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Dialectical Materialism and Quantum Processes

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Teleology involves goal-directed activity. Creation myths are invariably teleological because they suggest that some sort of personified Creator or Creators purposely fashioned the earth, the planets, the stars, animals, humans, etc. Proponents of the Lokayata tradition of philosophy in India (*ca*. 500 BCE), rejected teleological creation myths. They argued that the earth, the planets, stars, etc., arose by chance. Similarly, in ancient Greece, Democritus (*ca*., 460 BCE) and Epicurus (*ca*., 350 BCE) argued that the earth, the planets, the stars, etc., arose by chance (Bartels 2011). The work of Epicurus was a major focus in the doctoral dissertation of Karl Marx (b. 1818 – d. 1883).

It has been shown elsewhere how rejection of creation myths in ancient Greece was fundamental to the origins of science (Bartels 2011). Rejection of creation myths was based upon the philosophical materialist view that there is an objective reality which exists independently of supernatural or human perception/manipulation. Supernatural, personified entities – e.g., god or gods – do not exist in objective reality. This view was characterized by Karl Marx, Frederick Engels (b. 1820 – 1895), and V. I. Lenin (d. 1870 – d. 1924) as 'materialist' in contrast to philosophical 'idealism', according to which 'reality' is affected by supernatural and/or human perception/manipulation. Marx, Engels, and Lenin saw the history of philosophy as a contest between philosophical materialism and philosophical idealism. It is argued here that recent ontological and technological developments in quantum physics support philosophical materialism.

Lenin equated the views of the German scientist, Ernst Mach (b. 1838 - d. 1916), with the philosophical idealism of the 18th-century clergyman, Bishop George Berkeley (b. 1685 – d. 1753). Berkeley argued that all knowledge comes from Divinely-furnished sense experience. Lenin suggested that the logical consequence of the views of Berkeley and Mach was solipsism (1935 [1909]). Solipsism is the view that an individual 'mind' cannot know whether the external world and other individual 'minds' exist. Lenin rejected philosophical idealism and concluded instead that, "…the outer world [is] reflected by us [in consciousness]…" (1935 [1909]: 653; Goldstick 1980).

The Marxist-Leninist view of matter, as existing independently of human observation/manipulation, was called into question by scientific discoveries in the 1920s which seemed to indicate that attempts to observe certain subatomic processes would inevitably affect the processes in question (Fara 2009). According to the Copenhagen interpretation of quantum phenomena, "…certain pairs of measurably physical properties, such as position and momentum [of electrons], are said to be incompatible with each other. Measurements of one will always uncontrollably disrupt the other" (Albert 1994: 60). The Austrian physicist, Erwin Schrödinger, proposed a famous thought experiment in which an unfortunate cat could be simultaneously dead and alive depending upon potential exposure to radioactive material.

The late E.T. Jaynes (b. 1922 – d. 1998), a noted expert on probability theory, argued that proponents of the Copenhagen interpretation commit the 'mind projection fallacy' – i.e., projecting their subjective judgments as inherent properties of matter/objects.

The idealist notion that what we conceive as reality is affected by the process of perception – i.e., that reality is relative to perception/manipulation – was widely discussed in British academic circles during the 1930s (e.g., see Sayers 1995 [1930]). This discussion persists. Seemingly, our everyday experience of objects and processes with definite spatio-temporal properties dissolves into a 'soup' of possibilities (Ball 2019). It seems, however, that this 'soup' primarily involves an epistemological issue – viz., methods of measurement – rather than what may actually exist at the quantum level. In any case, there is much scientific speculation about how quantum probabilities coalesce into our everyday, shared experience of objects and processes with definite times and locations.

For some theoreticians, the alleged 'soup' of quantum-level processes resembles a sort of Kantian 'Ding an sich' – or 'thing in itself' – unknowable apart from human-imposed spatio-temporal categories.

Some physicists have suggested that 'Quantum Darwinism' explains how quantum-level processes are reflected at the macroscopic level.

> When you see an object… that information is delivered to your retina by the photons scattering off it. They carry information to you in the form of a partial replica of certain aspects of the object, [incorporating] information about its position, shape and colour. Lots of replicas are needed if many observers are to agree on a measured value – a hallmark of classicality. The [quantum] states that are best at creating replicas in the environment – the "fittest," you might say – are the only ones accessible to measurement (Ball 2019: 4).

Experimental results from teams at the Sapienza University of Rome and the University of Science and Technology in Hefei, Anhui, China suggest that Quantum Darwinian processes may exist. According to Jess Riedel of the Perimeter Institute for Theoretical Physics at Waterloo, Ontario, "Quantum Darwinism putatively explains, or helps to explain, all of classicality, including everyday macroscopic objects that aren't in a laboratory, or that existed before there were any humans" (quoted in Ball 2019: 5).

