as as neo-pragmatism. Instead, the enactive approach proposes to ground cognition and the mind into a specific causal

regime, i.e. (intrinsically purposive) biological organization. Moreover, at least some versions of enactivism advocate the thesis of a "continuity without identity" between life and mind: in particular, as we argue in Sect. 5, enactivism draws a qualitative distinction between biological agency and full-fledged mind, where mind is understood as the domain of cognitive autonomy, grounded but not reducible to biological agency.

The very fact of considering Hegel as the philosophical support for a contemporary form of naturalism may seem paradoxical, and yet debates over Hegel's naturalism have been playing a key role in recent Hegel scholarship. Such debates address the question whether (and how) the world of *Geist*, i.e. the minded faculties that characterize the human, can be understood as grounded on fundamental structures of nature. Talk of a Hegelian naturalism became effectively available in the early 2010s, with the work of Pinkard (2012). The ground for such interpretation can be traced back to Pippin (1989), who fuelled the so-called 'Hegel renaissance' in the United States by providing a non-metaphysical interpretation of Hegel's *Geist* as a Sellarsian space of reasons (cf. also Pinkard 1994; Pippin, 2008; Brandom, 2019). As a result, in today's mainstream debate, to be Hegelian is by and large to be a neo-pragmatist.

The dominance of such neo-pragmatist reading of Hegel is currently being called into question. Kreines (2015) and Peters (2015), for instance, argue that the 'philosophical appeal' of Hegel's metaphysics resides precisely in providing an approach to naturalism that is currently underrepresented in mainstream debates. Such an approach questions the Sellarsian norms-nature dichotomy in favor of a picture of nature as the "founding wellspring of agency" (Moss, 2017, 227) and of *Geist* as inherently rooted in the purposive nature of living organisms (Illetterati, 2016). This view has progressively gained traction within Hegel studies thanks to Khurana (2017) and Ng (2020), who picture Hegel's concept of life as overcoming the Kantian chasm between nature and freedom. Recent work has explored the potential of this idea in light of contemporary developments in the philosophy of biology, and most importantly the theory of biological autonomy (Gambarotto & Illetterati, 2020), which provides a naturalized account of the intrinsic purposiveness of organisms and a view of cognition as resulting from the autonomous nature of biological systems. In this respect, the peculiar traits of the Hegelian stance find substantial echo in the theory of autonomy.

How does the theory of autonomy deal with biological purposiveness? Within that framework (Varela, 1979; Moreno & Mossio, 2015), an autonomous system is conceptualized as a far-from-equilibrium natural system, continuously traversed by a flow of energy and matter. The system exploits the flow to produce work that maintains the system itself (Kauffman, 2000). More precisely, the thermodynamic flow takes the form of a set of processes and transformations controlled by structures acting as constraints. Constraints canalize the flow so as to maintain themselves over time. In biological systems, constraints depend on each other for their maintenance: such a mutual dependence is what is referred to as organizational closure (Montévil & Mossio, 2015). Biological systems realize self-determination through organizational closure, a concept that goes hand in hand with thermodynamic openness. In turn, organizational closure grounds intrinsic purposiveness by realizing self-deter-

mination, insofar as the effects produced by organized constraints play a role in determining the conditions of existence of the system as a whole (Mossio & Bich, 2017).

This circular relation between causes and effects is what makes biological organization purposive, because the conditions of existence of the system can legitimately be understood as the goal of its activities. This implies a fundamental distinction between *intrinsic* and *extrinsic* purposiveness. As variants of the same concept, these two forms of purposiveness share the general feature of implying a circular relation between causes and effects. In both cases the existence of a purposive entity depends, at least in part, on the effects of its own activity. Yet, they radically diverge in the way such dependence is realized. Intrinsic purposiveness, on the one hand, refers to a circular relation in which the existence of an entity depends on the effects it produces, in such a way that the loop can be closed *within* its own boundaries. When this happens, notably through organizational closure, the entity can be said to realize self-determination, insofar as it contributes to determining by itself its own conditions of existence, with no need to appeal to an external purposive entity. Intrinsically purposive entities are the product of their own activity. Their purpose coincides with their own existence. Extrinsic purposiveness, on the other hand, designates a situation such that the existence of an entity depends on its effects, but through the intervention of an external entity that closes the loop. An artifact typically exists because of what it does, although the effects that it produces do not directly explain its existence. To close the loop between effects and causes, one has to make reference to an entity other than the artifact itself, which produces the artifact because of its (expected) effects. Accordingly, an artifact possesses extrinsic purposiveness, because the circular relation extends *beyond* its boundaries, by including the intervention of an external entity pursuing its own goals.

Organizational closure is a necessary, and yet not sufficient condition for biological autonomy. Additional layers of complexity must be integrated to capture the characteristic properties of natural autonomous systems, of which biological organisms are the realization *par excellence* (Moreno & Mossio, 2015, 104). Among them, of particular importance for our argument are agency and regulation. On the one hand, autonomous systems are *agents*, i.e. they generate purposeful behavior in their interaction with the environment, so as to promote their maintenance (Barandiaran et al., 2009; Arnellos & Moreno, 2015). On the other hand, autonomous systems are *adaptive* systems, which implies that they are able to regulate their behavior so as to adapt to internal and external variations and perturbations (Bich et al. 2016). In a word, autonomous systems (organisms) are self-determining adaptive agents.

