

A LAW OF ACCELERATION

Chapter 34 in *The Education of Henry Adams*
by Henry Adams

Edited by Prof. Eric Steinhart

0. Note on the Preparation of this Work

The original text is: Adams, H. (1904) A law of acceleration. In H. Adams (1919) *The Education of Henry Adams*. New York: Houghton Mifflin, ch. 34. The text is copyright prior to 1923 and is in the public domain. See: <http://www.gutenberg.org/ebooks/2044>. A PDF of the original is available through Google Books.

The original text, written in the language and style of 1904, is almost completely unreadable in 2011. I have taken the liberty of editing it and paraphrasing it for the sake of readability; I have made every effort to preserve the author's original meaning. Section headings have been added by Prof. Steinhart.

All that follows is the edited and paraphrased version of the Henry Adams text:

1. Human History Traces a Path Like a Comet

IMAGES are not arguments, rarely even lead to proof, but the mind craves them. The image needed here is that of a new centre, or preponderating mass, artificially introduced on earth in the midst of a system of attractive forces that previously made their own equilibrium, and constantly induced to accelerate its motion till it shall establish a new equilibrium. A dynamic theory would begin by assuming that all history, terrestrial or cosmic, mechanical or intellectual, would be reducible to this formula if we knew the facts.

For convenience, the most familiar image should come first; and this is probably that of the comet . . . guided by the sum of forces attracting or deflecting it. Nothing forbids one to assume that the comet of humanity might grow, as an acorn does, absorbing light, heat, electricity -- or thought; for, in recent times, such transference of energy has become a familiar idea; but the simplest figure, at first, is that of a perfect comet -- say that of 1843 -- which drops from space, in a straight line, at the regular acceleration of speed, directly into the sun, and after wheeling sharply around the sun, the comet turns back along the path on which it came. The mind, by analogy, may behave like such a comet.

2. Measuring Human Progress

Motion is the ultimate object of science, and measures of motion are many; but with thought as with matter, the true measure is mass in its astronomic sense -- the sum or

difference of attractive forces. Science has quite enough trouble in measuring its material motions without volunteering help to the historian, but the historian needs not much help to measure some kinds of social movement; and especially in the nineteenth century, society by common accord agreed in measuring its progress by the coal-output. *The ratio of increase in the volume of coal-power may serve as dynamometer.*

The coal-output of the world, speaking roughly, *doubled every ten years* between 1840 and 1900, in the form of utilized power, for the ton of coal yielded three or four times as much power in 1900 as in 1840. Rapid as this rate of acceleration in volume seems, it may be measured in a thousand other ways which will give similar results. Perhaps the ocean steamer is easiest to measure, for any one in 1905 might buy a ticket on an ocean steamer, and thus hire the use of 30,000 steam-horse-power to cross the ocean. To go backwards in time, we must *halve this figure every ten years*: thus we get 234 horse-power for 1835.

Since 1800 scores of new forces have been discovered; old forces had been raised to higher powers, as could be measured in the navy-gun; great regions of chemistry had been opened up, and connected with other regions of physics. Within ten years a new universe of force had been revealed in radiation. Complexity had extended itself on immense horizons, and arithmetical ratios were useless for any attempt at accuracy. The force evolved seemed more like explosion than gravitation, and followed closely the curve of steam power; but, at all events, the ten-year period for doubling seems carefully calculated.

3. Looking Backwards Using the Measure of Progress

Thus, taking the year 1900 as the starting point for carrying the calculation of power use backwards in time, it seems reasonable to assume a ten-year period of halving as far back as 1820. A historian might be tempted to maintain a similar rate of movement back to 1600. To save trouble, one might tentatively carry back the same ratio of acceleration, or retardation, to the year 1400, so taking a uniform rate during the whole four centuries (1400-1800), and leaving to statisticians the task of correcting it.

Behind the year 1400, the process certainly went on, but the progress became so slight as to be hardly measurable. Forces, called loosely Greek fire and gunpowder, came into use in the west in the thirteenth century, as well as instruments like the compass, the blow-pipe, clocks and spectacles, and materials like paper; Arabic notation and algebra were introduced, while metaphysics and theology acted as violent stimulants to mind. An architect might detect a sequence between the Church of St. Peter's at Rome, the Amiens Cathedral, the Duomo at Pisa, San Marco at Venice, Sancta Sofia at Constantinople and the churches at Ravenna. All the historian dares affirm is that a sequence is manifestly there, and he has a right to carry back his ratio, to represent the fact, without assuming its numerical correctness. On the human mind as a moving body, the break in acceleration in the Middle Ages is only apparent; the attraction worked through shifting forms of

force, as the sun works by light or heat, electricity, gravitation, or what not, on different organs with different sensibilities, but with invariable law.