Theoretical/mathematical descriptions and analyses of the process of 'replication' mentioned above are beyond the scope of this paper. Such descriptions and analyses may not resolve the issue of whether quantum phenomena can escape a neo-kantian characterization (see above). It should be mentioned, however, that aspects of quantum Darwinism may be consistent with philosophical materialism and with the 'laws' of dialectical development (see below).

Scientists identify causal relations between objects and processes that have been theoretically isolated from their actual external and internal reciprocal contexts/relations. Marx characterized such scientific activity as the method of abstraction. The Marxist notion of abstraction almost certainly influenced the work of the British philosopher of science, Roy Bhaskar (b. 1944 – d. 2014; see Sayer 2000). It seems likely that Lenin and other Marxists saw the process of abstraction as an example of how objective reality is reflected in consciousness. Accuracy of abstraction in identifying causal relationships is confirmed by practice – i.e., acknowledgement by the scientific community on the basis of experiments that a postulated causal relationship repeatedly 'works.' As Engels wrote, "the result of our action proves the conformity… of our perceptions with the objective nature of the things perceived" (1935 [1877]).

Even though Lenin's view of matter as existing independently of human/supernatural perception/manipulation stood (and stands) in stark contrast to the relativistic/idealistic views mentioned above, few Marxists publicly defended the Leninist view during the mid-20th century, possibly because they felt unqualified to question what became the orthodoxy of the Copenhagen interpretation.

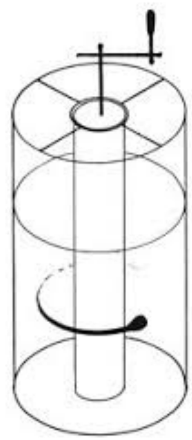
There was, however, an alternative to the Copenhagen interpretation that was consistent with the Marxist-Leninist view of matter as existing independently of human/divine perception/manipulation. This was the theory proposed by the American-born physicist, David Bohm (b. 1917 – d. 1992). He was charged and arrested in the U.S. in 1950 for refusing to 'name names' for the House Un-American Activities Committee. After he was acquitted in 1951, he left the U.S.

According to Bohm's interpretation of the behavior of matter and energy at subatomic levels, "…there are invariably definite matters of fact about the positions of particles…" (Albert 1994: 66). These 'matters of fact' are independent of observation.

One of the Marxist philosophers who initially understood the implications of Bohm's theory was Danny Goldstick of the University of Toronto.

Bohm suggested that all stable entities which we perceive are, in fact, subject to development and/or decay. Their stability depends on the concatenation of forces to which they are subjected, and which they, in turn, affect (Bohm 2003; Peat 2007). Marx, Engels, and Lenin expressed similar views (Lenin 1940 [1914-15]; Engels 1935 [1886]; Sheehan 1993). They noted that these views are similar to those of the pre-Socratic Greek philosopher, Heraclitus (Bartels 2011).

To illustrate some of the views mentioned above, Bohm used an example of cylinders enclosing glycerine, a clear, viscous liquid (see diagram below). The outer cylinder can be rotated. When a drop of food colouring is inserted into the glycerine, and the outer cylinder is rotated, the coloured drop is 'absorbed' and disappears in the liquid. When the cylinder is rotated in the opposite direction, the drop reappears. If multiple drops are inserted, they are dissipated when the cylinder is rotated, and they reappear when the rotation is reversed.



Bohm seems to have suggested that all stable objects are analogous to the coloured drops, and that they disappear and are reconstituted over time, not necessarily in the same form. In this case, time is unidirectional; rotation of the cylinder in a particular direction indicates a 'direction' of time; when the direction of the rotation is reversed, the 'flow' of time is reversed (see Barry 2019).

Is Bohm's approach exemplified by the more traditional Marxist accounts of dialectics? Most Marxists have focussed on three 'laws' that characterize dialectical processes inherent in matter/nature and in society:

1. the transformation of quantity into quality: When an object/entity undergoes change enough in one direction, it can and usually does eventually undergo a qualitative change. All things have both qualitative and quantitative aspects, or at least quantitative concepts can be associated with them.
2. the unity of opposites: All systems/things contain numerous paired elements within them that are in conflict with each other, such that the system or thing embodies the unity of those paired elements as well as the conflict between them. This is what is meant in this context by 'opposites.'
3. negation of negation: Whenever a transformation of something into something else occurs, the new entity retains some features of the former entity but also negates/eclipses certain features. When the second entity is transformed into a third entity, the newest entity negates/eclipses some features, but also retains certain features of the first entity that had been negated/eclipsed by the second.