Two implications of this framework are worth emphasizing. First, contrary to the extrinsic purposiveness of intelligent design, the intrinsic purposiveness of organisms is not explained away through evolution by natural selection, but it is a feature on which selective processes can operate. Second, the characterization of intrinsic purposiveness in terms of constraints closure allows clarifying what kind of circularity is at stake. Indeed, not any natural system realizing a loop should count as a purposive system. Otherwise, as it has often been pointed out, the water cycle should be interpreted as purposive (see e.g. Toepfer, 2012). Purposive circularity is that involving the mutual dependence among constraints. As Mossio & Bich (2017) have argued, the crux is self-determination. A system realizing organizational closure can

be legitimately said to contribute to determining its own conditions of existence, because of the constraints exerted on the thermodynamic flow. If the constraints were not exerted, the system would not exist. In contrast, many other natural cycles, such as the water cycle, realize a circular chain of transformations which is sufficiently determined by external boundary conditions. These cycles do not determine their own conditions of existence, they simply happen when such conditions are independently met.

We think that the interpretation of intrinsic purposiveness brought about by the theory of biological autonomy is scientifically legitimate and fecund. From the perspective of mechanistic science, purposiveness is controversial because of the circularity between causes and effects. More precisely, purposiveness leaves itself open to three main criticisms: first, it implies a straightforward inversion of time, such that subsequent events affect antecedent ones; second, it appeals to intentions, and gives in to anthropomorphism; third, it relies on some *sui generis*, mysterious force or principle able to generate a specific effect, which was otherwise underdetermined by physicochemical principles. Although they point to very different issues, these criticisms have a common ground, insofar as they question the integration of purposiveness into the causal structure of the world, as accepted by natural science. Yet, autonomy theorists (see for instance Mossio & Bich, 2017) argue that such criticisms, addressed in the name of scientific naturalism, do not to affect their framework: the intrinsic purposiveness of autonomous agents does not invert time, it has nothing to do with anthropomorphism, and it does not appeal to mysterious, unnatural principles. As a matter of fact, an increasing number of philosophical, theoretical and modeling contributions have been examining its features and exploring its prospects.

The theory of autonomy thus provides an account of biological purposiveness that, while non-reductive, meets the requirements of naturalism. Consequently, arguing that Hegel's position is coherent with the framework of biological autonomy amounts to arguing that Hegel can also be interpreted as supporting an original kind of naturalism with regard to agency and the mind. However, the precise features of such a naturalism require a more detailed characterization, which we address in the remainder of the paper. In particular, we emphasize that there is no one single way to approach the issue of biological purposiveness from a naturalized standpoint, and that the way the enactive approach does so can be specifically qualified as Hegelian.

3 Kant and Hegel on intrinsic purposiveness

So far, we have hinted that there are relevant similarities between Hegel and the theory of biological autonomy with regards to their conceptions of intrinsic purposiveness. We aim now to qualify this claim in detail, by showing that the Hegelian stance on intrinsic purposiveness can be better captured in contrast to the Kantian stance. For this reason, in this section we dwell on Hegel's criticism of Kant's teleology. Kant's treatment of intrinsic purposiveness is encapsulated by the famous antinomy of teleological judgment. The antinomy consists in the impossibility of reconciling the maxim according to which "all generation of material things and their forms must be judged as possible in accordance with merely mechanical laws" and the maxim

stating that "some products of material nature cannot be judged as possible according to merely mechanical laws (judging them requires an entirely different law of causality, namely that of final causes)" (Kant 2000, 5: 387). The products of nature that cannot be accounted for in mechanical terms are organisms (or 'organized beings' as Kant called them).

Understanding what Kant means by mechanical explanation is not straightforward and a large debate in Kant scholarship has dealt with this issue. According to McLaughlin's interpretation (1990, 2014), that we follow here, Kant conceives mechanism as a specific instantiation of the transcendental principle of causality that frames the relations between parts and whole in a system: the parts are the causes and the whole is the effect; the parts determine the whole, but not vice-versa. At the same time, organisms appear to us as purposive entities, which in general terms means, as Kant explains in § 61 of the *Critique of the Power of Judgment* (hereafter: CPJ), that their very possibility requires appealing to final causes. Otherwise, it would be impossible to explain their existence, insofar as "nature, considered as mere mechanism, could have formed itself in a thousand different ways without hitting precisely upon the unity in accordance with such a rule" (Kant 2000, 5: 315).

Mechanism seems to drastically underdetermine the complexity and adaptation displayed by organismal organization, which requires appealing to teleological principles. Troubles begin as soon as the question of the scientific legitimacy of final causes is addressed. Kant's discussion is long and complex, and we restrict ourselves to follow some general steps. Kant begins by arguing that teleological explanations are explanations that imply an object to be caused by its concept. This is what happens in the case of artifacts or machines, whose orderly arrangement of parts into an organized whole is caused by the (previous) concept (i.e. the project) of a rational agent (Kant 2000, 5: 360). In Kant's philosophical framework, purposiveness is first and foremost a feature of reason, be it human or divine.

For Kant, however, the appeal to divine intentions and the analogy with artifacts are neither philosophically legitimate nor empirically relevant when dealing with organisms. It is here that the distinction between extrinsic and intrinsic purposiveness comes into play: while artifacts are endowed with extrinsic purposiveness, organisms are intrinsically purposive entities. This means that they possess a unique self-organizing power, as emphasized in § 65 of the CPJ, a "formative power" which bestows organization on unorganized matter and cannot be accounted for in merely mechanical, causally efficient, terms. The distinction between extrinsic and intrinsic purposiveness is ground-breaking because it reveals that, contrary to the initial characterization, purposiveness may refer to a causal regime not appealing to rational intentions.

Nevertheless, the move is insufficient because intrinsic purposiveness is still in conflict with mechanism, insofar as it implies the idea that the whole determines the parts just as the parts determine the whole. Since Kant was firmly convinced that mechanism is the only admissible scientific explanatory strategy, he was unable to consistently integrate intrinsic purposiveness into natural science, and expressed the tension in the form of the antinomy.

