



## Unity, Motion, and Reciprocity in Friedrich Engels' *Dialectics of Nature*

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**ABSTRACT:** The *Dialectics of Nature* is one of the most significant works regarding materialist dialectics, first and foremost because it fills the gap in expounding materialist dialectics as the objective law of motion on earth. The fundamental aspect of this expounding is the view that postulates human and nature in their unity and presenting the dialectic as the objective law of motion on earth through the sphere of natural sciences and establishing the material basis of the materialist dialectics as the view of the whole. This is not merely a matter of theory; this activity is required for the praxis to sublimate the capitalist mode of production and the mode of scientific production internal to it.

**KEYWORDS:** Dialectics of nature, motion, reciprocity, metaphysics, unity of opposites.

### INTRODUCTION

Lenin (2009) says, “without revolutionary theory there can be no revolutionary movement” in *What is to be Done?* In the section titled ‘Engels on the Importance of the Theoretical Struggle’ in which this phrase appears, Lenin (2009, 370) also mentions that Friedrich Engels placed the theoretical struggle on a par with two forms of the great struggle of Social-Democracy (political and economic). In this work, I propose to consider the *Dialectics of Nature* of Engels as a moment of this struggle. This undertaking of Engels is essentially comprised of constituting the materialist dialectics as the law of movement internal to nature, which connotes that dialectics is not only a subjective process of the mind that one may or may not choose to reflect on the world. Thus, the laws of motion of nature and society are not separate and one can find the necessity of social revolution in the womb of nature. When Karl Marx (1985, 246–247) in his letter to Ferdinand Lassalle wrote that “Darwin’s work is most important and suits my purpose in that it provides a basis in natural science for the historical

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class struggle” he was maintaining the unity of the laws of motion of society and nature. In this way, an essential aspect of dialectical materialism is also discerned: the unity of humans and nature through their multi-faceted reciprocal relations.

It should be well-understood that the motives of Engels in delivering the *Dialectics of Nature* were not his individual interest in the natural sciences or philosophy. He wrote it down with the view of constituting the theory of the socialist revolution in its wholeness. Engels’ interest in the natural sciences was primarily due to the fact that the advances realised by them made the dialectical laws of motion of nature evident. At the same time, Engels’ occupation with the natural sciences served to achieve the theoretical conception in its wholeness that the struggle of the proletariat needed. This is one of the reasons of the importance he gave to the discovery of the conservation of motion (energy), for it demonstrated that the various spheres of the natural sciences previously had been supposed as independent from and indifferent to each other were in fact interconnected. Thereby the being of the natural sciences as independent fields of specialisation was negated. Then, while the advances made by the natural sciences affirm dialectics as the mode of motion in nature, simultaneously we arrive at the necessity of a single science to reflect on both society and nature.

What is the relationship between nature and materialist dialectics? First and foremost, nature and the motion internal to it unite the materialist dialectics as an objectively valid theory. The dialectics internal to nature negates the view that dialectical reasoning is originated as a particular motion of the human mind reflected on nature and society. On the contrary, motion internal to nature necessitates materialist dialectics as the true mode of reasoning. This necessity, at the same time, corresponds to the act of turning the dialectics, standing on its head to be turned right side up again (Marx 1996, 19). The specific ordering in time of the various notions that are in opposition is what discerns the materialist dialectics from the Hegelian dialectics. The materialist dialectics asserts the primacy of matter to the idea, practice to theory, labour to mind, nature to spirit. Therefore, regarding the laws of dialectics, Engels states,

The mistake lies in the fact that these laws are foisted on nature and history as laws of thought, and not deduced from them. This is the source of the whole forced and often outrageous treatment; the universe, willy-nilly, has to conform to a system of thought which itself is only the product of a definite stage of development of human thought. If we turn the thing round, then everything

becomes simple, and the dialectical laws that look so extremely mysterious in idealist philosophy at once become simple and clear as noonday. (Engels 1987a, 356)

It is reflected on Engels' view of the whole in *Dialectics of Nature* in this contribution through key subject matters that point at unity in general. These are the unity of organic and inorganic nature, of human and nature, and of cause and effect. Related to the notion of unity are two fundamental principles of dialectics, the changes in quantity result in qualitative changes and the unity of opposites; through this work, it is attempted to provide insight into the way these principles manifest themselves in nature. This way it becomes possible to attain a view of the world in constant motion in virtue of the reciprocal actions of the objects that comprise the world, a view freed from all metaphysical residue. This view matters today in particular to comprehend the ecological crisis, a symptom of which is the Covid-19 pandemic. This comprehension is also decisive to bring about the struggle against those who cause the crisis. This struggle necessarily aims at new modes of relations between the human and nature, which requires new relations of production, new social relationships, a new social organisation freed from the market relationships.

## THE UNITY OF HUMAN BEING AND NATURE

The *Dialectics of Nature* is not only determinative to achieve a true dialectical materialist comprehension but also to sublimate the capitalist relations of production that encompass all life on earth, to realise the praxis of the constitution a new mode of relationship between human and nature. As yet beginning from *Economic and Philosophical Manuscripts of 1844* the necessity to comprehend nature and society through a single science has been put forward,

*Industry* is the *actual*, historical relationship of nature, and therefore of natural science, to man. If, therefore, industry is conceived as the *exoteric* revelation of man's *essential powers*, we also gain an understanding of the *human* essence of nature or the natural essence of man. In consequence, natural science will lose its abstractly material—or rather, its idealistic—tendency, and will become the basis of *human* science, as it has already become—albeit in an estranged form—the basis of actual human life, and to assume *one* basis for life and a different basis for *science* is as a matter of course a lie. (Marx 1975, 303)

Two years after these lines had been written, when Marx and Engels (1975, 28) in *German Ideology* stated that the history of nature and the history of men were inseparable and each of them depended on the other, they were conveying this unity to the science of history. But as István Mészáros rightly remarks the constitution of a unitary science that deals with nature and society in their unity can't be a matter of theoretical undertaking:

In order to realise 'human science' philosophy, political economy, the 'abstractly material' natural sciences, etc., must be *reciprocally integrated* among themselves, as well as with the totality of a social practice no longer characterised by the alienation and reification of the social relations of production. (Mészáros 1970, 114)

Even when the theory acknowledges the human society as its sole subject matter, the materialist dialectics that postulates nature and society in their unity is necessary for the object and its notion to overlap, thereby it is necessary to constitute a true praxis, to constitute a true ontology of humans for them to transform their reality, to constitute the true notions regarding human history. Nature is the greatest necessity, it also necessitates the division of labour, thus it necessitates the socialisation of humans. This is why Christopher Caudwell (1958, 211) maintains that "man, the individual, cannot do what he wants alone. He is unfree alone. Therefore, he attains freedom by co-operation with his fellows." Human existence both as a natural being and as a social being, and the unity of freedom with the necessity that these modes of being connote was expounded by Marx with clarity:

A being which does not have its nature outside itself is not a natural being, and plays no part in the system of nature. A being which has no object outside itself is not an objective being. A being which is not itself an object for some third being has no being for its object; i.e., it is not objectively related. Its being is not objective. (Marx 1975, 337)

Essentially, what mediates nature as the necessity with human subjectivity and his freedom is labour. Human ontology necessarily derives from his essential activity as production and from the latter's collective character. Postulating production as the fundamental activity makes it evident that what makes human consciousness is his necessity to transform nature, and makes it possible to constitute the human ontology accordingly. Thereby the dialectical materialist idea of the human, contrary to the view

that considers humans as passive beings belonging to a teleological process, that considers nature as externalisation of the Spirit as Hegel did, constitutes itself as the conception of the constitution of nature and humans through the latter's actions. Then we get to a fundamental aspect of historical materialism: labour antedates consciousness. Just as Caudwell (1958, 212) says, man's free will depends on economic production. Consciousness develops by the evolution of language, science, and art, and these are all born of economic production.

Charles Darwin's work proved that nature has its own history and it is not separated from human history. This inseparability imposes itself in particular in the era of ecological crisis by the capitalist class that views nature as the raw material from which value to be extracted. The Covid-19 pandemic as an aspect of today's ecological crisis, rigorously expresses the reciprocity of human and nature, the subjectivity of nature as such; nature is not receptive in the face of human actions upon it. Today, nature indisputably expresses that its own ontology is inseparable from humans'. Caudwell spoke of this inseparability,

The development of humanity is not the increasing separation of man from a 'state of nature'. It is man's increasing interpenetration with nature. History is not, as the bourgeois supposes, the story of man in himself, or of human 'nature' [...] but the story of the increasing interpenetration of nature by man as a result of his struggle with it [...] The story of man is not the story of the increasing subjection of man's freedom and individuality to organisation in order to cope with nature, but his growth of freedom and individuality through organisation imposed by nature, in his interaction with it. (Caudwell 1950, 133)

The sublation of the era of the ecological crisis that we live in is a matter of practice of course. But this practice should rest on a true theory of non-human nature and its relation to the human. This theory, if it is going to work to end the ecological crisis, should postulate the unity of humans with nature. The theory should not suppose the non-human nature as a passive entity, since the history of humans' interaction with nature tells us that the work of humans on nature is not one-sided and nature responds to humans and forges a new living, a new history for humans. The following passage is illustrative to understand the unity of the history of humans and of nature,

Let us not, however, flatter ourselves overmuch on account of our human victories over nature. For each such victory nature takes its revenge on us. Each victory, it is true, in the first place brings about the results we expected, but in the second and third places it has quite different, unforeseen effects which only

cancel the first [...] Thus at every step we are reminded that we by no means rule over nature like a conqueror over a foreign people, like someone standing outside nature –but that we, with flesh, blood and brain, belong to nature, and exist in its midst, and that all our mastery of it consists in the fact that we have the advantage over all other creatures of being able to learn its laws and apply them correctly. (Engels 1987a, 460–461)

This excerpt is significant particularly in the era of the Covid-19 pandemic. Just as Engels said, man’s activity over nature, even though immediately brings forward the desired effects, the activity internal to nature produces unintended effects. For example, Richard Lewontin and Richard Levins (2007, 18) speak of so-called human victory over diseases. In the sphere of public health, in the “war” against diseases, it was thought that the “weapons” acquired through technological advances ensured the ultimate victory of civilisation over diseases. This view described by the authors is bourgeois ideology *par excellence*, which presupposes nature as a passive recipient of human actions, the ideology that imagines nature as the raw material of the commodity-producing society. Then Lewontin and Levins are in line with Engels when they speak of the unintended consequences of human action on nature,

Waves of European conquest spread plague, smallpox, and tuberculosis. Deforestation exposes us to mosquito-borne, tick-borne, or rodent-carried diseases. Giant hydroelectric projects and their accompanying irrigation canals spread the snails that carry liver flukes and allow mosquitoes to breed. Monocultures of grains are mouse food, and if the owls and jaguars and snakes that eat mice are exterminated, the mouse populations erupt with their own reservoirs of diseases. New environments, such as the warm, chlorinated circulating water in hotels, allow the Legionnaire’s bacteria to prosper. (Lewontin and Levins 2007, 19)

Besides, even though it is not mentioned directly in these passages, various symptoms of the ecological crisis that the world is getting through, such as the Covid-19 pandemic, the climate crisis, deforestation, extinction of the species, and so on are the costs of the capitalist class that it externalises to be paid by the public. Thus, the unity of the history of humans and nature is constituted also through the class struggle.