'Negation of negation' was a major feature of the idealist view of G.F. Hegel (b. 1770 – d. 1831), a highly-influential German philosopher (Singer 1983). A materialist interpretation of 'negation of negation' was proposed by Engels (1935 [1877]). The meaning of 'negation of negation' was, and remains, controversial. The notable U.S. Marxist scholar, Kenneth Neil Cameron (b. 1908 – d. 1994), suggested that 'negation of negation' should be abandoned because it is scientifically fruitless (1993: 168-69). An exploration of this issue is beyond the scope of this paper. Consequently, discussion here is limited to the first two 'laws' that characterize dialectical processes.

Because the views of Democritus and Epicurus (see above) and those of later philosophical materialists did not include dialectical development, or the inherent dynamics of matter, they were negatively characterized as 'mechanical,' and thus as inadequate, by Marx and Engels.

The dialectical laws of nature, and some of their relationships to quantum processes, are explored below.

Consider an ice cube. Its stability is affected by external forces, which include the temperature of the air around the cube. It should be emphasized that this relationship is reciprocal. The temperature of the cube also affects the air around it.

The stability of the cube also depends on internal factors. So long as the attraction between the molecules which make up the cube is relatively strong, the cube remains stable. But if this attraction is weakened, the cube will melt (see Yakhot 1965).

The ice cube example shows the aspect of dialectical processes whereby quantitative change brings about qualitative change, and whereby internal and external influences work together. As the temperature of the ice increases, molecular attraction decreases because increased agitation drives them farther apart. The strength or weakness of attraction is dependent on closeness or remoteness.

Quantum Darwinism (see above) suggests that there is a relationship between degrees of replicability at the quantum level and 'public' accessibility to measurement at the macroscopic level. It remains to be seen whether this relationship is usefully analogous to the dialectical 'law' of nature regarding transformation of quantity into quality.

In conclusion, philosophical idealists usually claim that some sort of personified supernatural entity has a developmental direction or goal which gave rise to life, humanity, and human history. In contrast, Marx, Engels, and other philosophical materialists claimed that life and humanity arose non-teleologically because of the inherent, dialectical properties of matter and energy (Lenin 1930 [1914-15]).

References

Albert, David A. 1994. 'Bohm's Alternative to Quantum Mechanics.' *Scientific American*, May: 58-67.

Ball, Philip. 2019. 'Quantum Darwinism: an Idea to Explain Objective Reality, Passes First Tests.' *Quanta Magazine* (22 July).

Barry, Rolando. 2019. 'The Universal Law That Aims Time's Arrow.' *Quanta Magazine* (1 August).

Bartels, Dennis. 2011. 'From Myth to Science.' *Humanist Perspectives* 117: 16-25.

Bartels, Dennis and Hamid Abdollahyan. 2008. *Comparative Perspectives in Sociology, Anthropology, and Communication* (in Persian). Tehran: Samt Publications.

Bohm, David. 2003. *The Essential David Bohm*. Lee Nichol, ed. London: Routledge.

Cameron, Kenneth Neill. 1993. *Marxism, a Living Science*. NY: International Publishers.

Engels, Frederick. 1935 [1886]. Ludwig Feuerbach. In Emile Burns, ed. *Handbook of Marxism*. NY: International Publishers.

––– 1935 [1877]. Herr Eugen Dühring's Revolution in Science (anti-Dühring). In Emile Burns, ed. *Handbook of Marxism*. NY: International publishers.

Fara, Patricia. 2009. *Science, a Four Thousand Year History*. Oxford University Press.

Goldstick, Danny. 1980. 'The Leninist Theory of Perception.' *Dialogue* Vol. XIX, no. 1: 1-19.

Kharin, Yuri A. 1981. *Fundamentals of Dialectics*. Moscow: Progress Publishers.

Konstantinov, F.V., et al. 1974. *Fundamentals of Marxism-Leninism*. Moscow: Progress Publishers.

Lenin. V.I. 1930 [1914-15]. 'The Teachings of Karl Marx,' in *Ten Classics of Marxism*. NY: International Publishers.

––– 1935 [1909]. Materialism and Empirio-Criticism. In Emile Burns, ed. *Handbook of Marxism*. NY: International publishers.

Peat, David. 2007. *Pathways of Chance*. Pari, Grosseto, Italy: Pari Publishing.

Sayer, Andrew. 2000. *Realism in Social Science*. Thousand Oaks, CA: Sage Publications.

Sayers, Dorothy. 1995 [1930]. *The Documents in the Case*. NY: HarperPaperbacks.

Sheehan, Helena. 1993. *Marxism and the Philosophy of Science*. Amherst, NY: Humanity Books.

Singer, Peter. 1983. *Hegel*. Oxford University Press.

Yakhot, O. 1965. *What is Dialectical Materialism*? Moscow: Progress Publishers.

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