A lively debate exists about how Kant solves the antinomy between mechanism and purposiveness, and we do not deal with this issue here. What matters for us is to

underscore that Kant's own philosophical framework makes the scientific treatment of intrinsic purposiveness uneasy. The structure of his critical philosophy, which imposes a mechanistic interpretation of the science of nature, forbids handling purposiveness as a natural phenomenon. At the same time, Kant ascribes purposiveness to human reason, insofar as the autonomy of the will is a condition for moral agency, as discussed in the *Critique of Practical Reason*: in order for moral agency to be possible, the will cannot be necessitated by mechanical laws, and must instead be autonomous, i.e. able to give its own law to itself, and pursue its own goals. The result, as Kant writes in the CFJ (5: 171), is a dualism between the 'concepts of nature' and the 'concepts of reason.' The purposiveness of organisms gets, so to speak, caught in the middle: organisms display purposive features that are analogous to those exhibited by human reason, but this is only a "a remote analogy with our own causality in accordance with ends" (5: 375), because purposiveness is not a form of natural causality (Mensch 2013; Breitenbach 2014).

In the 'Teleology' section of his *Science of Logic*, Hegel acknowledges that "one of Kant's greatest services to philosophy was in drawing the distinction between relative or *external* purposiveness and *internal* purposiveness; in the latter he opened up the concept of *life*, the *idea*, and with that he *positively* raised philosophy above the determinations of reflection and the relative world of metaphysics" (Hegel 2010, 654). Yet, Hegel stresses, Kant's fundamental contribution remained unaccomplished, precisely because of the Kantian dualism between nature and reason. For Hegel, the move which is required to go beyond Kant's position consists in freeing our understanding of nature from mechanistic canons, abolishing the Kantian dualism and, inversely, arguing that there is a fundamental continuity between the intrinsic purposiveness of nature and the intrinsic purposiveness of reason.

The philosophical treatment of intrinsic purposiveness is offered by Hegel in the transition between the 'Objectivity' and the 'Idea' sections (which are respectively the penultimate and final sections of the *Science of Logic*), and more precisely in the transition from the 'Teleology' chapter (the last of 'the Objectivity' section) to the 'Life' chapter (the first of the 'Idea' section). The 'Objectivity' section deals with mechanism, chemism and teleology, the latter referring there to extrinsic purposiveness. All these determinations have in common the fact of dealing with 'objects', i.e. inert entities that are 'acted' extrinsically, from the outside. In the Life section, the extrinsic determination proper to objectivity gives way to self-determination, which overcomes the hiatus between 'concept' (that refers to the cognition of a rational agent) and 'object' (that refers to any inert entity governed by blind mechanical necessity).

Life is the "highest stage that nature's externality can attain by withdrawing into itself and sublating itself in subjectivity" (Hegel 2010, 677). Hegel's notion of subjectivity here does not refer to the full-fledged cognitive features of human understanding (Kant's transcendental unity of apperception). Rather, the living being is 'subject' precisely because of its capacity for self-determination. Hegel characterized this novel understanding of subjectivity as the "originative *judgment* of life" (*ursprüngliche Urteil des Lebens*) (Hegel 2010, 678). With this expression, Hegel refers to the separation of an individual cognitive subject from objective nature: through the circular relation that characterizes the living individual, one in which every part of the

system is at the same time the cause and the effect of itself, the organism constitutes an autonomous causal regime, which stands out from mechanical objectivity.

As Kant, Hegel underscores that intrinsic purposiveness goes with self-determination, which implies that the parts of the organism exist only through their relation with the whole. In an organism, "each member is reciprocally end and means, maintains itself through the other members and in opposition to them" (Hegel 2004, 337). Similarly, in his lectures on the philosophy of nature Hegel argues that "the organism is a purpose in itself – it produces only itself" (Hegel 2012, 133).

Hegel emphasizes the processual nature of intrinsic purposiveness, by elaborating on what, in contemporary terms, we might call the interplay between organizational closure and thermodynamic openness in biological systems. In particular, Hegel elaborates on the peculiar dialectics between the stability of the organization and the continuous turnover of its material constituents: "there is no permanence in the organism; everything is reproduced" (2004, 378, modified translation). Yet despite the continuous material change taking place in the organism, the "figure" or "shape" (*Gestalt*) remains constant. Organisms maintain themselves by continuously replacing their constituents, which opposes the tendency to go to thermodynamic equilibrium and die. The idea of material turnover brings Hegel to the notion of "assimilation" (*Assimilation*), which consists in "the turning of the external into the unity of selfhood" (2004, 393, modified translation). The dynamical realization of intrinsic purposiveness requires transforming external entities into constituents of the organism, which is paradigmatically instantiated by the phenomenon of metabolism.

At this point, one may wonder whether Hegel's contribution provides the philosophical tools to solve what we might call "Kant's problem," which consists in providing a mechanical explanation for the intrinsic purposiveness of organisms, which in turn requires decomposing the whole into its parts. As Kant, Hegel is convinced that the mechanical treatment of organisms is highly problematic, due to the mutual dependence of their parts. In his words, "*purposive connection* has proved to be the truth of *mechanism*" (2010, 652). The expression conveys the idea that, contrary to what Kant thought, mechanism cannot be considered as the ultimate explanatory strategy. Rather, it should be replaced by a more comprehensive form of explanation, one capable of accounting for the agential features of *Geist*: an organic entity cannot be decomposed and explained by analyzing its parts and must instead be conceived according to teleological principles.

For Hegel, an organism is "a manifold, not of *parts* but of *members*" which "exist as such only in the individuality" and if separated "revert to the mechanical and chemical relations of common objectivity" (2010, 681). Once taken apart from the whole, the members lose their inherently 'living' features: "if a finger is cut off, a process of chemical decomposition sets in, and it is no longer a finger" (2004, 352). If mechanistic explanations are understood (as we do, following McLaughlin's interpretation) as a strategy that attempts to explain the whole in terms of its parts, then Hegel is not providing any additional hint, with respect to Kant, about how organisms could be examined mechanistically. And, if biological explanations are conceived as being mechanistic, it seems to follow that intrinsically purposive systems cannot be studied scientifically.