The science of prehistoric man has no value except to prove that the law went back into indefinite antiquity. A stone arrowhead is as convincing as a steam-engine. The values were as clear a hundred thousand years ago as now, and extended equally over the whole world. The motion at last became infinitely slight, but cannot be proved to have stopped. The motion of Newton's comet at aphelion may be equally slight. To evolutionists may be left the processes of evolution; to historians the single interest is the law of reaction between force and force -- between mind and nature -- the law of progress.

4. Resistance to the Law of Acceleration is Futile

Or better, one might, for convenience, use the formula of squares to serve for a law of mind. The force of mind increases in the direct ratio of its squares. As the human comet approached the sun or centre of attractive force, the attraction of one century squared itself to give the measure of attraction in the next.

The great division of history into phases by Turgot and Comte first affirmed this law in its outlines by asserting the unity of progress, for a mere phase interrupts no growth, and nature shows innumerable such phases. The development of coal-power in the nineteenth century furnished the first means of assigning closer values to the elements; and the appearance of supersensual forces towards 1900 made this calculation a pressing necessity; since the next step became infinitely serious.

A law of acceleration, definite and constant as any law of mechanics, cannot be supposed to relax its energy to suit the convenience of man. In every age man has bitterly and justly complained that Nature hurried and hustled him.

Fifty years ago, science took for granted that the rate of acceleration could not last. The world forgets quickly, but even today the habit remains of founding statistics on the faith that consumption will continue nearly stationary. Two generations, with John Stuart Mill, talked of this stationary period, which was to follow the explosion of new power. All the men who were elderly in the forties died in this faith, and other men grew old nursing the same conviction, and happy in it; while science, for fifty years, permitted, or encouraged, society to think that force would prove to be limited in supply. This mental inertia of science lasted through the 1880s before showing signs of breaking up; and nothing short of radium fairly wakened men to the fact, long since evident, that force was inexhaustible. Even then the scientific authorities vehemently resisted.

The discovery of radium was the most revolutionary thing since the year 300. The mind of man had more than once been upset, but never caught and whirled about in the vortex of infinite forces. Power leaped from every atom, and enough of it to supply the stellar universe showed itself running to waste at every pore of matter. Man could no longer resist it. Forces grasped his wrists and flung him about as though he had hold of a live

wire or a runaway automobile; which was very nearly the exact truth for the purposes of an elderly and timid single gentleman in Paris, who never drove down the Champs Elysees without expecting an accident, and commonly witnessing one; or found himself in the neighborhood of an official without calculating the chances of a bomb. So long as the rates of progress held good, these bombs would double in force and number every ten years.

5. The Singularity is Near

Impossibilities no longer stood in the way. One's life had fattened on impossibilities. Before the author of this essay was six years old, he had seen four impossibilities made actual -- the ocean-steamer, the railway, the electric telegraph, and the Daguerreotype; nor could he ever learn which of the four had most hurried others to come. He had seen the coal-output of the United States grow from nothing to three hundred million tons or more. What was far more serious, he had seen the number of minds, engaged in pursuing force -- the truest measure of its attraction -- increase from a few scores or hundreds, in 1838, to many thousands in 1905, trained to sharpness never before reached, and armed with instruments amounting to new senses of indefinite power and accuracy, while they chased force into hiding-places where Nature herself had never known it to be, making analyses that contradicted being, and syntheses that endangered the elements.

Every day Nature violently revolted, causing so-called accidents with enormous destruction of property and life, while plainly laughing at man, who helplessly groaned and shrieked and shuddered, but never for a single instant could stop. The railways alone approached the carnage of war; automobiles and fire-arms ravaged society, until an earthquake became almost a nervous relaxation. An immense volume of force had detached itself from the unknown universe of energy, while still vaster reservoirs, supposed to be infinite, steadily revealed themselves, attracting mankind with more compulsive course than all the Pontic Seas or Gods or Gold that ever existed, and feeling still less of retiring ebb.

