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TEAM 5 PAPER

THE NEOTECHNIC ERA

The Neotechnic phase is the third and final chapter of our society's technical transformation up until the 1930's as described by Lewis Mumford in his book *Technics and Civilization*. As the phases that came before, the Neotechnic marks the uniform change of primary energy sources and industrial materials. More revolutionary, however, was the change in attitude of production and consumption of these items by industry and society, which directed the technical evolution towards a more efficient, self-contained age of machines. As a result, the Neotechnic phase can be summarized with two major advances: the application of efficiency and the use of electricity. Hand-in-hand, efficiency and electricity made current machines and tools faster, more powerful, and fully mechanized. The introduction of the machine and electricity into all aspects of industry and human's everyday lives is what characterizes the largest adaptation of the Neotechnic phase and by the end of Mumford's tenure this adaptation is fully realized.

The doctrines taught by the scientific method were employed to the systematic investigation of social or humane needs such as medicines, domestic appliances and industrial materials. This became the job of the engineer: to utilized science to fin new uses for materials, to fix a problem, or to change a process to a simpler or more complex setup – to bridge the gap between science and industry. Acquiring the knowledge of math and the sciences, the engineer built bridges and buildings, designed a process for making stronger steels, discovered new uses for aluminum, shaped more aerodynamic automobiles and airplanes, and designed a grid to power the United States with electricity. With the addition of the engineer's refinement to

manufacturing and energy production and resourceful inventions to increase the quality of life, mechanization was inducted into everyday living, as was a new understanding of science into the realm of common knowledge.

Though the engineer's were formed out of a need for methodical and poignant investigation of industrial needs and social problems, the realm of science would eventually benefit from this relationship as well. Trust and respect in the sciences was compensated in the form of added funding and facilities, which gave engineers the forum to advance beyond the plateau of scientific achievement that marked the end of the Paleotechnic era. The education of engineers introduced a structured, deeper background of science to their training. Ironically, however, the scope of this education and work environment was severely limited from the business and humanities for which their inventions were used to better.

Early Neotechnic advancements in industry were the product of a notorious engineer-manager, Frederick Winslow Taylor, made famous by his mathematical dissection and precise timing of each factory worker's job, which lead to a doctrine of efficiency in the workplace that spread to factories across the western world. Taylor also invented tools that perfected the movements of the workers and aided in the increased rate of production. This rote assembly of miniaturized or specialized tasks foreshadowed the complete elimination of artistry and craftsmanship that was yet to come.

The introduction of a new, transportable energy source in the Neotechnic would turn out to have an even greater impact that Taylor's doctrines. Electricity was introduced commercially to both industry and society at the turn of the century and within ten years its impact on efficiency in the workplace would more than double economic productivity. Electricity presented the idea of "outside" energy sources, made by powerplants and delivered into the

manufacturing plant or home. Nearly any form of mechanical energy production, utilized in the Paleotechnic, could be transformed into electricity, which was easily and more efficiently transmitted any distance to the necessary location. This broke industries geographical dependency on coal and allowed further expansion of industrial mecas or cities away from the valleys and riverbeds. Electricity converted readily into different types of energy, such as heat and light in addition to mechanical energy, thus broadening the capabilities of the machine. Henry Ford was a second engineer manager of the Neotechnic, which utilized the machine and electricity to subdivide labor and increase the productivity of the plant, much as Taylor utilized the worker. Electricity eliminated the stream engine or other energy source from the immediate vicinity of the plant, thus freeing up room to develop spatial tactics to improve efficiency. Ford and his revolutionary application of the assembly line in his Highland Park automobile plant created a precedent in machine and plant design that is still utilized today. Ford's machines helped reduce the production of an automobile to a series of elementary processes equal in time and machine-power, whereby controlling the exact rate of production. Ford's doctrine of efficiency, which contained the efforts of the worker and exploited the use of the machine, countered the reduced need for manpower by expanding industrial production beyond the cities to other areas of urban development. Ford stated, "There is no point in centralizing manufacturing unless it results in economies.... A product that is used all over the country should be made all over the country, in order to distribute buying power more evenly. For many years we have followed the policy of making in our branches whatever parts they were able to make for the area they served. A good manufacturer who makes himself a specialist will closely control his production and is to be preferred over a branch"(226). Materials and parts were transported in from plants made in their respective regions of industry, thus the ability to profit

from manufacturing extended to those regions who previously only mined or gathered their host natural resources.