And yet this is where Hegel's most original insights step in. Hegel leaves Kant's own problem unresolved, but points to new research directions that mechanistic science tends to overlook. Instead of analytically studying how the parts determine the whole and vice-versa, Hegel's suggestion is to focus on the phenomena produced by the organism as a whole, notably in its interaction with the environment: in particular, biological organisms can be studied by presupposing that they are intrinsically purposive *agents*, which in turn opens the way to a continuity between life and mind that overcomes Kant's dualism. As such Hegel's stance on intrinsic purposiveness induces him to evoke themes that have been subsequently addressed by disciplines such as cognitive science, ecology and evolutionary biology, especially in the twentieth century, as we will discuss in the following section. Philosophically, the Hegelian stance is important because it contends that the study of intrinsic purposiveness can be scientifically legitimate and fecund *even if* the question of its analytical, mechanistic treatment is unsettled. The Hegelian stance promotes a non-reductive conception of scientific explanation, according to which specific kinds of phenomena can be adequately explained by appealing to an *explanans* located at the relevant level of description, even though such *explanans* cannot be reduced to more fundamental constituents.

4 Two branches of autonomy: organizationism and enactivism

In recent years, there has been an increasing talk of a 'return of the organism' at center stage of contemporary biology (Bateson, 2005; Huneman 2010; Nicholson, 2014) and that in various disciplines as for instance developmental biology (Gilbert & Sarkar, 2000), evolutionary developmental biology (Callebaut, Müller & Newman, 2007), systems biology (Saezler et al., 2011) and evolutionary biology (Wagner & Laublicher, 2000). As a matter of fact, a similar trend exists in cognitive science, where numerous contributions advocating what is generally referred to as "embodied cognition" have appeared over the years (Varela et al., 1991; Shapiro, 2011). Versions of embodied cognition have been promoted in various fields as cognitive development (Thelen & Smith, 1994), robotics (Pfeifer & Scheier, 1999) and perception (Noë, 2004).

One main reason for this parallel trend is that both biology and cognitive science have been profoundly influenced, during the second half of the twentieth century, by theoretical perspectives relying on the machine analogy, and particularly the computer analogy: these are genocentrism and computationalism respectively (see for instance Thompson, 2007: 174). In both perspectives, the organism plays a marginal role, as a vague *explanandum*, while none of them *relies on* distinctive organismic features so as to produce relevant explanations of biological and cognitive phenomena. Organicism and embodied cognition react to genocentrism and computationalism by a similar conceptual move, which places the organism at center stage of their explanatory endeavor. Through this move, the organism becomes not only a central target of biological and cognitive explanation but also an *explanans*. In particular, one of the organismic features that come to the foreground is *agency*, understood as

the capacity to purposefully engage in interactions with the environment, as well as with other organisms.

We submit that our qualification of the enactive approach as 'Hegelian'allows to capture its specific philosophical foundations with regard to other frameworks pertaining to organicism and embodied cognition. The key philosophical role we attribute to the Hegelian stanceis the assumption, which is lacking in other approaches, of intrinsic purposiveness as the ground for natural agency. In particular, we take the Hegelian stance as consisting in a *twofold move*. On the one hand, it accepts and makes explicit the idea that organisms realize an intrinsically purposive organization, whose fundamental *telos* is its own preservation. On the other hand, it implies a shift in focus, which presupposes purposive organization as an *explanans* to address organisms' behavioral and cognitive abilities, which emerge through their interaction with the environment.

Since the emergence of embodied cognition, agency as an explanatory concept has been brought to the foreground by different approaches, nourished by a scientific and philosophical tradition which includes, among others, Uexküll (1934/2010), Goldstein (1934/1995) Canguilhem (1953/2008), as well as philosophical work belonging to the phenomenological tradition (Merleau-Ponty, 1942/1983; Jonas, 1966/2001). At least three of these approaches are worth mentioning, in a roughly chronological order of appearance. The first one is *ecological psychology* (Gibson, 1979/2015), which places heavy emphasis on the fact that perception is perception of affordances, i.e. possibilities for action available to agents engaged in the purposive exploration of the environment. The second approach is *enactivism*, introduced by Varela, Thompson and Rosch (1991), according to which perception consists in action being guided through sensorimotor patterns, while cognition designates more generally the enaction (or "bringing forth") of a world due to the history (one may say the "sedimentation") of perceptual activities leading to a congruence ("structural coupling") between the agent and the environment. The third and more recent approach is *sensorimotor theory* (O'Regan and Noë, 2001; Noë, 2004), whose central claim is that perception is the mastery of the laws of sensorimotor dependencies, which refer to the covariation between sensory and motor patterns, produced by the "skillful engagement" of an agent in the world.

In recent years, the focus on agency as an explanatory tool is also gaining momentum in biology, even though the tendency is still relatively small when compared to cognitive science. However, the situation is quickly changing, and a strong impulsion toward the consideration of agency as an *explanans* is coming from the debate about the need of a "rethink" or an "extension" of the modern synthesis of evolution established in the 1940s (Pigliucci and Müller, 2010). Indeed, the topics addressed by the emerging extended evolutionary synthesis (i.e. constructive development, phenotypic plasticity, niche construction and extended heredity, see Laland et al., 2015) collectively provide support to Lewontin's claim (1985: 89) according to which "the organism cannot be regarded as simply the passive object of autonomous internal and external forces; it is also the subject of its own evolution." As Walsh (2015), Okasha (2018) and Jäger (forthcoming) have also recently advocated, the organism must be understood as an agent playing an active role in shaping evolutionary processes.