In 1850, science would have smiled at such a romance as this, but, in 1900, as far as history could learn, few men of science thought it a laughing matter. If a perplexed but laborious follower could venture to guess their drift, it seemed in their minds a toss-up between anarchy and order. Unless they should be more honest with themselves in the future than ever they were in the past, they would be more astonished than their followers when they reached the end. If Karl Pearson's notions of the universe were sound, men like Galileo, Descartes, Leibnitz, and Newton should have stopped the progress of science before 1700, supposing them to have been honest in the religious convictions they expressed.

In 1900 they were plainly forced back; on faith in a unity unproved and an order they had themselves disproved. They had reduced their universe to a series of relations to themselves. They had reduced themselves to motion in a universe of motions, with an acceleration, in their own case of vertiginous violence. With the correctness of their

science, history had no right to meddle, since their science now lay in a plane where scarcely one or two hundred minds in the world could follow its mathematical processes; but bombs educate vigorously, and even wireless telegraphy or airships might require the reconstruction of society.

If any analogy whatever existed between the human mind, on one side, and the laws of motion, on the other, the mind had already entered a field of attraction so violent that it must immediately pass beyond, into new equilibrium, like the Comet of Newton, to suffer dissipation altogether, like meteoroids in the earth's atmosphere. If it behaved like an explosive, it must rapidly recover equilibrium; if it behaved like a vegetable, it must reach its limits of growth; and even if it acted like the earlier creations of energy -- the saurians and sharks -- it must have nearly reached the limits of its expansion.

If science were to go on doubling or quadrupling its complexities every ten years, even mathematics would soon succumb. An average mind had succumbed already in 1850; it could no longer understand the problem in 1900.

6. The Future: Life Beyond 1900

Anyone can see that the American of the twentieth century -- the child of incalculable coal-power, chemical power, electric power, and radiating energy, as well as of new forces yet undetermined -- must be a sort of God compared with any former creation of nature. At the rate of progress since 1800, every American who lives into the year 2000 will know how to control unlimited power. He will think in complexities unimaginable to an earlier mind. He will deal with problems altogether beyond the range of earlier society. To him the nineteenth century would stand on the same plane with the fourth -- equally childlike -- and he will only wonder how both of them, knowing so little, and so weak in force, should have done so much. Perhaps, in 1964, an American might even be able to travel back in time, to sit with Gibbon on the steps of Ara Coeli.

The law of acceleration is definite, and will only require ten years more study to determine whether it holds good. No scheme can be suggested to the new American, and no fault needed to be found, or complaint made; but the next great influx of new forces seems near at hand, and its style of education promised to be violently coercive. The movement from unity into multiplicity, between 1200 and 1900, was unbroken in sequence, and rapid in acceleration. Prolonged one generation longer, it will require a new social mind. As though thought were common salt in indefinite solution it must enter a new phase subject to new laws. Thus far, since five or ten thousand years, the mind had successfully reacted, and nothing yet proved that it will fail to react -- but it will need to jump.

These laws, to be referred to as the Law of constant acceleration, and the Law of relative acceleration are in complete conformance with the principles of both, the time and energy theory, and the millennium theory of relativity. The Laws of Acceleration. The Relationships Between Time, Velocity, and Rate of Acceleration. © 2001 Joseph A. Rybczyk. 1. Introduction. The purpose of this paper is to identify the dual nature of constant acceleration and to establish the two laws that define its characteristics. Whereas the first law deals with the constant aspect of such behavior, the second law de law of acceleration " a generalization in biology: the order of development of a structure or organ is directly related to its importance to the organism " Useful english dictionary. acceleration " I noun dispatch, expedition, expeditious performance, hastening, hurrying, increase of speed, quickening, shortening of time, speedup, spurt, stepping up a pace associated concepts: acceleration clause, acceleration doctrine, acceleration of " " " Law dictionary. acceleration clause " n: a clause (as in a loan agreement) that accelerates the date of payment in full under specified circumstances (as d Acceleration is a measure of how fast velocity changes. Acceleration is the change of velocity divided by the change of time. Acceleration is a vector, and therefore includes both a size and a direction. Acceleration is also a change in speed and direction, there is: Speed (a scalar quantity) (uses no direction). Distance is how far you traveled. Time is how long it took you to travel. Speed is how fast you are moving - Speed = Distance / Time. Velocity (a vector quantity) (uses a direction).