Naval War College Review

Volume 3
Number 6 *June*

Article 2

1950

Momentum as a Factor in National Security

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MOMENTUM AS A FACTOR IN NATIONAL SECURITY

A lecture delivered by
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at the Naval War College
on May 8, 1950

My thesis is creative momentum, its components and characteristics and its relation to all development—good or bad, natural or man made, political, military, administrative, scientific, economic and industrial. My argument is that relative superiority in any field of development results from the product of the static values and the momentum; a high static value will quickly lose superiority if the momentum of its evolution to higher forms is relatively low.

The evidence that I submit will fade or become obsolete. What I hope will remain is a small intellectual tool or way of thinking which, when added to your many tools, may be of value in solving the problems you will encounter in the pursuit of your profession.

As the first piece of evidence in support of the argument I would like to develop for you a presumptive curve of growth of the millions of species of life that now inhabit our planet. Competent biologists say the first organic cells were evolved from inorganic material about one thousand million years ago. For approximately five hundred million years organic life was not sufficiently dense or complex to leave fossil records. Science tells us,

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however, that many points along the curve of evolution are marked by organisms that attained stability in ages past and still exist today.

Some of the unicellular organisms of ancient origin have differential sensitivities which gave them the equivalent of sense organs in various parts of their bodies. There is also evidence that in their efforts to survive many of them developed cooperative relationships. An indication of the first step toward multicellular cooperation is found in certain forms of amoeba. When their feeding grounds give out these amoeba, in response to some mysterious signal, quickly gather together into worm-like forms, thus, by cooperation acquiring a mobility which enables them to move with comparative rapidity to new feeding grounds where they disperse. A further step in evolution is found in certain slime molds which form and disperse and in which the amoeba are specialized, some forming the head, some the stem, and some the foot.

All single cells have a sort of immortality; that is, they reproduce by fission. This was an obstacle to the evolution of new species. For the first 500 million years, therefore, the curve of increase of new species had a low exponentiality; that is, the upward slope of the curve of growth was very gradual.

With the evolution of bi-sexualism and death, a very rapid growth in the number of species became possible and the growth curve rose steeply with an increasing exponentiality. The curve reached a plateau comparatively recently—probably between one and ten million years ago. Some few species are still disappearing and some evolving but, generally speaking, there is now a plateau in the number of species.

The eminent French biologist, Lecomte du Nouy, says that the only evolution of any consequence still continuing is the spiritual and intellectual evolution of man; all other forms of life have either failed to adapt and therefore ceased to exist or have become perfectly adapted and ceased to evolve.

Here, then, in number of species plotted against a billion years of time is a curve the slopes of which show the growth and decay of momentum in the evolution of life. A gradual slope for the first half of the curve, turning upward into a steep slope for the last half of the curve, and turning over toward an asymptote, or plateau, at the upper part of the curve.

The basic factor which produced momentum in the development of the countless species of organic life was conflict with the adverse forces of environment. Many failed to survive. The dinosaurs, for example. With little brains and big posteriors, they managed by sheer strength and size, to survive for 140 million years, but their momentum toward sizes and their lack of momentum toward brains eventually proved their undoing. They failed to adapt to changing conditions and disappeared. The same phenomenon is observable in the history of man-made organizations. Big posteriors and little brains are not a very alert or adaptable combination.

Every surviving species is characterized by the means evolved to insure its survival. From the microbe to the elephant, life is replete with the most intricate and amazing individual and social mechanisms to serve this purpose.

For example, there is a beetle of the Meloid family which lays its eggs near the burrows of certain mining bees. The eggs hatch tiny lice. The lice seek flowers frequented by the bees and, at precisely the right moment, hop on the bee's back and hide in its fur. There they stay until the bee has provisioned herself with pollen and honey. Then, at the moment when the bee lays her egg, the tiny louse jumps from the back of the bee and lands on the egg, which it uses as life raft and larder for several years while it goes through seven metamorphoses, finally emerging as an adult beetle to start the life cycle all over again.

Only once does the tiny Meloid louse seek the flowers; only once does it jump on the bee's back; only once does it jump on the egg. Survival required that some sort of memory cell must continue through all of the transformations and tell the tiny organism precisely what to do and precisely when to do it.

The survival mechanisms of all the two-winged insects—of which there are some fifty thousand species—include a gyroscopic automatic pilot that is amazingly compact and effective, and far superior to anything man has invented. The migratory birds and homing pigeons are equipped with position finding mechanisms—Lorans—the nature of which we can dimly understand although the mechanisms are still a mystery. Many animals are physically superior to man. And yet in a very short period of evolutionary time man has become the lord of creation on this planet. Let us construct the curve of his evolutionary momentum.

