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The Physics of Marxism

Centuries before the life of Karl Marx, the Scientific Revolution spurred great strides in both the methodology and content of science. People began to discover natural laws, allowing for both a deeper understanding of how the universe worked and unprecedented advances in human technology. While fields such as chemistry, geology and biology all came to have their own revolutions, modern science was founded on the development of physics.

Inspired by science's efforts to understand the physical world, Marx endeavored to discover a science of human history. Indeed, the very idea that he *might* find laws governing how society changes over time is predicated on the existence and reliability of natural laws in the hard sciences. Perhaps it is no surprise, then, that Marx's analysis of society tended toward the deterministic. For Marx, competition, craft-liberty and the division of landed property are the "necessary, inevitable and natural consequences" of monopoly, the corporation and feudal property (Marx, 1844 / 1978: 71). Whatever capitalism's starting point, "inherent laws" (Marx, 1867 / 1978: 376) ensure that "its final form is invariably the same — a productive mechanism whose parts are human beings"(Marx, 1867 / 1978: 390). But in the end, "capitalist production begets, with the inexorability of a law of Nature, its own negation" (Marx, 1867 / 1978: 438), and lasting communism is the predestined result.

Beyond the basic idea of determinism, though, much of Marx's work parallels explication of specific laws of physics. At times his analysis of social relations is symbolically suggestive of

physical laws, while at others societies are described explicitly as systems of forces and energies. For example, “that the necessary result of competition is the accumulation of capital in a few hands” (Marx, 1844 / 1978: 70) and that this further centralizes politics and production in urban areas is tantamount to a social law of gravity, even to the extent that an entity’s ability to attract increases with its size.

In particular, two of the most fundamental sets of physical laws play themselves out in Marx’s work. First, Marx introduces ideas related to the third law of Newtonian mechanics in *Estranged Labour*, using them throughout others of the *Economic and Philosophic Manuscripts of 1844* then elaborating further in both *Capital, Volume One* and, along with Friedrich Engels, in the *Manifesto of the Communist Party*. Then, just as physics developed thermodynamics only after mechanics, Marx’s analysis increased in sophistication as he developed in his later work not only concepts based on the remaining laws of motion but the laws of thermodynamics.

Marx wanted to develop a theory that explained the motor of history, i.e., the laws behind processes of historical change. It seems appropriate, then, that he should incorporate ideas of physical motion. The most common such idea in Marx’s work is found in Newton’s third law of motion, the Law of Conservation of Momentum, which says that for every action there is an equal and opposite reaction (Barnes-Svarney, 1995: 275). This idea is most apparent in Marx’s overarching idea that capitalism brings about its own demise as the pushing down of the proletariat must lead eventually to its springing back up. The idea is expressed, though, in many details as well.

This is clearly evident throughout *Estranged Labour*, the first of his *Economic and Philosophic Manuscripts of 1844*. Marx’s language can be evocative, as when he claims that “the more the worker by his labour *appropriates* the external world, sensuous nature, the more he

deprives himself of *means of life*" (Marx, 1844 / 1978: 72), or it may even take on the very form of scientific laws, proposing an overtly mathematical relationship: "... we have shown that the worker sinks to the level of a commodity and becomes indeed the most wretched of commodities; that the wretchedness of the worker is in inverse proportion to the power and magnitude of his production" (Marx, 1844 / 1978: 70). Probably the strongest example of his use of the equal and opposite reaction comes from its simple repetition:

> (The laws of political economy express the estrangement of the worker in his object thus: the more the worker produces, the less he has to consume; the more values he creates, the more valueless, the more unworthy he becomes; the better formed his product, the more deformed becomes the worker; the more civilized his object, the more barbarous becomes the worker; the mightier labour becomes, the more powerless becomes the worker; the more ingenious labour becomes, the duller becomes the worker and the more he becomes nature's bondsman.)
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> *Political economy conceals the estrangement inherent in the nature of labour by not considering the direct relationship between the worker* (labour) *and production.* It is true that labour produces for the rich wonderful thing — but for the worker it produces privation. It produces palaces — but for the worker, hovels. It produces beauty — but for the worker, deformity. It replaces labour by machines — but some of the workers it throws back to a barbarous type of labour, and the other workers it turns into machines. It produces intelligence — but for the worker idiocy, cretinism. (Marx, 1844 / 1978: 73)

In the other 1844 manuscripts, the idea of an equal and opposite reaction is explored further and in more subtle ways. In *Private Property and Communism*, for example, Marx applies the concept in suggesting that "*just as* society itself produces *man as man,* so is society *produced* by him" (Marx, 1844 / 1978: 85). The Newtonian law describes a kind of equilibrium and is not intended to have any sort of negative connotation. Where the *Estranged Labour* examples are all about the degradation of the labor, here we find simply an expression of duality, two forces having a mutual effect. In this respect, the very idea of a dialectic seems related to this physical law.