Engels implied another aspect of the ecological crisis of the present. He said that “classical political economy, the social science of the bourgeoisie, in the main examines only social effects of human actions in the fields of production and exchange that are actually intended” (Engels 1987a, 463). Thus, the political economy’s inability to understand the objectivity that

the subject moves within. This inability both applies to the understanding of the unity of human and non-human nature and to the systematic crises that the capitalist economy suffers from. This corresponds to what Georg Lukács called as false consciousness of the bourgeoisie. The cause of this false consciousness is the bourgeoisie's inability to perfect its own science of classes, to discover a theoretical solution to the crises problem. There is of course a true scientific solution to this problem, but this is necessarily ineffective since the bourgeoisie's adoption of this solution would mean viewing society from a position other than the bourgeois class'. Lukács said that this is impossible unless a ruling class willingly abdicates its social dominance. Then false consciousness of the bourgeois class originates from the objective class situation of the bourgeoisie (Lukács 1971, 53–54).

Engels related bourgeoisie's social science's concerning itself solely with the intended consequences of subjective actions to the social organisation,

As individual capitalists are engaged in production and exchange for the sake of the immediate profit, only the nearest, most immediate results must first be taken into account [...] The same thing applies to the natural effects of the same actions [...] In relation to nature, as to society, the present mode of production is predominantly concerned only about the immediate, the most tangible result; and then surprise is expressed that the more remote effects of actions directed to this end turn out to be quite different, are mostly quite the opposite in character. (Engels 1987a, 463–464)

Here, crucial concepts and laws of motion concerning the materialist dialectics, the undertaking internal to the *Dialectics of Nature* in particular, and the understanding of Marxism as praxis (the unity of practice and theory) were enunciated.

For instance, this last phrase of Engels is built on the objectivity of the capitalist economy as the anarchy dominating the sphere of circulation. Independent commodity producers constitute the basis of the capitalist economy and this corresponds to a disorganised whole that works through anarchy. This is why Nikolai Bukharin (1971, 29–30) said, “in capitalist society the theoretical foreknowledge of the general course of events does not provide the instrument for taking direct control of that course (and there is no subject to set himself such a task: society itself is subjectless, blind, unorganised).” This revives two fundamental problems regarding the crises of capitalist society which are also connected with the problem of the unity of the human with non-human nature. The first is the inability of the bourgeois class to unite its theory with its practice. It is impossible

to realise this unity through theoretical work; the sublation of the capitalist mode of production is necessary. This is why Alexander Bogdanov spoke of the futility of philosophy as a means of bringing together a world that is practically torn apart. Bogdanov said that philosophy is nothing but the attempt to organise and to gather up that is divided and fragmented through the force of specialisation. The social experience is atomised in reality. Thus, it is objectively impossible for philosophy to connect what reality has disunited. The task becomes objectively achievable only when reality changes (Bogdanov 2016, 238). Then the bourgeois class in its theory and practice is unable to procure wholeness and therefore is desperate to control the effects of its disorganised actions.

The second problem which is also related to the disorganisation of the capitalist society in particular pertains to the primacy of the action to the knowledge, which is originated in the reciprocal relationships of the independent commodity producers within the scope of the market. In the relationship of exchange, the subject acquires the knowledge of his action only after the event. In *Capital*, Marx (1996, 86) said “we are not aware of this, nevertheless we do it” regarding the exchanging subjects who also equate different kinds of labour expended on products, while they equate different products as values. Then the market is where the subject acts unconsciously. In this sense, the market, in its essence is the expression of the world that the bourgeoisie created after its own image. To have a true insight into the workings of this world, comparing it with its opposite, socialist planning is important,

Planning is not equivalent to ‘perfect’ allocation of resources, nor ‘scientific’ allocation, nor even ‘more humane’ allocation. It simply means ‘direct’ allocation, *ex ante*. As such, it is the opposite of market allocation, which is *ex post*. These are the two basic ways of allocating resources, and they are fundamentally different from each other [...] Essentially they have a different internal logic. They generate distinct laws of motion. They diffuse divergent motivations among producers and organizers of production, and find expression in discrepant social values. (Mandel 1986, 7)

Today the capitalist class and its various representatives struggle to alleviate the effects of the economic crisis of 2008 and to revive the economic activity, but miserably fail. The crisis that was brought about by the Covid-19 pandemic continues; besides, the overwhelming forces of the market at every moment add new facets to the ecological crisis that themselves are the reason of. Therefore, the mutual exclusiveness of a society whose economic life is organised through socialist planning and the one whose

economy is under the rule of the blind forces of the market is necessary to understand the historical materialist view and this necessity was emphasised by various Marxists in various epochs (Engels 1925; 1987a; 1987b; Marx and Engels 1976; Marx 1986; Jameson 2009; Marcuse 2009; Liodakis 2001; Magdoff and Williams 2017). Is there a way to understand the relationship between socialist planning and the market other than their mutual exclusion? A possible way to approach this problem is to examine the modes of organisation of production and distribution envisioned by utopian socialists. One of the most prominent examples of it is the issue of labour-time tickets to mediate the exchange of goods and the establishment of the labour-time ticket bank, which would manifest itself as the subject conducting to that exchange. This view was comprehensively criticised by Marx; the essential reason of his opposition to this mode of organisation was this:

There can therefore be nothing more incorrect and more absurd than to assume, on the strength of exchange value and money, control by the associated individuals of their collective production, as was done in the case of the labour-time ticket bank mentioned earlier. (Marx 1986, 96)

Still, Engels (2010, 296–297) admires Robert Owen's vision of labour-ticket, which is supposed to mediate the exchange of the products of labour in *labour bazaars*. Although these institutions are necessarily doomed for failure they were the first steps towards a much more radical revolution of society. Therefore, the relationship between planning and the market mechanism, if not to be understood in terms of mutual exclusion it must be comprehended as the former being developed in the womb of the outlook of utopian socialists, which presupposes the exchange value as given. The effort to sublimate the blind necessity of the market also pertains to the activities of the members of the capitalist class. Monopoly capitalism emerges and with it the reign of the planning, not of the market. Planning reaches out from the factory to the firm. The fundamental reason behind this state of affairs is the inner logic of capitalism itself “and its peculiar dynamic of accumulation and competition” (Mandel 1986, 6) and the growing objective socialisation of labour (*ibid.*, 11). Therefore, one can infer that the act to sublimate the inefficiencies, uncertainties, and the strict limits imposed by the blind necessity of the market on human subjectivity is not exclusive to socialist revolutionaries only, but the big capital itself in actuality works towards the same effect.