Biologists tell us that man is of the order of primates, the family homonidae, the genus homo, and the species sapiens. The order of primates probably evolved some 20 million years ago, the family homonidae several million years later, and the genus homo about one million years ago. The specie sapiens is comparatively young, probably less then 100,000 years. It is a very remarkable fact that all men on this planet are of the same order, family, genus and species—this is not true of any other higher animal. That it is true in the case of man is shown by the fact that all of the species of whatever size or race can breed with each other and produce fertile offspring.

Here again in the evolution of the species sapiens we can, in our imagination, construct the characteristic curve: A long, gradual slope of evolution of the order of primates, the family homonidae, and the genus homo, followed by the evolution of a species of such superior mentality that he was able to eliminate all competing species of the genus and begin an evolution on a steep slope to become the most superior form of life on the planet. Although the physical evolution of the species has practically ceased, the intellectual and spiritual evolution continues on a curve of high exponentiality. This rapid evolution is due to man's creative mind or, more accurately, to the creative minds of that relatively small minority with innate ability to think in the abstract, to make new contributions to knowledge, invention, and to act together in bringing about specialization combined with cooperation.

The curve of acquisition of man's knowledge is well illustrated by the discovery of the 92 elements. My friend, Buckminster Fuller, has developed this curve by plotting these elements vertically against time horizontally. Nine of the elements (carbon, lead, tin, mercury, silver, copper, sulphur, gold and iron) were known and used prehistorically. Therefore, Mr. Fuller's curve begins with the discovery of arsenic in the year 1250. This discovery was probably an accident of an alchemist's trick but was nevertheless the first recorded isolation of a chemical element. Two hundred years elapsed before the discovery of the next element, antimony, about 1450. Then approximately 200 years more to the next, phosphorus. Then approximately 60 years to cobalt and platinum, about the year 1730. The slope to cobalt is very gradual; then it turns up sharply and continues on a steep slope to the completion of the basic curve in 1932 with the isolation of the element alabamine. This completion of the inventory of all the 92 basic elements of the universe was, as Mr. Fuller says, an attainment of epoch-making proportions. Advancement continues in the discovery and production of the super-atoms numbered above 92 and the radio-active isotopes of all the atoms.

It is interesting to see how our progress in science and engineering has been linked with the discovery and control of the 92 universal atomic building blocks. Steel, which is the basis of our industrial civilization, was developed less than 100 years ago after the elements entering into it were isolated and made available. Alloy after alloy and development after development has followed the availability of more building blocks. Now that we have them all and are continually adding to the super-atoms and isotopes, the possibilities are beyond the imagination. In every branch of the basic physical sciences, the curve of acquisition of knowledge is similar to that of the atomic curve. All are rising on a steep incline with no plateau in sight.

In all group activities, and especially those of men, the factors contributing to creative momentum are analogous to those in mechanical momentum. Mass is represented by the total amount of balanced, specialized knowledge, experience and facilities contributing to the effort. Velocity is proportional to the cooperation between those engaged in the effort. Motive power is provided by the urge to accomplish and the urge derives from various degrees and forms of conflict including desire for reward, fear of failure, competition, rivalry, criticism, hate, and even love. When all of the three factors (urge, knowledge and cooperation) are large, momentum is quickly attained and maintained or increased.

When any one is lost or seriously depleted it may take a long time to regain momentum and in the meantime competitive groups may have attained such a high momentum that it is impossible to overtake them.

The history of scientific and engineering progress in the United States provides some interesting examples of the importance of momentum to technical achievement. Until comparatively recent times the rewards for achievement in pure science were low. There were very few people in the field and therefore little competition. As a consequence, most of the achievements in pure science were made in other countries. Only the last three elements in the atomic scale, illinium, virginium and alabamine, were discovered by Americans. For the last twenty years we have been rapidly gaining momentum in the pure sciences. In engineering, however, our competitive system and our large domestic market has resulted in giving us a very high momentum over many decades.

In technical developments having military value we have sometimes failed to recognize the importance of momentum and the factors contributing to it. New developments are surrounded with unnecessary barriers of secrecy, thus removing them from the stimulus of criticism and from the cooperation of those who might contribute to the development. To be sure, we should do everything we can to keep knowledge of our developments away from potential enemies, but we should never let this interfere with obtaining the cooperation and criticism of those on our side who might add to the development.