Despite the expanse of industrial centers, the machine, powered by electricity would displace over 2 million workers between the years 1919-1929. The focus on increased efficiency meant that the craftsmanship of the worker no longer contained value, but rather slowed the overall rate of production and thus was eliminated. Automation in the manufacturing plant and power plant did reduce the number of dangerous tasks and resulting injuries faced by the workers, however most of these drudgeries were only the plight of the Paleotechnic worker. For instance, the mechanical firing of the coal broilers did not become widely implemented in the powerplant until the Neotechnic age when coal was no longer the primary fuel source. Nonetheless, automation was the goal of every stage in industry and would eventually override the aptitudes of the blue-collar workman.

Electricity's contribution to industry were not limited to its aid in efficiency, but also provided the new materials and alloys needed to revolutionize the scope of manufactured products. This was the age of the chemical industry, which boasted the Neotechnic ideal of efficiency, employed by science and the engineer, long before the mechanical industry changed its form. Most of the functions of the engineer were applied in the chemical industry with the deliberate invention of metals and synthetics to increase measures of efficiency such as conductivity and strength, decreased weight, and improved rust protection. Aluminum, copper glass and steel would replace iron just as electricity replaced steam power. Materials with once novel physical properties such as mica and rubber developed new functions in the Neotechnic at the hands of the engineer. The raw material that gained the most utility was petroleum. Once only used as lubricant, it was now manipulated to produce synthetic fuels, plastics and fibers.

Organic products also acquired value in the chemical age. The production of urea by Wohler in 1825 set the stage for organic materials to replace the use of many inorganic materials. However, the evolution of rubber, originated from gum trees in the tropics but later developed in the manufacturing plant with the isolation of benzene, proved that organic materials would not always rely on organic sources. Still the search for petroleum, aluminum and other rare elements such as cobalt, uranium, helium, and radium expanded beyond the perimeter of self-sufficiency to include the less industrialized nations of South America and Africa. Mumford's description of the world commodity which grew out of the Neotechnic predicted the global market that we depend on today, "No country and no continent can surround itself with a wall without wrecking the essential, international basis of it technology: so if the Neotechnic economy is to survive, it has no other alternative than to organize industry and its policy on a worldwide scale….The geographic distribution of the rare earths and metals by itself almost establishes that fact"(Mumford 233).

The increased efficiency in locomotion coming out of the Neotechnic coinciding with the need to travel greater distances for materials may have been fortuitous. However, the resulting dependency on petroleum to supplement the new and improved transportation machines was not. The internal gas combustion engine was possibly the second most important characterization of the Neotechnic era. Its utilization of lighter, liquid forms of fuel overcame the bulk and weight issues associated with the burning of coal in steam engines which formerly rendered aspirations of speed and flight difficult if not unattainable. Airplanes would replace trains for long continental travels and ships for most overseas travel. The internal combustion engine coupled with Ford's ambitious production line enabled the wide distribution of automobiles to the public. "But what happened here, unfortunately, is what happened in almost every department of

industrial life. The new machines followed, not their own pattern, but the pattern laid down by previous economic and technical structures"(Mumford 236). Sharing the pitfalls of the locomotive, the "new and improved" automobiles only increased the degree of congestion, noise and pollution in the cities, the number of deaths associated with travel as well as our dependency on the other regions for fuel sources. The freedom of transportation, however, would not be hindered by the setbacks mentions previously and the economy would thrive in the marketing of new supplements to the human contact extinguished by the accelerated geographic distribution.