## THE UNITY OF ORGANIC AND INORGANIC NATURE

From the point of view of the materialist dialectics, to ascertain the unity of nature and human in it, to apprehend the decisiveness of labour as the mediator of the unity of human and nature, understanding the unity of the inorganic and organic nature is crucial. In the *Economic and Philosophical Manuscripts of 1844*, Marx expounded this unity. He said that both man and animal live on inorganic nature. The universality of man in practice consists in the fact he makes all nature his inorganic body, first as his direct means of life and then as the material, the object, and the instrument of his life activity. Nature is man's inorganic body. Man is linked to nature physically and spiritually, thus, nature is linked to itself, for man is a part of nature (Marx 1975, 275–276). Humans as organic beings are tied to inorganic nature first and foremost by means of labour. Through labour, humans extend the breadth of their activity, the inorganic nature becomes humans' extension to ensure their dominance over nature in general. To reckon with this unity conduces the sublation of all metaphysics that postulates that the human and society can be understood in themselves.

Aside from the activity of humans over nature, Engels maintains the unity of the organic and inorganic, through demonstrating a process that does not involve humans directly. This is the preparation of the compounds hitherto had been produced only in living organisms through inorganic means, which proved the laws of chemistry have the same validity for organic as for inorganic bodies. This bridges the gulf between inorganic and inorganic nature, a gulf Kant regarded as impassable (Engels, 1987a, 326).<sup>1</sup>

Engels (1987a, 338) spoke of the necessity of classifying material of knowledge in separate fields of investigation only to bring them into correct connection with one another afterwards. In a similar vein, Lewontin

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1. Kant's consideration of the antinomy between organic and inorganic as impassable was propounded in the discussion he makes under the heading 'Critique of Teleological Judgement.' According to Kant the understanding concerned with the things in the form of natural ends is such that, mechanical explanation of these things is not only limited but also circumscribed within definite boundaries. Our judgement on such products should always be subject to a teleological principle (Kant 2007, 246). Here the teleological judgement of Kant not only gravitates towards the purpose but also involves the notion Engels calls as the first impulse. The antinomy between natural ends and their mechanical explanation also manifests itself as the antinomy between *generatio aequivoca* and *generatio univoca* in the philosophy of Kant. The former is the generation of an organised being from crude inorganic matter. According to Kant the principal is the latter, according to which the organic can only come into existence out of organic.

and Levins (2007) spoke of the necessity of making a distinction between internal and external for the advances that have been realised by modern reductionist biology. But for today's scientific problems this distinction is bad biology and presents a barrier to further scientific advance (Lewontin and Levins 2007, 31). The capitalist mode of production has changed the climate, polluted the soil, air, and water in various ways, it caused pathogens' further penetration into humans' social life. These changes in the inorganic nature both changed the organic nature on earth as a whole and the social relations of men. Therefore, to constitute the true ontology of today's humans, the notion of the unity of inorganic and organic nature is indispensable more than ever.

The unity of organic nature with inorganic nature is determinative to understand the emergence of human-being, to gain insight into this species' ontology. The determination of the species-being of humans through their action on their environment is at the same time comprises a fundamental aspect of the dialectical view of nature and its materialist outlook:

Man, too, arises by differentiation. Not only individually but also historically. When after thousands of years of struggle the differentiation of hand from foot, and erect gait, were finally established, man became distinct from the ape and the basis was laid for the development of articulate speech and the mighty development of the brain that has since made the gulf between man and the ape an unbridgeable one. The specialisation of the hand—this implies the tool, and the tool implies specific human activity, the transforming reaction of man on nature, production [...] Man alone has succeeded in impressing his stamp on nature, not only by shifting plant and animal species from one place to another, but also by so altering the aspect and climate of his dwelling-place, and even the plants and animals themselves, that the consequences of his activity can disappear only with the general extinction of the terrestrial globe. And he has accomplished this primarily and essentially by means of the hand. (Engels, 1987a, 330)

The notion of the unity of inorganic and organic nature is crucial for the dialectic materialist view of the world since by way of this unity some fundamental claims of dialectic materialism merge. This unity, first of all, entails that the essence of the human being is comprehensible only in its social and natural environment. Also, this notion of unity suggests that this essence is not passive and given but is determined through the activity—first and foremost labour—of human beings. It also implies that for any science to formulate a true notion of its subject matter, the latter must be

dealt with as it is immersed in the objective whole which is in constant flux.

Then the dialectic materialist view of human beings which supposes the unity of organic nature with inorganic nature begins with the differentiation of hand from the foot. The initial emergence of *bipedalism* in a line of apes is designated as probably the most significant of the biological milestones by Ardea Skybreak (2006, 148). Freeing of the hands made it possible for men to use them as tools and afterwards let the production and use of other various tools, let men travel greater distances, and was determinative for the reproduction of the human species in general. Darwin (1981, 141) indicates the decisiveness of the use of hands for men to attain their dominant position in the world.