The development and production of the atomic bomb was frequently referred to as the best kept secret in the world. Actually, it proved to be no secret at all. One man, perfectly equipped to understand it, had access to everything, learned everything, and transmitted everything to our potential enemies, notwithstanding all the barriers of secrecy surrounding the whole operation and every cell within it. It is doubtful that our opponents profited much from the information. Either their momentum was too low to enable them to understand and make use of it or too high in some previously chosen direction to permit them to change. The barriers undoubtedly kept the momentum of the development at a lower point than it would have been if there had been free and complete cooperation and criticism between the many carefully screened people who were working on the multitudinous phases of the problem.

The same kind of thing happened with the torpedo. Until after World War I it was competitive. In Germany the competition and criticism evidently continued under the fascist state with consequent high momentum in development. With us the stimuli of competition was reduced and, notwithstanding the conscientious efforts of the many fine men who were working on the problem, the momentum was not sufficient to give us a superior torpedo when we entered World War II and had to compete with the Germans and Japanese.

In my own field of military instrumentation I have seen many examples which emphasize the importance of momentum in technical developments. When the momentum of development is high enough every example of military instrumentation becomes obsolete very rapidly. If, notwithstanding every effort to keep it secret, the enemy should learn about it at any particular point, it would do him very little good. In fact, it might mislead him into believing that a particular development is the last word, whereas it might only be the beginning.

My company had an example of that in 1939 when the FBI discovered that one of our employees was conveying technical information to the Germans. The spy had been well chosen; he was an experienced designer and very skilled in taking verbal descriptions from engineers and reducing them to drawings. His record was excellent. American born and educated, 15 years of experience with other companies engaged in classified developments for the Armed Forces of the United States, and 10 years of experience with us.

Our spy never took a paper or drawing from our building. All of his information was in his head and was reduced to paper in the basement of his home. He transmitted it by mail to an accomplice who micro-photographed it and conveyed it through devious channels to a steward on a Pan American plane flying to Lisbon where it was transferred to a German emissary.

The FBI discovered him early in his activities and asked us to keep him until they could nail down the others in the chain. They intercepted everything he sent, showed it to us and asked us to approve its transmission if it was of no importance. The interesting thing was that, after consulting the Government Services involved, we agreed to the transmission of many of his drawings. We were quite confident that none of the information transmitted would do the Germans any good. Even complete information would probably have been of little value. The Germans had acquired momentum in other directions and could not change. Eventually, after a year and a half from the time our spy was first discovered, the thirty-two German agents in the ring were taken simultaneously by the FBI, were convicted, and are now serving time in Leavenworth.

Even when you want to bring a friendly ally up to date in a new development it is sometimes very difficult because he does not have the background momentum or has acquired momentum in some other direction. This phenomena was observable on many occasions in the cooperation between Great Britain and the United States during the last war. Sometimes they would be ahead of us and sometimes we ahead of them, and it was always difficult to change over from one line of development to another.

The greatest danger in the cancellation of the 65,000-ton aircraft carrier might be the loss of momentum in the development of that type of ship. Many of the men who were working together in the evolution of new designs for aircraft carriers must have been dispersed, and the stimulus removed from those who remained, with consequent loss of momentum in the development of this very important type of ship. During the Pax Britannica the British were not content with their superior naval power; they continued to develop new types of ships, such as the dreadnought and the battle cruiser, and thereby gained momentum in ship design which kept them superior to all other navies for many years.

In the social sciences, if they can be called "sciences," the curve is still on a gradual slope with low exponentiality. There have been some examples of a steep rise, especially in the field of government. For example, the Athenian Republic, in a period of 80 years, rose with great rapidity, but complacency led to a turning of the curve and its termination by the conquest of Alexander, the Great. In modern times our own Republic is the most progressive example of balance between increasing specialization and increasing cooperation by means of individual freedom. Young as we are, it is an extraordinary fact that, among all the nations of the Twentieth Century, we have the longest history of unchanged political philosophy.

In general, however, world society is still in a very unstable condition. The early conflicts which led to the extinction of other species of the genus homo continued for many centuries, with the result that the less fit of the species were forced to the less desirable portions of the planet. Many of these groups were so weak that they have remained where they are without protest. Others have gradually gathered momentum in an effort to break out of their boundaries and spread to richer portions of the earth and this tendency has been accelerated by improved communications.

This was the case with the Japanese. For more than 2000 years they were content with their islands and chose to have very little communication with the outside world. Following the visit of Commodore Perry they began to learn how to build a better life for themselves by acquisition of scientific knowledge and by the development of industrialization. Their rise as an industrial nation followed a very steep curve and resulted in a momentum which eventually carried them into a war which they could not win, with consequent loss of their position as a world power. They can again become an important industrial nation, but it is hard to conceive that they could in the foreseeable future acquire any serious military potential. In this day of rapid development of practically every offensive and defensive weapon, the possibilities that the Japanese or the Germans could acquire any serious military potential is about the same as the possibility that a Model T Ford standing at the curb could catch a Cadillac passing by at 100 miles an hour.