While the above literature does share Hegel's emphasis on the explanatory role of agency in the biological and cognitive domain, most of these accounts do not specifically endorse the Hegelian stance as characterized above. In particular, what is lacking in most authors is the anchoring of agency to intrinsic purposiveness: in particular, this implies that agency is not understood as a *distinctive* capacity of living systems. There is however one exception: enactivism, and in particular Varelian enactivism, which grounds agency into the general theory of autonomy[2].

The theory of autonomy has been elaborated in two distinguishable, although closely related, directions. On the one hand, many contributions have dealt with the constitutive *organization* of autonomous systems, by examining how and under what conditions a set of parts realizes self-determination through closure in far-from-equilibrium conditions. Landmark contributions in this respect are Maturana and Varela's autopoiesis (1980), Rosen's (M,R)-systems (1991), Kauffman's molecular autonomous agents (2000) and some developments have appeared more recently (Montévil & Mossio 2015; Moreno & Mossio 2015). Using a neologism, let us call this research direction 'organizationism.' On the other hand, enactivism focuses on the behavioral and cognitive abilities of autonomous systems and ultimately aims at accounting for the *mind* as a natural phenomenon (in addition to Varela et al., 1991, synthetic accounts are also offered by Thompson, 2007 and Stewart et al., 2010). If we were to express the distinction between organizationism and enactivism in disciplinary terms, we would say that they tend to contribute to explanatory endeavors in biology and cognitive science, respectively.

We submit that organizationism and enactivism have different explanatory strategies vis-à-vis intrinsic purposiveness, and notably with regards to agency. Organizationism focuses on the features that biological organization has to possess in order to display agential capacities: agency is something that is to be explained, by appealing to concepts such as closure, functions, regulation and dynamical decoupling (see for instance Moreno & Etxeberria, 2005). Enactivism, in turn, aims at accounting for behavioral and cognitive phenomena by *presupposing* that biological organisms are intrinsically purposive agents interacting with an environment. Agency is something that is used to explain, by relying on its rooting into biological organization.

The distinction should by no means be understood as watertight. It might be the case that organizationist approaches presuppose agential capacities at one level of description to account for biological phenomena taking place at a different level. For instance, this is the strategy adopted by Soto and coworkers when appealing to the biological "default state" (Sonnenschein & Soto, 2016). In their work, individual cells are supposed to be purposive agents by hypothesis, while multicellular phenomena such as morphogenesis (Montévil et al., 2015) and cancer (Sonnenschein & Soto, 2016) are accounted for in organizationist terms, resulting from mutual constraints exerted on individual agents. Reciprocally, contributions to enactivism may sometimes undergo an exploration of the organizational conditions of purposive agency. In our understanding, this is for instance the case of Di Paolo's (2005) landmark study on autopoiesis and adaptivity.

[2] In section 5.2 below we further discuss the implications of this crucial difference between enactivism on the one side, and ecological and sensorimotor approaches on the other side.

The shift that both organizationism and enactivism may operate between different explanatory strategies with regards to agency should be understood in light of the fact that they both emanate from the theory of autonomy, which aims at recomposing the philosophical divergence between the Kantian and Hegelian stances. As it is often recalled (see for instance Thompson, 2007: 128), the theory of autonomy promotes a "deep continuity thesis of life and mind," according to which mind emerges from life, and mind is a complexification of the distinctive organizational properties of life. Accordingly, the decision about whether a given study counts as a contribution to organizationism or enactivism may be a matter of degrees. A significant example of a research domain, which lies at the intersection between organizationism and enactivism, is 'Varelian' neuroscience (Varela, 1995). Theoretical and empirical work pertaining to this domain seeks to account for cognitive capacities by exploring how these are realized by a self-maintaining and self-regulated network of neurodynamic structures (Barandiaran, 2017), emerging from large-scale integration (Varela et al., 2001) and sensorimotor couplings (Engel et al., 2013).

In spite of their overlaps and convergences, we do maintain that organizationism and enactivism adopt significantly different explanatory attitudes with regards to intrinsic purposiveness. We therefore claim that while the former is better understood as the heir of the Kantian stance, the latter (in its "autopoietic" or, more precisely, "autonomist" version as labeled by Barandiarian, 2017) should be qualified as Hegelian. To some readers, this statement might appear counterintuitive, insofar as key contributions to the enactive approach refer to Kant as a philosophical precursor, while never mentioning Hegel (Weber & Varela 2002; Thompson 2007). Yet, the reference to Kant is by no means incompatible with the fact of having (maybe unknowingly) a Hegelian stance. As discussed, Hegel did rely on Kant's treatment of purposiveness, while shifting the focus to different philosophical questions. In a similar vein, enactivism grounds its conception of purposiveness into Kant's without adopting a Kantian stance, which would imply attempting to solve Kant's *own* problem, as previously characterized.

Indeed, advocates of autonomist enactivism have repeatedly underscored the *first move* of the Hegelian stance: the rooting of agency and cognition into biological intrinsic purposiveness (which justifies the reference to Kant). As a matter of fact, Weber and Varela (2002), Di Paolo (2005) and Thompson (2007) acknowledge the legacy of Hans Jonas's biophilosophy (1966/2001) for enactivism, and in particular his "re-enchantment of metabolism," seen as the fundamental realization of intrinsic purposiveness in nature. Following Jonas, enactivists place heavy emphasis on the idea that natural agency is first and foremost a manifestation of the purposive organization of living systems (and not only of human beings), whose activity aims at determining their conditions of existence. Crucially, autonomist enactivism also makes the *second move* associated with the Hegelian stance, which consists in presupposing (instead of explaining, which would amount to adopting a Kantian stance) the realization of a purposive organization, and in shifting the focus to the interactive phenomena that it generates as a whole.