Engels (1987a, 453) said that “the hand is not only the organ of labour, it is also the product of labour.” Here the reciprocal relationship between the living organism and its environment is put forward concisely, particularly by means of the changes in the primary organ of labour –the hand. But in order to understand the historicity that determines this change, through which men became capable of producing objects requiring finesse to form, another aspect of this change should be mentioned. The clearest instance of this aspect was indicated in *Capital*:

In so far as machinery dispenses with muscular power, it becomes a means of employing labourers of slight muscular strength, and those whose bodily development is incomplete, but whose limbs are all the more supple. The labour of women and children was, therefore, the first thing sought for by capitalists who used machinery. (Marx 1996, 398)

Then the organic change of hands in the history of the relationship of the human to his environment and in the course of the social life of the human is not just about the physical transformation of the hand, but also is about the subrogation of the possessors of the labouring hands. This change, in turn, brought about serious changes in society, particularly in the sphere of class struggle.

Freeing of the hands not only made humans able to transform their environments but elicited the main feature that identifies the human as such, which is his capacity and need to socialise. Engels says that labour expands man’s horizon at every advance. Labour facilitated to bring the members of society together by increasing cases of mutual support and joint activity, and by making clear the advantage of this joint activity to each individual. Then men became compelled to say something to each other (Engels 1987a, 454). Therefore, an element as much determinative

as freeing of the hands regarding the historical materialist view of the human emerges: being human is only socially possible. And this being is realised in the reciprocity of the hand and brain. This is called by Engels as “the reaction on labour and speech of the development of the brain and its attendant senses, of the increasing clarity of consciousness, power of abstraction and conclusion.” This reaction gave both labour and speech an ever renewed impulse to further development. Then comes into play the fully fledged man, society which drove forward and guided this further development of labour and speech (Engels 1987a, 456). Then, the historical emergence of the human is contingent upon his collective activity.

All these are not presented solely as explanatory material regarding the historical materialist view of history, but rather to indicate to arrive at a nodal point that is significant regarding the question of epistemology. This question concerns the idealistic view of the world. Asserting the primacy of the hands to the brain in the constitution of the human was revolutionary regarding the natural sciences of Engels' time –as a matter of fact, it still is. As Foster and Burkett emphasise:

[...] the significance of the freeing of the hands for tool making (hence, labour) was downplayed in 19th- and early 20th-century science, and the belief of most evolutionary scientists continued to be that brain had led the way in the evolution of the human species so that our earlier ancestors would distinguish themselves first and foremost by their cerebral development. (Foster and Burkett 2000, 415)

The meat diet was determinative for the development of the brain and also man had a lot more materials for his nourishment. In virtue of the expansion of edible materials, man became able to live in any climate. All this diversification of the relationships of man with non-human nature and the reciprocal, combined development of the hands, the speech, and the brain caused the man to determine and achieve higher aims for himself (Engels 1987a, 458). The determination of higher aims that Engels spoke of resulted in this,

Law and politics arose, and with them that fantastic reflection of human things in the human mind –religion. In the face of all these images, which appeared in the first place to be products of the mind and seemed to dominate human societies, the more modest productions of the working hand retreated into the background, the more so since the mind that planned the labour was able, at a very early stage in the development of society [...], to have the labour that had been planned carried out by other hands than its own. All merit for the swift

advance of civilisation was ascribed to the mind, to the development and activity of the brain. Men became accustomed to explain their actions as arising out of thought instead of their needs [...]; and so in the course of time there emerged that idealistic world outlook which, especially since the fall of the world of antiquity, has dominated men's minds. It still rules them to such a degree that even the most materialistic natural scientists of the Darwinian school are still unable to form any clear idea of the origin of man, because under this ideological influence they do not recognise the part that has been played therein by labour. (Engels 1987a, 458–459)

This excerpt matters in the sense that in it Engels elucidated the origins of idealism in the objective-material world; to be more specific, in the division of labour. This stands for what Engels (1987b, 169) called as “the great division of labour between the masses discharging simple manual labour and the few privileged persons directing labour, conducting trade and public affairs, and, at a later stage, occupying themselves with art and science.” This is the separation of mental labour from manual labour.

Alfred Sohn-Rethel (1978, 37) says that the importance of the division between mental and manual labour is for the bourgeois class as vital as the private ownership of the means of production. Then within the becoming of the class society, knowledge is appropriated by the ruling class, and knowledge becomes their property. Particularly under the rule of the bourgeois class, while knowledge is further drifted apart from the people that earn their livelihood through manual labour, the sphere of knowledge increasingly became the privileged realm of the ruling class. This way the world comes to be perceived as the product of the mind of the ruling class. This way ideological view of the world comes to be situated. Through this ideology that is brought about by the separation of mental labour and manual labour, man has imagined that he dominated the world in virtue of the power of his mind.

## THE TRANSFORMATION OF MOTION INTO ONE ANOTHER

In nature, the transformation of one form of motion to another without any loss, which was proved by William Robert Grove matters for the materialist dialectics mainly due to two reasons. First of all, the conversion of motion is the proof of the dialectical law that the quantitative changes, at a specific nodal point are going to result in qualitative changes. And in a letter to Marx dated 1858, Engels (1983, 326) wrote that Hegel would be delighted with the correlation of forces in physics, or the transformation of motion without the occurrence of any loss. The conversion of motion,

the passing of one type of motion to another is according to Engels (1987a, 477) one of the three great discoveries of natural sciences in the sense that, through this discovery, it was understood that the numerous active causes in nature are the modes of existence of motion. And then the conservation of motion became a natural-scientific fact. This discovery negates the metaphysics since motion hitherto was understood as a quality of matter that had been given by an external and unknown power and it proves that motion is the epitome of matter. As Foster and Burkett (2000, 418) say, through the discovery of the conservation of motion in conversion, the ancient materialist principles of Democritus and Epicurus that nothing comes from nothing, and nothing being destroyed can be reduced to nothing were given new meaning. Without a doubt, countless advances in various fields of natural sciences have been made after the period the *Dialectics of Nature* had been drawn up. But these advances don't render dialectics obsolete as the method for making judgements on the natural processes. According to T. Jayaraman, the advance of scientific knowledge in the last century emphasised the instinctively dialectical materialist character of science. Particularly, when the physical matter is in question, the transformation of quantitative changes into qualitative ones is the standard understanding of science. Great advances have been made in the science of materials and one of these is about the understanding of the various transitions between the different phases of matter. Now enormously sophisticated machines are available to understand the transitions between qualitatively different phases of matter that arise from the quantitative change of some attribute. And the study of qualitative changes that arise from quantitative changes is virtually commonplace in scientific understanding (Jayaraman 2010, 63–70). Even a scholar who was very much skeptical towards dialectics and its relevance to natural sciences as Mario Bunge (1973, 182) claimed that “the only hypothesis of dialectics that would seem to hold universally is the quantity-quality law.” Ted Grant and Alan Woods (2002, 44) mention that some of the most recent investigations of the chaos theory are centered on the critical point where a series of small variations produce a massive change of state. The work of physicist Per Bak and others on self-organised criticality used the example of a sandheap to illustrate processes that occur at many levels of nature, corresponding to the law of transformation of quantity into quality.