Another interesting example can be found in *The Meaning of Human Requirements*: "When political economy claims that demand and supply always balance each other, it immediately forgets that according to its own claim (theory of population) the supply of *people*

always exceeds the demand" (Marx, 1844 / 1978: 100). Here, Marx chides classical political economy for failing to obey its own claim of an equal and opposite reaction, that between supply and demand. The suggestion is that capitalism is ill-founded at least in part because it breaks a natural law of equilibrium.

Decades later, in both *Capital, Volume One* and the *Manifesto of the Communist Party*, Marx still appears taken with ideas based on the third law of motion, providing both suggestive and more empirical applications. The laborer, of course, remains a victim of the capitalist system, evident from the "economic paradox" of the use of machinery in which "the most powerful instrument for shortening labour-time, becomes the most unfailing means for placing every moment of the labourer's time and that of his family, at the disposal of the capitalist for the purpose of expanding the value of his capital" (Marx, 1867 / 1978: 406). A similar statement about machinery can be found in the *Manifesto*, this time represented by a more scientific sounding direct proportion and preceded immediately by yet another proportion in which, "as the repulsiveness of the work increases, the wage decreases" (Marx & Engels, 1888 / 1978: 479). Indeed, the *Manifesto* provides two statements of direct proportion between the increase of bourgeois capital and the decreased status of the proletariat (Marx & Engels, 1888 / 1978: 475, 478-9).

Of course, it is all due to the greed of the capitalist for whom "The magnitude of profit whets his appetite for more profit" (Marx, 1867 / 1978: 405). In other words, the more he gains, the less his satisfaction. However, this is not the only opposite reaction to which the capitalist is subject. If he is too greedy and overburdens flax-growing soil to reap short-term profits, he will later face raised costs in the form of the increased labor-time necessary for the production of linen (Marx, 1867 / 1978: 318). Finally, though, on a positive note, comes communism's ultimate

opposite reaction, the triumph of the proletariat and its effects on a national scale: “In proportion as the exploitation of one individual by another is put an end to, the exploitation of one nation by another will also be put an end to. In proportion as the antagonism between classes within the nation vanishes, the hostility of one nation to another will come to an end” (Marx & Engels, 1888 / 1978: 488-9).

In his later works, Marx also ventured beyond the Law of Conservation of Momentum into ideas related to the first two laws of motion. Newton’s first law of motion is the Law of Inertia, which says that the momentum of a system remains constant in the absence of outside forces (Barnes-Svarney, 1995: 275). Marx clearly expresses this idea in his analysis of the general formula of capital:

> The repetition or renewal of the act of selling in order to buy, is kept within bounds by the very object it aims at, namely, consumption or the satisfaction of definite wants, an aim that lies altogether outside the sphere of circulation. But when we buy in order to sell, we, on the contrary, begin and end with the same thing, money, exchange-value; and thereby the movement becomes interminable. (Marx, 1867 / 1978: 332).

In the first case, that of C-M-C, the outside force acting on the system is the fact that definite wants are limited. However, M-C-M’ is driven by a desire for capital, which itself “has no limits” (Marx, 1867 / 1978: 333), and thus it remains in motion. The “industrial *perpetuum mobile*... would go on producing forever, did it not meet with certain natural obstructions in the weak bodies and the strong wills of its human attendants” (Marx, 1867 / 1978: 405). In the end, though, Marx claims that an even larger force, that of the proletarian revolution, will bring a permanent end to capitalist inertia.