Productivity and time, both considered proportional to profit, required new means of communication as people and industry the United States and other countries dispersed. Sending letter through the mail system was simply to slow for political leaders, businessmen, and industry, and reduced communication to a single party communicating and the other party waiting for a response. The new civilization required an instantaneous form of communication, and unfortunately, the phrase "Beam me up Scotty!" was at most a science fiction dream. The telegraph and telephone surfaced as new forms of communication that could fulfill the need. The telegraph, invented by Samuel Morse in 1837, was used as a means of contact of short distances, utilizing stations about 20 miles apart from each other ("Telegraph"). Therefore, often messages had to be relayed across several stations to reach the proper destination. The telegraph, however, did not emerge as a widespread machine for consumers; instead, the telegraph was used primarily by scientists, politicians, weather stations, and other people of importance to send critical messages across short distances. For example, engineers near Johnstown sent messages during a storm warning of a possible flooding situation, which eventually ruined the town later into the night. The railroad industry, although slow to adopt the telegraph, eventually used to keep record of trains stop times. The telephone brought communications to the next level by

allowing the average American to communicate by a faster means. The telephone allowed two individuals to have a live conversation with a delay of less than a few seconds between responses. As the machine grows more complex and mechanized, "communications is now on the point of returning, with the aid of mechanical devices, to that instantaneous reaction of person to person with which it began" (Mumford 239). As Mumford realized while writing *Technics and Civilization*, new machines such as the radio and television would ultimately allow nearly face to face contact without the need for physical interaction. The television and use of teleconferencing allows the sight of facial expressions and body language. However, as the machine continues to evolve, we must remember to use machines properly; in other words, one should not use a machine when it is not needed. Using machines properly will maximize their effectiveness.

To learn from the past, we must first know the past. The inventions of the Neotechnic phase greatly increased the capabilities of civilization to create permanent records of the past through the use of the camera, motion picture, and phonograph. Although these inventions were first used mainly for entertainment, science found a great deal of value in these instruments. There are certain experiments, such as astronomical events where the "photograph gives the effect of repetition to what was, perhaps, a unique event never to be observed again" (242). The photograph and motion picture also has great value to record historical events. The photograph increased the effectiveness writers could convey to their audience. Now the newspapers could show how the newest skyscraper looked and history texts had a more visually appealing form. The motion picture and phonograph combination became one of the most influential forms of expression. The nightly news, family sitcoms, cartoons, and movies could reproduce a video with sound, whose success still shines today in our homes, movie theatres, and on our personal computers. However, the personal stories are often missing from the big picture. No longer did

father pass down stories of war with horrifying details; instead, students read a textbook and see only the objective view of history. There is no way one could fully experience an event or location with images and sounds. Still, one cannot visit every monument or ancient city or know someone who can reminisce about the past. Thus, the permanent record has its upsides and downsides.

Along with the permanent record, there were many permanent changes with respect to the health of people in the Neotechnic phase. The Paleotechnic mines and factories had dehumanized its workers mentally, socially, and physically. The mines and crowded living conditions became breeding grounds for disease, especially bacteria. Advances in science and medicine learned of the healthiness associated with sunlight. Exposure to sunlight not only sanitized water by killing bacteria; sunlight also helped to prevent rickets and to cure tuberculosis (246-247). Discoveries and inventions such as UV and IR light, X-rays, the use of the microscope, and light bulb contributed to the increased awareness of health and science. The doctor now relied on X-rays to diagnose problems. The X-ray could see what the naked eye could not, and its use could avoid the use of invasive surgery. Scientists used the microscope to learn of diseases which spreading through bodily fluids. No longer did doctors boast about how much blood and dirt accumulated on their coats as they did in the Paleotechnic phase (171). With the power of electricity and the use of metals such as tin and aluminum, canning food preserved food longer and prevented some of the diseases that various meats attracted. The Neotechnic ideals can be summed up by the "efforts to increase mechanical performance must cease when the balance of the whole man is threatened" (250). The machine should be made more efficient by changing the motions and actions of man, so long as man is not hurt in the process.