An eminent Japanese educator, when asked why his country made the blunder of going to war with us, replied: "We made three disastrous errors: First, we over-estimated the power of the Germans; second, we underestimated your great industrial momentum and its power to produce and transport vast quantities of weapons, equipment and supplies; and, third and most serious, we mistook your disagreements and diversities of opinion for weakness instead of the great strength they really are." American competition and diversity of opinion provides the motive power for productive momentum.

As you know better than I, our only serious competitor is Russia. For centuries they have been confined to a relatively unfavorable portion of the earth. They have vast areas of waste land. Their sources of food and raw materials are inadequate in many portions of their country. Transportation facilities connecting the richer lands with the poorer lands are difficult to establish. They have inadequate outlets to the sea. With an instinctive mass urge they gathered momentum for centuries under the Czars. This leadership degenerated and was replaced by a police state which has intelligently employed every modern technique of ideology, infiltration, communication, discipline and technical development to build a strong military power.

During the last war the Russians acquired from the Allies and the Germans an enormous amount of technical information and have further added to their technical abilities by pressing into service many capable German scientists and engineers. From considerable contact with them from 1929 to 1936, I have the impression that both the mass and velocity of their technical progress is still considerably lower than ours, but the urge is very great.

The greatest weakness of the Russian State derives from the suppression of criticism. Stalin recognized this in a letter he wrote to Maxim Gorky in 1930. In this letter, as reported by TIME Magazine, Stalin said: "We cannot do without self-criticism. Without it will come immediate stagnation, rotting away of the apparatus, growth of bureaucratism, undermining of creative initiative in the working class." What Stalin feared has happened. Whether or not their tendency toward stagnation can be compensated for by other factors remains to be seen.

The Russians have several obvious advantages. Their population is widely dispersed with no large concentrations of people or industrial power. Because of the vast size of their country and the poor transport communications, they have probably had to make each industrial area self-sufficient. Their totalitarian government makes it possible to deliver a heavy blow against us without warning. From all accounts their military forces are superior in number of planes, submarines, ground forces and equipment.

It is doubtful if the free world will attempt in peacetime to match the size of the Russian military forces. Our strength lies in our large engineering and industrial momentum. All of the factors contributing to that momentum are large. The urge from hope of reward, competition and other factors is much greater than that of the Russians. The mass, represented by specialized knowledge, experience and facilities, is very great, and, notwithstanding the competition, the cooperation within individual industries and between them, by means of engineering and management societies, is very high. We have several serious vulnerabilities, among them being large industrial concentrations, especially in our port cities, a very high degree of interdependence of each industry on many others, the fact that most of our industries have a high momentum in peacetime production which would have to be redirected for war. All of our vulnerabilities would be aggravated if we were attacked by surprise, for then it would be extremely difficult to accomplish the redirection of our industrial power and to compensate for its interdependence.

Because of the importance and complexity of the problem of conversion of our industrial power, the Congress created the National Security Resources Board and charged it with the responsibility of providing the President with plans for mobilizing and utilizing all of the resources of the country, human, material, financial and industrial. Fortunately, this vitally important agency now has as chairman one of the most able men in our Government. Under his leadership it will gain momentum rapidly.

It is my great hope that within this year the Resources Board, the Munitions Board, the Industrial College of the Armed Forces, the technical and procurement branches of the Armed Forces, and all of industry will be working in close cooperation in the development of mobilization plans which will provide for the quick conversion and expansion of our resources under any contingency that can be foreseen. When such plans have been evolved our vulnerability will be greatly lessened, though it may never completely disappear.

In conclusion, let me shape in a few words the small intellectual tool which I wish to leave with you. The attainment and maintenance of superiority in any field of endeavor is dependent upon the momentum in that endeavor. The motive power for creating that momentum is derived from the urge for its accomplishment and the urge is derived from a great variety of factors, among them being hope of reward, fear of failure, criticism, competition, rivalry and desire to excel. The equivalent of mass is the total of balanced knowledge, experience and facilities assembled for the endeavor. The equivalent of velocity is derived from the cooperation between all those concerned with the effort. The factors contributing to urge sometimes conflict with those contributing to cooperation; in that case it is the resultant of urge and cooperation that counts. Free cooperation is obviously better than forced cooperation. Free cooperation in any group can be greatly increased if every individual knows what is expected of him and is made to feel that his position in the group is secure. Superiority in any endeavor can be quickly lost if its momentum with relation to competing endeavors is lessened.

If you want to know what the score is going to be, try to figure out what the momentum is.