As a matter of fact, Thompson and Varela (2001: 424) distinguish three distinct, and yet mutually constraining dimensions of embodiment: organismic regulation, sensorimotor coupling and intersubjective interaction. While the first dimension cor-

responds to the constitutive organization of the organism (which is usually *not* the explanatory goal of the enactive approach, but rather its point of departure), the second one points to perceptual, sensorimotor and perceptual abilities (what Di Paolo et al., 2017, label "sensorimotor life"), and the third one to communicative, linguistic and social interactions (Di Paolo et al., 2018). From an enactive perspective, these behavioral and intersubjective dimensions of embodiment are the natural ground of the mind, and they constitute the manifestations of intrinsic purposiveness with respect to which the Hegelian stance applies. By setting such an original research agenda, the enactive approach elaborates on themes that are highly reminiscent of Hegel's own discussion of purposiveness, which we consider in the following section.

5 The Hegelian stance on agency and cognition

As Hegel does when he discusses the assimilation of external elements through metabolism, enactivism emphasizes the role of autonomous organization in grounding biological individuality. The self-determination of the intrinsically purposive organization enables conceptualizing the living individual in terms of a "self-asserting" and "self-affirming" entity (see e.g. Weber & Varela, 2002: 119). Such a self-affirming identity leads to the distinction between system and environment, as Thompson points out: "we see the co-emergence of inside and outside, of selfhood and a correlative world or environment of otherness, through the generic mechanism of network closure (autonomy) and its physical embodiment" (2007: 49). In turn, the distinction between the biological individual and the environment provides the ground on which the distinctive themes of the Hegelian stance are deployed.

5.1 Hegelian themes on purposeful agency

Hegel argues that subjectivity (which, as mentioned in the previous section, is more fundamental than human conscious subjectivity) of (animal) organisms generates two related dimensions: "the simple feeling of self (*Selbstgefühl*)" (2012, 725), on the one hand, and "sensation" (*Empfindung*) on the other hand, which in turn enables a "theoretical behavior" (*theoretisches Verhalten*) towards external objects (2012, 717). To our understanding, Hegel presents here the core idea of enaction as introduced above, whereby the biological individual brings forth the external world as an object of perception. This is a *leitmotif* of the enactive literature, and many claims making this point can be easily found, as for instance: "an organism is a center that organizes matter into a living being and its *Umwelt*, hence enacting on this stage the original split of subject and its world and their dialectical interrelatedness" (Weber & Varela, 2002: 120).

The Hegelian stance connects the constitution of perceptual structures to a fundamental *drive* stemming from the self-determining activity of autonomous organization. In an unpublished fragment from the Nürnberg years (1808–1816), *On Mechanism, Chemism, Organism and Cognition*, Hegel describes the agency of the subject as "activity of deficiency" (*Tätigkeit des Mangels*, see Illetterati, 1996; Michelini, 2012). Because of their material turnover, biological organisms are in

need of assimilating external entities and of transforming them into constituents, and their activity is oriented towards the satisfaction of that fundamental need. The organism's relation to external objectivity is mediated for Hegel by the "feeling of *lack* and the urge to get rid of it" (2004, 384). The very same idea, we hold, is put forward by enactivists when they refer to concepts as *precariousness* and *concern*. Weber and Varela (2002), Di Paolo (2005; 2009) and Thompson (2007), in particular, elaborate on Jonas' emphasis on the inherent association between "freedom" (autonomy, in enactive terms) and "need" ("needful freedom"). In particular, they underlie that the precarious existence of autonomous systems, due to the necessity of maintaining a continuous supply of matter and energy, goes with a concern, a drive to affirm their individuation against the tendency to disintegration. Precariousness begets need, and need begets concern.

In turn, the drive that autonomous agents have with regards to their own conditions of existence gives them a *point of view* on the world they enact. Because they are driven by need, it makes a difference for natural agents whether a certain state of affairs rather than another is realized and perceived. Such a difference provides a ground to ascribe meaning and value to the object of perception, in relation to its influence on the conditions of existence of the agent, as well as to the possibility of action that it opens. Here again, Hegel depicts the relation between the agent and its environment by emphasizing the fact that the latter provides opportunities for action to the former. Crucially, such opportunities are inherently relational, as they depend on organisms' intrinsic purposiveness and the point of view that it generates.

Hegel insists on this point in his treatment of organic assimilation. In § 357 of the *Encyclopedia*, for example, he argues that "the self-feeling of individuality is also directly exclusive and in a state of tension with a non-organic nature which stands over it as its *external* condition and material" (2004, 380). In the addition, he further specifies that "the individual exists for itself over against this non-organic nature, but in such a way that the connection between them is altogether absolute, indivisible, inner, and essential" (Ibid, 381). Again, in § 357a, Hegel argues that "in this external relation the animal organization is *immediately* reflected into self" and then, in the Addition, he specified that "the object which is hard, warm, etc., exists independently outside of me: but equally it is immediately transformed, made ideal, a determinateness of my feeling" (Ibid, 382). As recently argued by Lindquist (2018, 392), for Hegel "living beings do not have the rest of nature set over against them as something indifferent but inhabit environments that afford them opportunities to live and act in. These environments are not the sorts of collections that physics has in view; an animal does not care about mass or gravitation but about food and whether a branch can be walked on."

The enactive research program has provided a substantial development of these ideas, by bringing the concept of *sense-making* to the foreground (Weber & Varela 2002, 18). Enacted objects acquire a meaning that inherently depends on the purpose of the agent: intrinsic purposiveness generates meaning. The now classical example is the bacterium swimming in a sucrose gradient: "That sucrose is a nutrient isn't intrinsic to the structure of the sucrose molecule; it's a relational feature, linked to the bacterium's metabolism. Sucrose has significance or value as food, but only in the milieu that the organism itself brings into existence" (Thompson 2004, 286). Hegel's

previous remark on the *locus* of determination is mirrored by enactivists' emphasis on the idea that agency implies an asymmetrical interaction with the enacted world. Because of adaptivity, in particular, the agent regulates its interactions with the external environment "according to the norms established by its own viability conditions" (Barandiaran et al. 2009, 8). It is the agent that regulates the couplings following its needs and goals, not the environment: the agent is the source of determination.