This conversion towards more humanistic priorities was extended to the production of more socially useful products. Of course, machines were used to make these products, but for the first time the impersonal machines where producing products and making discoveries that were relevant to creating better lives for people. The influence of biology, the beginnings of conservation, and new methods of population planning were all parts of the Neotechnic phase that allowed people to manufacture and invest in products that had humanistic implications rather than the previous emphasis on industrial technology and mass production. Mumford's *Technics and Civilization* illustrates the severity of urbanization and industrialization and how the change affected the world's population. This chapter ends by showing human's resilience to the mechanized change, and how they used machines to make their daily lives easier.

One of the most compelling inventions that aided in communication and travel during the Neotechnic phase was the air plane. The Wright brothers were the first men on the planet to join the birds in the sky. Through their study of birds' takeoffs and landings, they were able to mimic the evolution of the bird. After this, many inventors followed suit and began to look back to nature for the best advice in design technology. New concepts of aerodynamics were being used to reduce the amounts of fuel needed to get the same amount of power out of a machine. The utility of this concept allowed engineers to promote the best design possible. Dramatic increases in efficiency were a direct product of mimicking the natural biota. Style also became important. The most aesthetically pleasing products produced a much higher demand than those products that had a utility purpose only.

The Neotechnic phase leaned away from a society purely based on bulk quantities. Now that technology was available to decrease inputs and still increase outputs, the market and scientific research became interested in developing a new realm of thinking. Small quantities of

hormones, precious metals, vitamins, bacteria, and viruses had large impacts on the way that humans lived. For the first time in history, the machine and the drive for quantative qualities was overridden by the necessity of minute quantities that had begun a push for consumer power.

The human condition and the quality of life began to dramatically increase with the investments in research for diets and fertility. Society began an obsession that continues today with death, disease, and old age. The market soon capitalized on peoples' willingness to pay to prevent the inevitable. Now beauty and health products that were once marketed towards the upper class were now mainstream products. During this time, housewives began to incur the burden of a spotless household. New machines were being designed to aid in cleaning, but they only produced a greater need to clean the house regularly. Human health and life expectancy dramatically increased in this period due to the emphasis on quality foods. No longer were people eating what they had just killed till it was gone, or only eating what could be grown in that season. Life began to have a variety of flavors and colors regardless of the climate or location. The invention of cold storage also largely contributed to freshness and quality foods, while competing with the canning industry for a place in the market. Birth control was also aiding in the health of the community. Couples could now separate pleasure from brining children into the world. The population was therefore controlled, and a switch from the quantitative to the qualitative occurred.

While the health of the human population was increasing, the health of the biota was being destroyed. The quest for efficient and accessible sources of fuel had created wastelands of once pristine environments. The soil and streams near oil wells became saturated in the sticky black substance. The harsh side effects of oil spills became apparent as fish, plants, and other animals were killed from contamination. Since the market did not care much about pollution and

destruction, the environment mostly was ignored. In the 1920s, the consumptions of oil increased by 500 percent (Nye 198). It is no wonder why Americans referred to petroleum as "black gold." Thus, the profit-making theme carried over from the Paleotechnic phase and continues to be part of our society.

The Neotechnic phase was not a complete change from its predecessor. The Neotechnic phase stressed a change from the life of industry where workers worked double shifts in dangerous conditions to a better life. In reality, factories still stayed around, and greatly resurfaced during the wars. Some factories were moved to foreign countries where a lack of labor laws allowed human cruelty through sweatshops. Life in America may have improved, but the Paleotechnic and Neotechnic faults were shipped internationally. During the time where Mumford's book leaves off, America changed to a high energy and high consumption period. No longer did people buy only what they needed; people bought for the purpose of satisfying every want they had. Every home soon adopted the radio and television. After World War 2, suburban sprawl, traffic congestion, and car pollution significantly affected the lives of Americans. The price to pay for consumption and energy, however, always came after its use, and often did not directly affect the average person. We find that high energy and consumption will not lead to happiness.

Sources:

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