Motion is always reciprocal, this is why it is so significant for dialectics: “Even the relative equilibrium of freely floating bodies can only exist where the motion is reciprocally determined” (Engels 1987a, 334). The reciprocal

determination of objects also connotes the unity of opposites as the unity of attraction and repulsion. Engels expounds on the nature of motion:

It is an eternal cycle in which matter moves, a cycle that certainly only completes its orbit in periods of time for which our terrestrial year is no adequate measure, a cycle in which the time of highest development, the time of organic life and still more that of the life beings conscious of nature and of themselves, is just as narrowly restricted as the space in which life and self-consciousness came into operation; a cycle in which every finite mode of existence of matter, whether it be sun or nebular vapor, single animal or genus of animals [...] is equally transient, and wherein nothing is eternal but eternally changing, eternally moving matter and the laws according to which it moves and changes. (Engels 1987a, 334–335)

The notion of the eternal cycle brings forth the unity of repetition and change, of transient and eternal, and of finite and infinite. It brings forth the finitude of all particular beings of nature and the social relationships that reproduce nature.

Essentially, Engels tried to present dialectics as a universal law of motion, and to realise this undertaking he expressed the dialectics as the truth by means of the exactness of natural sciences. This way, it becomes possible to obtain the concept of the necessity of proletarian dictatorship in the heart of nature. Therefore, by means of the advances in natural sciences, we are provided with the view of the whole, kernel of which is constituted by nature. Vigier (1966, 245) said that dialectal materialism is not only the demand of historical totalisation, it results first and foremost from the very movement of science. Empiricism is of course a necessary moment in the advance of the natural sciences. That's why Engels talks about the advances that have been made by the empirical natural sciences that arrive at brilliant conclusions. These made it possible not only to overcome the mechanic one-sidedness of the eighteenth century but also through generalising the results into a system of materialist knowledge of nature and by virtue of the proofs of the interconnections internal to nature, has become a theoretical science (Engels, 1987a, 476). It is the development of science that drums the dialectic into the natural scientists as Lukács (2000, 95) said. Then Engels' interest in natural sciences is not by itself but is rather to affirm dialectics as the view of the whole, as the method that connects the separate phenomena into a notion. Discoveries in the sphere of chemistry mattered to Engels also because Hegel had already informed them in his Logic, thus Engels (1987a, 359) says: "the sphere...in which the law of

nature discovered by Hegel celebrates its most important triumphs is that of chemistry.”

Chemistry, the conversion of motion in particular provided the exactness that Engels desired to incorporate into dialectics, not biology (Darwin's science) in which uncertainty, chance, and error play a bigger part. On this matter, Engels (1987a, 361) said this: “In biology, as in the history of human society, the same law holds good at every step, but we prefer to dwell here on examples from the exact sciences since here the quantities are accurately measurable and traceable.” The conservation of motion is the correlative of the dialectical law of the transformation of quantitative change into a qualitative one. This fundamental dialectical law of motion, which was celebrated by Lenin (1976, 123) in his *Conspectus of The Science of Logic* with the expression Leaps! Leaps! Leaps!, was expounded by Hegel,

In the quantitatively measured scale of musical relations, a quantum gives rise to a relation of harmony in the progression of notes without that quantum having on the scale any other relation to the preceding and the succeeding ones than these have in turn to those preceding and following them [...] The succession of merely indifferent relations which neither alter the preceding specific reality nor otherwise form any such reality, is suddenly interrupted; and while from the standpoint of quantity the succession proceeds in the same manner, a specific relation breaks in through a leap. (Hegel 2010, 321)

The same kind of nodes and leaps occur in chemical combinations and in every birth and every death. Hegel (2010, 321–322) opposes the ordinary saying *Natura non facit saltum*, because “the alterations of being in general are not only the passing over of magnitude into another magnitude, but the transition from the qualitative into the quantitative and contrariwise, a becoming-other that interrupts gradualness and stands over against the preceding existence as something qualitatively other.”

## DIALECTICS AND METAPHYSICS

Engels (1987b, 513; 1990, 26, 370, 384, 385) speaks of the opposition between metaphysics and dialectics in his various works. The section titled Natural Science and Philosophy of the *Dialectics of Nature* is essential to comprehend the materialist dialectics and to find the base of materialist dialectics in nature. First, Engels presents the difference between materialist dialectics and Hegelian dialectics. Contradiction in Hegel is mystical since his categories are pre-existing and the dialectics of the real world are

mere reflections of these categories. Therefore, Hegel postulates the motion of mind as precedent to nature. For example, about Hegel's work titled the *Philosophy of Nature*, Kangal (2020, 132) mentions the same view of Hegel's. He says that Hegel's view of nature is dedicated to demonstrate that Spirit passes to Nature via Idea. It is the Spirit that gives life to Nature. Spirit is prior to Nature, motion and interaction in Nature is endowed to it by Spirit (Kangal 2020, 132). Hegel views nature as the alienation of the Idea. But Engels maintains that in reality, the relationship is the other way around: the forms of motion of the real world are reflected as the dialectics of the mind. Therefore, we also get the distinction between objective dialectics and subjective dialectics. The former prevails throughout nature and the latter is the dialectical thought, which asserts itself everywhere in nature, determines the life of nature (Engels 1987a, 485). Engels, in his 1891 dated letter to Conrad Schmidt mentions this opposition:

The inversion of Hegel's dialectics is based on the assumption that it is the 'self-development of the idea' of which, therefore, the dialectic of facts is only the image, while the dialectic in our minds is but the reflection of the actual development taking place in the natural world and human history in obedience to dialectical forms. (Engels 2001, 287)

Then Engels maintains the unity of subjective dialectics and objective dialectics. He says that our subjective thought and the objective world are subject to the same laws. Hegel's reasoning is significant in this sense: In his work, thought and being are in unity and his philosophy has proved the analogy of the processes of thought to those of nature and history and vice versa (Engels 1987a, 545). Georgi Plekhanov (1944, 11) makes the same point when he says, "man is only a part of nature, a part of being; that is why there can be no contradiction between his thought and being...the laws of being are also the laws of thought." The various types of judgement that Hegel specified in *Logic* are connected to the conservation of motion by Engels. On this subject, Engels says that what seems as the thought-form of judgement as such in Hegel, confronts us as the development of empirically-based theoretical knowledge of the nature of motion in general. Then, if they are truly known, the laws of thought and the laws of nature are necessarily in accord (Engels, 1987a, 505). The dialectics, as the laws of motion of nature, antedates the dialectical reasoning and the latter is the *aposteriori* reflection in our minds. Humanity achieves this reflection through the development of forces of production and its

contradiction with the relations of production. Therefore, materialist dialectics is not contingent; it is the mutual product of nature as such and human labour.

What are the main principles that make us discern dialectics from metaphysics? Engels (1987a, 356) has a simple answer to this question: "The general nature of dialectics to be developed as the science of interconnections, in contrast to metaphysics." Then we understand that the absolute opposition between dialectics and metaphysics also corresponds to the opposition between fluid categories and fixed categories. The fixed opposites such as basis and consequence, cause and effect, identity and difference, appearance and essence are untenable. One pole is present in the other *in nuce* and at a definite moment one opposite turns into its other, all logic develops from this contradiction (Engels 1987a, 485). Lewontin and Levins concisely explained dialectical materialism's view of nature,

Dialectical materialism enters the natural sciences as the simultaneous negation of both mechanistic materialism and dialectical idealism, as a rejection of the terms of the debate. Its central theses are that nature is contradictory, that there is unity and interpenetration of the seemingly mutually exclusive, and that therefore the main issue for science is the study of that unity and contradiction, rather than the separation of elements, either to reject one or to assign it a relative importance. (Lewontin and Levins 2009, 133)

Here, a common error should be set aside. From the perspective of the materialist dialectics, the problem is not the incorporation of philosophy into the activities of natural scientists, because philosophy inevitably is involved in the scientific activity. Kaan Kangal (2020, 112) also mentioned this as Engels' contention: "a philosophy always informs natural sciences in theory or in applied practice." The matter is to save the natural sciences from philosophical outlooks such as positivism and empiricism:

Natural scientists believe that they free themselves from philosophy by ignoring it or abusing it. They cannot, however, make any headway without thought, and for thought they need thought determinations. But they take these categories unreflectingly from the common consciousness of so-called educated persons, which is dominated by the relics of long obsolete philosophies [...], or from uncritical and unsystematic reading of philosophical writings of all kinds. Hence they are no less in bondage to philosophy, but unfortunately in most cases to the worst philosophy, and those who abuse philosophy most are slaves to precisely the worst vulgarised relics of the worst philosophies. (Engels, 1987a, 490–491)

Complementary to this operation is to connect the separate spheres of natural science. Then, natural science enters the field of theory and in this case, the methods of empiricism will not suffice (*ibid.*, 338). Therefore, an aspect of setting aside empiricism is to set up a theory that considers nature as a whole. That's why Engels (1987a, 341) regards the Greek philosophy as "fruitful for modern natural science," for the Greeks viewed nature as a whole, even though this was a result of contemplation.

Engels, emphasising the constraints of the empirical method of scientific production opposes its teleologic approach to the relationship between cause and effect and empiric mode of agglomerating the scientific material. Engels' opposition to teleology manifests itself when he criticises the derivation of force from the relationship of an organism to its environment. Engels designates this as replacing the changes caused by the functions of our organisms with a fictitious cause, "a so-called force corresponding to the change." Then he speaks of carrying this method to the external world and inventing as many forces as there are diverse phenomena (Engels 1987a, 372). This operation includes the collection of empirical, immediate knowledge of the changes that have only one cause.<sup>2</sup> Constitution of such a collection of the knowledge of appearances takes place on the basis of the pre-supposition that movement is caused by a force external to nature. The reciprocal relations of organisms to reproduce are realised as they were in virtue of the impulse of an external power.