Sense-making represents a signature topic of the Hegelian stance on intrinsic purposiveness: "an important step towards a true conception of the organism is the substitution of the concept of stimulation by external potencies for that of the action of external causes" (2004, 385). This idea provides a conceptual ground enabling the exploration of many abilities exhibited by agents in their purposeful interactions with the world, as well with other agents. Hegel remarks that organisms do not just exploit ecological "potencies" to secure assimilation: they also "strive" to survive by generating new opportunities.

Such capacity is captured by the German term *Kunstrieb* which, according to a dictionary from 1836-37, defines "in the case of animals, their inherent ability to produce certain composite effects similar to human art; a kind of natural instinct."[3] According to Hegel, the primary form of *Kunsttrieb* "is the instinctive building of nests, burrows and lairs, whereby the general totality of the animal's surroundings is its own. [...] Then there is the migration of birds and fish, which is related to their climatic sensitivity, and also the collecting of provisions for the winter, whereby that which is to be consumed later by the animal becomes part of its present habitat [...] The other side of the *Kunsttrieb* is that many animals first prepare their weapons. The spider weaves its web in order to catch its food for example" (2004, 407–408).

The *Kunsttrieb* enriches enactive sense-making with a productive dimension at play in the manufacturing of artifacts as well as in the modification of the environment, the latter capacity being close to what is referred to as "niche construction" in contemporary biology. Enactivists have explored the *Kunsttrieb* especially in the work of the "Compiègne School" (Steiner, 2010). The central idea consists in looking at artifacts as interfaces enabling *augmented* sense-making (Froese et al., 2012), i.e. new modes of perceptual interactions. In particular, tools modify sensorimotor regularities and thereby contribute to enact the world. By relying on the work of Leroi-Gourhan (see for instance Lenay, 2018), Compiègne enactivists place emphasis on the constitutive role of tools in shaping human cognition, and on the coevolution of tools and the human brain (Stewart, 2010). This research group has also investigated the perceptual role of tools from an empirical perspective, by focusing on sensory supplementation, the modification of perception resulting from the modification of the technological interface (Lenay et al., 2003).

As far as we know, in turn, enactivism has not specifically addressed niche construction as a particular way of bringing forth a world of experience, letting aside some preliminary hints by Stewart (2010). A more consistent engagement of enactivism in this research direction in the future would be good news notably in terms of

[3] Online source provided by the Trier Centre for Digital Humanities, Universität Trier: http://woerterbuchnetz.de/Adelung/call_wbgui_py_from_form?sigle=Adelung&lemid=DK02963&hitlist=&patternlist=&mode=Vernetzung

its connection with evolutionary theory. Indeed, niche construction is one of the main phenomena advocating for an organicist turn in evolutionary theory, suggesting that agents play an active role in modulating evolutionary processes. Thereby, an enactive account of the *Kunstrieb* would make a junction between the theory of autonomy and the theory of evolution, thereby complementing the existing investigations on autonomy and evolution conducted from a rather organizationist perspective (see for instance Ruiz-Mirazo et al., 2008).[4]

5.2 From agency to the mind

In the *Philosophy of Nature* Hegel explicitly underscores that intrinsic purposiveness manifests itself in biological systems first and foremost as agency. Purposiveness, in this sense, should not be understood as an exclusive feature of a conscious (rational) mind but, rather, as a general attribute of biological behavior. The *Kunstrieb*, Hegel argues, "appears as a purposive action, as wisdom of Nature, and it is this category of purposiveness that makes the *Kunstrieb* difficult to comprehend. [...] This constructive instinct is in fact *analogous* to Understanding as a self-conscious entity; but one must not therefore, in thinking of purposive action in nature, think of self-conscious understanding" (2004, 405). Hegel thus makes a distinction between natural agency and mindedness.

The complex relation of continuity and discontinuity between life and mind is well represented in the *Science of Logic*, where reason, as the fundamental feature of *Geist*, is considered as continuous, but not identical with biological agency: "it is from the *idea of life* that the idea of spirit has emerged, or what is the same thing, that has demonstrated itself to be the truth of the idea of life" (Hegel 2010, 694). The claim of *Geist* as 'the truth of nature' (cf. also *Enz* § 381) can be interpreted, as some critics have done, as conveying the idea that, while for Hegel mental phenomena might be fundamentally grounded in the agency of biological systems, the world of *Geist*, with its linguistic and inter-subjective features, transforms organismal cognition into something else entirely (Moss 2017; Testa 2020, 2021; Corti 2021).

Also in this respect the Hegelian stance is at play in the enactive approach, which has increasingly emphasized the qualitative difference between agency and cognition . In fact, the question whether biological autonomy (which includes agency) straightforwardly implies cognition is the object of an ongoing debate within enactivism. On the one hand, some authors support Maturana and Varela's original position

[4] Putting evolutionary questions in relation to a Hegelian stance might appear problematic. In fact, while the relation between Romantic philosophy of nature to evolutionary theory has been widely discussed (cf. e.g. Richards 2002; Richards 2016), what seems to be particularly relevant with regard to Hegel is his open rejection of evolutionary approaches (such as Lamarck's) found in § 249 of the *Encyclopedia*. It is not our intention to enter this debate here, but we agree with the position expressed by Harris (1998, 206), who after discussing Kauffman's *The Origins of Order* (1993), concludes that "this change of outlook premises a theory of evolution based on the nature of, and nisus toward, the whole: a process bound to be dialectical in essence. Had such a theory, with sound scientific credentials, been at Hegel's disposal in the early nineteenth century there can be little doubt that he would have embraced it with alacrity." We believe this statement to be especially true today in the context of the recent return of the organism and calls for an Extended Evolutionary Synthesis where the phenomenon of organismal agency is bound to play a central role.

according to which "living systems are cognitive systems, and living as a process is a process of cognition" (Maturana and Varela 1980, 13; see also Bourgine and Stewart 2004). On the other hand, some authors follow Di Paolo in arguing that the continuity between life and mind does not amount to identity (Di Paolo 2005; Di Paolo et al. 2017, 2020).