Newton’s second law of motion, the Law of Constant Acceleration, says that, when a force acts on a body, the body accelerates in the direction of the force (Barnes-Svarney, 1995: 275). This relates to the idea that capitalist expansion accelerates because there is always pressure to accumulate more, shown by the idea expressed earlier that the magnitude of profit

makes the capitalist want profit all the more. The concept is supported by the historical accelerations of production marked by agriculture and the Industrial Revolution, which simply represent increases in the level of acceleration itself.

An incarnation of this law that harms the capitalist is expressed in part of Marx's analysis of the length of the work day, when he says that the excessive extension of the work day shortens the life of the laborer and thus "the forces used up have to be replaced at a more rapid rate and the sum of the expenses for the reproduction of labour-power will be greater" (Marx, 1867 / 1978: 374). But in the end, according to Marxist theory, production will accelerate more than ever before when socialism can act as a positive force, freeing people and their productive capacities. It is explicitly stated that "The supremacy of the proletariat will cause [national differences and antagonisms] to vanish still faster" than they wane even under late capitalism (Marx & Engels, 1888 / 1978: 488).

Thermodynamics is the study of the flow, production and conversion of heat into work (Barnes-Svarney, 1995: 283). Its concepts play nicely into many of Marx's ideas, especially those about labor, which is perhaps no coincidence due to the shared focus on work. The first law of thermodynamics, from which is derived the law of the conservation of energy, is that the conversion of heat into work is never efficient. Energy is always lost in the process (Barnes-Svarney, 1995: 283). This lost energy is highly suggestive of surplus value, where the effort expended by the laborer beyond what is required for his own subsistence is lost to the capitalist. This concept thus reveals itself to be even more central to the analysis of the work day than is the second law of motion. Marx's laborer defends his need for a "normal" work day by explaining how he must preserve himself so that he may "be able on the morrow to work with the same normal amount of force, health and freshness as to-day." He must, in effect, conserve his energy

lest he die from overexertion at the hands of the demanding capitalist: “By an unlimited extension of the working-day, you may in one day use up a quantity of labour-power greater than I can restore in three” (Marx, 1867 / 1978: 363). Indeed, this is the physical law that proves the impossibility of perpetual motion, which we have already seen Marx equate to capitalism. We can now understand all the better just how the exploitation of the laborer eventually leads to capitalism’s demise, just as the loss of energy in physical processes will keep a process from continuing indefinitely.

The parallel between heat and surplus value is enhanced with a nice symbolism by the second law of thermodynamics which states that heat will always flow from an object having higher temperature to an object having lower temperature (Barnes-Svarney, 1995: 283). The laborer works, exerts energy, and is thus the source of heat. The heat then flows to the entity that is not working, that is generating less energy: the “cold,” heartless capitalist. The third law, which says that all molecular motion ceases at absolute zero (Barnes-Svarney, 1995: 283), suggests humanity’s ultimate dependence on labor. In Marxist theory, labor “is a necessary condition, independent of all forms of society, for the existence of the human race; it is an eternal nature-imposed necessity, without which there can be no material exchanges between man and Nature, and therefore no life” (Marx, 1867 / 1978: 309). Man dies without labor, just as all motion stops when there is no heat. The final law, known as the “zero law,” says that no heat flows between any two bodies that are at the same temperature (Barnes-Svarney, 1995: 283). This evokes the idea of an egalitarian society in which nobody exploits anybody else’s labor. Indeed, the capitalist can only exploit the laborer in the first place because he holds the means of production, i.e., because there is already inequality.

Whether or not it was intentional on his part, a great deal of Marx’s analysis of capitalism,

labor and social relations finds parallel concepts in the laws of motion and thermodynamics. There is, however, at least one crucial way in which Marxist theory may contradict the laws of physics. Marxist socialism espouses the increase of productive activity, enabled by increasing technological development, to achieve abundance and fulfillment for all people. Though capitalism may be justly criticized for its attempt at perpetual motion, such a socialist system may be equally poised to bring about its own demise by ignoring the limits of natural resources. Whatever improvements it may hold for the human condition, such a system may simply not be able to perpetuate itself.

Given Marx's highly perceptive insights into the engines of social history, it is surprising that he did not see the additional lessons that the laws of nature had to teach. However, his work stands as a truly innovative and unprecedented attempt at devising a science of human history. It became only more elegant over time, impressively employing genuinely scientific ideas. Inasmuch as this is true, perhaps the idea of progress will not have to be discarded along with certain progressivist ideas inconsistent with natural law.

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