## THE UNITY OF OPPOSITES

To exhibit the dialectics in nature, one of the fundamental ways is to make the unity of opposites evident as it exists in nature. Engels approaches the case of polarity (attraction and repulsion) as the most apparent one regarding the unity of opposites. Engels remarked that the unity of attraction and repulsion in nature in a single body begins in the sphere of magnetism. Then, just as motion is the common mode of existence of all matter, the

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2. Hegel's concept of bad infinity is appropriate to grasp the essence of this method. Bad infinity specifies the finitised infinity, the infinity of understanding, not of the reason; the infinity entangled in unreconciled, unresolved, absolute contradictions; the infinite as repetitive monotony; the infinite as a first elevation of sense representation above the finite to thought, but to a thought which, for content, has only a nothing and is unable to bring the negative back to the positive; the infinity in the form of the quantitative progress to infinity that does not enhance the object, but bloats the subject who ingests such vast quantities (Hegel 2010, 109-193); the view of objectivity of the sense perception and of essentialism.

unity of attraction and repulsion manifests itself in the various spheres of nature: in chemical processes, electricity, in the organic life while the cell nucleus is formed and regarding the evolution, the most complicated plant on the one hand and human on the other there is the continuous conflict between heredity and adaptation (Engels, 1987a, 492). Therefore, a fundamental principle of the materialist dialectics, the unity of opposites manifests itself in various processes of nature. This should make it clear that in dealing with nature employing fixed concepts that exclude each other, motion and development in nature become incomprehensible. In nature opposites such as positive and negative, finite and infinite, life and death,<sup>3</sup> part and whole, chance and necessity, organic and inorganic, so on and so forth are in unity. All these oppositions in nature are intertwined, in this sense natural sciences' dealing with their subject matters by way of the ordinary logic of "either-or" is theoretically inhibiting. For example, when the relation of positive and negative is in question Hegel's (1991, 174) view is this: "Certainly, these [the positive and the negative] contain the determination of being and nothing. But the positive makes no sense by itself; rather, it is strictly related to the negative. And the situation is the same with the negative."

One of the most determinative unity –as affirmed by Engels– for the materialist dialectics is the unity between the cause and the effect. Hegel (2010, 494) said that "*an effect contains nothing whatever that the cause does not contain. Conversely, a cause contains nothing that is not in its effect [...]* Cause as such entails its effect, and the effect entails the cause." Then Hegel spoke of the sameness of endless progression from effect to effect and the regression from cause to cause. In the latter, a cause becomes an effect that has another cause and the effect becomes a cause that has another effect in turn. The cause has an effect and is at the same time itself effect, and the effect not only has a cause but is itself cause. Regarding the active substance, the cause reveals itself in the effect as what it is and the effect is identical with the cause, is not an other (Hegel 2010, 499–510). Why does the unity of the cause and the effect matter? First, the unity expresses that everything in nature and society is in a reciprocal relationship and no relationship is merely one-sided. Second, it presents a view of the world in which none of the beings is passive and each of them is active causes that

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<sup>3</sup> "The *negation* of life as being essentially contained in life itself, so that life is always thought of in relation to its necessary result, death, which is always contained in it in germ. The dialectical conception of life is nothing more than this [...] Living means dying" (Engels, 1987a 572).

have an effect on the other. Kangal sets forth the implications of this unity concisely: “The emergentist articulation of dialectical structures in nature serves to explicate the view that if one thing brings about another thing, the prior is affected by what it gives rise to” (Kangal 2020, 165).

In fact, the unity of the opposites as such is not only significant as an isolated law of dialectics. It is the notion within which various oppositions, laws of motion, relations, so on and so forth are intertwined. The unity of the opposites is also one of the determinative moments of the absolute opposition between dialectics and metaphysics. Engels put this opposition forward in these words,

*The law of identity* in the old metaphysical sense is the fundamental law of the old outlook:  $a = a$ . Each thing is equal to itself. Everything was permanent, the solar system, stars, organisms. This law has been refuted by natural science bit by bit in each separate case, but theoretically, it still prevails and is still put forward by the supporters of the old in opposition to the new: a thing cannot simultaneously be itself and something else [...] For natural science in its comprehensive role, however, even in each single branch, abstract identity is totally inadequate, and although on the whole it has now been abolished in practice, theoretically it still dominates people’s minds, and most natural scientists imagine that identity and difference are irreconcilable opposites, instead of one-sided poles which represent the truth only in their reciprocal action, in the inclusion of difference within identity. (Engels 1987a, 496)

Fundamental aspects of metaphysics, the idea of permanence, the idea of self-identity of all things necessarily evoke the idea of the first impulse, of an unnatural force that sets things in motion in a way that keeps them in equilibrium. And in fact, the dialectical negation of the idea of a force preceding nature not only negates the idea of creation, but it also implies change is inherent to nature and society, that they are in a reciprocal relationship and the unity of cause and effect. Thereby an essential aspect of Engels’ undertaking made through the *Dialectics of Nature* becomes evident as to include the natural sciences and the advances realised by them in the materialist dialectics and to comprise the truth that the world is constantly changing.

## CONCLUSION

### Why the *Dialectics of Nature* is Important for Marxism and Praxis?

In the *Dialectics of Nature* Engels elaborates the laws of dialectics through the immediacy of empiric natural sciences and provides the dialectics with

its materialist basis. In so doing, he exposes dialectics not merely as a subjective mode of reasoning that is to be reflected on nature, but as the law of motion internal to nature. This way, it becomes possible to approach nature and society in their unity with a single method.

This takes us to the problem of human ontology. Engels' view is the negation of the metaphysical human concept that views the human as identical with himself, a being in itself. In fact, what identifies the human is his being in constant flux, due to his activities and relationships. Neither nature nor human is postulated through fixed and rigid categories, then it becomes possible to consider the whole and its part in reciprocal constant change. This change is first and foremost happens through the reciprocal relations between humans and nature; that is to say, these two opposites are both the cause and the effect of each other.

Engels spoke of the unity of social history and natural history. Therefore, the actions of the revolutionary subject not only change the history of society but also of nature. The revolution is necessary to sublimate the capitalist mode of production that caused the ecological crisis and further leads it to an impasse. The relations of production internal to the capitalist mode of production constitute the objectivity in which all subjects and nature are subordinated to market relationships. The capitalist relations of production necessitate the overproduction of capital, thereby the ecological crisis, the price of which is paid by the proletariat becomes an objective necessity. The fragmented capitalist society in which the actions of the subjects are governed by the law of competition is unable to cope with the crisis. Therefore, the resolving of the ecological crisis hinges on the struggle of building a socialist society in which manual labour is not separated from mental labour, science views society and nature in their unity, and exchange value disappears.

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