The main argument in support of the second position underscores that cognitive capacities do not necessarily contribute to biological self-determination; in some cases, they can even threaten self-determination. Therefore, a conceptual distinction is to be made between biological and cognitive autonomy which, as its advocates have suggested, relies on the realization of self-sustaining loops of interaction with the world, enabled (but underdetermined) by metabolic closure (Barandiaran and Moreno 2006; Di Paolo 2009). The emergence of complex cognitive abilities, language, reasoning and possibly consciousness, requires as a necessary condition the realization of these sensorimotor habits and social patterns of interaction, which can be understood as distinct *loci* of intrinsic purposiveness. The theory of autonomy is thereby expanded so as to account for what Barandiaran has labeled "mental life" (Barandiaran 2017). Hence, insofar as mental capacities are associated with cognitive ones, a theory of intrinsic purposiveness as sense-making is not yet an account of the mind. Although there is fundamental continuity between these layers of purposiveness, each successive layer is also under-determined by the previous one, and calls for a proper explanatory endeavor.

At this point, the reader may wonder what difference it makes to adopt a Hegelian stance when comparing autonomist enactivism with other approaches of agency and cognition evoked above. We submit that unlike the enactive approach, neither ecological psychology nor the sensorimotor account possess the conceptual resources to account for the teleological and normative dimensions of agency and cognition. These approaches do describe perception in terms of a dynamical, active engagement of an agent in its environment; yet, the reasons of such an engagement, its purposes and norms, as well as the process of sense-making are not part of their explanatory endeavor. From this, further important differences derive. In particular, enactivism differs from both ecological psychology and sensorimotor theories with regards to functionalism (Di Paolo 2009, 16). While the latter approaches do not put principled restrictions on what kind of systems could be agents, enactivism tends to emphasize that machines cannot enact a world, because enaction implies sense-making, which implies concern, which implies need, which implies precariousness, which implies a specific far-from-equilibrium dynamical organization that is found in living beings, but is absent in artifacts. In the Hegelian stance, materiality matters.

6 Conclusions

The central objective of this study has been to establish a connection between Hegel and the enactive treatment of intrinsic purposiveness. Understood as a branch of the theory of autonomy, enactivism adopts a characterization of intrinsic purposiveness that satisfies the requirements of scientific naturalism. Intrinsic purposiveness goes with self-determination, which in turn is realized by organizational closure. It has

been our contention that such a characterization makes purposiveness workable in scientific theorizing and modeling. In particular, we have argued that enactivism differs from other approaches to embodied cognition precisely because of its anchoring of agency and cognition in the intrinsic purposiveness of biological systems.

Moreover, we have suggested that qualifying the enactive approach as Hegelian allows us to capture its specificity with regards to the other branch of the theory of autonomy, namely organizationism. As discussed, the different stance that organizationism and enactivism have on purposiveness mirrors that between Kant and Hegel on this matter. Hegel adopts Kant's understanding of intrinsic purposiveness and conceives biological systems as causes and effects of themselves, by emphasizing their capacity to maintain their form in spite of (today we would rather say: thanks to) a continuous material turnover. Yet, Hegel does not follow Kant's path in examining the circular relations between the organized parts, and the related tension between self-determination and mechanism (and, more generally, between analysis and decomposition). Hegel makes a different move: he presupposes purposive agency, and shifts the focus from the constitutive organization to the behavior and the cognitive skills of a natural agent interacting with the environment, as well with other agents. We have suggested that in this shift - made by enactivism in its core explanatory endeavor – lies the Hegelian stance vis-à-vis intrinsic purposiveness.

It is worth underscoring that the Hegelian stance is as explanatorily legitimate as its organizationist counterpart. The move which consists in relying on purposive organization and shifting the focus to interactive and cognitive phenomena is not a weakness or a shortcut; rather, it is a way of setting an explanans which is *appropriate* with regards to the explanandum. The Hegelian stance, in this respect, puts to work a non-reductive attitude vis-à-vis explanation, as we hinted above: phenomena located at different levels of description require different explanatory strategies, without reducing one level to the other. The analysis developed here suggests, as indicated in Sect. 2, that the Hegelian position constitutes a form of naturalism, albeit not a reductive one. This is true especially for the complex relation of continuity and discontinuity between life and mind. While intrinsic purposiveness represents for Hegel the fundamental trait of life-mind continuity, the way it is declined in human cognition also implies fundamental discontinuities. Also on this count, the enactive approach seems to take up a Hegelian stance, by stressing the fundamental difference between biological and cognitive autonomy. Although there is an undeniable continuity between these layers of purposiveness, each calls for a proper explanation.

The flourishing of autonomist enactivism seems to be concrete evidence that a Hegelian stance can give rise to a productive research domain dealing specifically with the intrinsic purposiveness at play in behavioral and cognitive phenomena. The claim that the enactive stance on intrinsic purposiveness can be qualified as Hegelian is meant to show, at the same time, the fecundity of the stance and its distinctive philosophical underpinnings in contemporary literature. Certainly, the non-reductive flavor of the Hegelian stance raises the question of the relationship between enactivism and organizationism, within the theory of autonomy. For us, a sensible attitude in this respect consists in favoring *unification ex-post* rather than *reduction ex-ante*. Different stand-alone branches of the theory of autonomy can explore different pur-

posive phenomena, and take up different explanatory challenges, while leaving unification as a future, although not ineluctable, horizon.

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