

ARTIFACTS OF TECHNOLOGY: INDICES OF PROGRESS IN DEVELOPMENT

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Abstract

Man has employed technology to conquer and manipulate the world. Recent technological developments, including the printing press, the telephone, and the Internet, have lessened physical barriers to communication and allowed humans to interact on a global scale. However, not all technology is benign. Using secondary information from literature, this review paper explains artifacts and technology, and relates artifacts of technology to development.

Introduction

Food, shelter and clothing remain the basic needs of man that must be addressed at all times for any meaningful development. But, driven by curiosity, man has gone beyond addressing these basic needs to conquering the world around him. Technology has been his handy ally in this quest.

Since ages, technology has impacted life and society profoundly. Survival and success depend on designing, making and selling goods and services that the customer wants at the time he wants it and at the price he is prepared to pay; innovating to improve quality and efficiency; and maintaining an edge over all competition, which science and technology represent (Eneh, 2008).

Using secondary information from literature, this review paper explains artifacts and technology, and relates artifacts of technology to development.

Literature Review

Artifact

In archaeology, an artifact or artefact is any object made or modified by a human culture, and often later recovered by some archaeological endeavor. Examples include stone tools, such as projectile points, pottery vessels, metal objects (e.g. buttons or guns), and items of personal adornment (e.g. jewelery and clothing). Other examples include bone that show signs of human modification, fire cracked rocks from a hearth or plant material used for food. Artifacts can come from any archaeological context or source, such as *grave goods* (buried along with a body) and also from any feature or other domestic settings, like Hoards, Votive offerings, etc.

Artifacts are distinguished from the main body of the archaeological record, such as stratigraphic features, which are non-portable remains of human activity, including hearths, roads, or deposits and remains, and from bio-facts or eco-facts, which are objects of archaeological interest made by other organisms, such as seeds or animal bone.

Natural objects which have been moved but not changed by humans are called *Manu ports*. Examples include seashells moved inland or rounded pebbles placed away from the water action that would have fashioned them. These distinctions are often blurred. For instance, a bone removed from an animal carcass is a bio-fact, but a bone carved into a useful implement is an artifact. Similarly, there can be debate over early stone objects which may be crude artifacts or which may be naturally occurring phenomena that only appear to have been used by humans.

The study of artifacts is an important part of the field of archaeology, although the degree to which they represent the social groupings that created them is a subject over which archaeological theoreticians argue. Focusing on the artifact alone can produce very intensive and enlightening work on the object itself, but can ignore surrounding factors which may shed further light on the manufacturing

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society. Traditional museums are often criticized for being too artifact-led, that is displaying items without any contextual information about their purpose or the people who made them.

Artifacts are often called "finds" when handled during archaeological excavation. They are used in archaeological analysis and tracking technological advances. They are related to the archaeological record by their position defined by the Archaeological context they are discovered in. This is important for Seriation and relative dating analysis and is closely related to work post excavation with the use of a Harris matrix created during excavation. An analysis of finds is often made during excavation for the purpose of spot dating, which is a process of assessing dates of contexts being excavated. It is used as a form of confirmation concerning phasing and highlighting any potential for further discovery on a given site as it progresses. Spot dating tends to rely on pottery typology. Apart from dating and supporting the process of excavation, artifacts lend themselves to a host of post excavation disciplines.

The characteristics of Ancient Egyptian technology are indicated by a set of artifacts and customs that lasted for thousands of years. The Egyptians invented and used many basic machines, such as the ramp and the lever, to aid construction processes. They used rope trusses to stiffen the beam of ships, unknown again until modern engineering. Egyptian paper, made from papyrus, and pottery was mass-produced and exported throughout the Mediterranean basin. The wheel, however, did not arrive until foreign invaders introduced the chariot in the sixteenth century B.C. The Egyptians also played an important role in developing Mediterranean maritime technology including ships and lighthouses (Bernard Stiegler, 2003).

Technology

Technology is a broad concept that deals with the usage and knowledge of tools and crafts, and how they affect the ability to control and adapt to the environment. In human society, it is a consequence of science and engineering, although several technological advances

predate the two concepts. Technology is a term with origins in the Latin "*technologia*" ("*τεχνολογία*") - broken down to "*techne*" ("*τέχνη*"), meaning "craft" and "*logia*" ("*λογία*"), meaning "saying". However, a strict definition is elusive; "technology" can refer to material objects of use to humanity, such as machines, hardware or utensils, but can also encompass broader themes, including systems, methods of organization, and techniques. The term can either be applied generally or to specific areas. Examples include "construction technology", "medical technology", or "state-of-the-art technology". Other species have also been observed to have created and used technology, including non-human primates, dolphins, and crows (Ursula, 1989).

In general, technology is the relationship that society has with its tools and crafts, and to what extent society can control its environment. The Merriam-Webster (2005) dictionary offers a definition of the term: "the practical application of knowledge especially in a particular area" and "a capability given by the practical application of knowledge". Ursula (1989) gave another definition of the concept as "practice, the way we do things around here". Bernard Stiegler (2003) defines technology in two ways: as "the pursuit of life by means other than life", and as "organized inorganic matter."

Technology can be most broadly defined as the entities, both material and immaterial, created by the application of mental and physical effort in order to achieve some value. In this usage, technology refers to tools and machines that may be used to solve real-world problems. It is a far-reaching term that may include simple tools, such as a crowbar or wooden spoon, or more complex machines, such as a space station or particle accelerator. Tools and machines need not be material; virtual technology such as computer software and business methods, fall under this definition of technology.

The word "technology" can also be used to refer to a collection of techniques. In this context, it is the current state of humanity's knowledge of how to combine resources to produce desired products, to solve problems, fulfill needs, or satisfy wants; it includes technical methods, skills, processes, techniques, tools and raw materials. When

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combined with another term, such as "medical technology" or "space technology", it refers to the state of the respective field's knowledge and tools. "State-of-the-art technology" refers to the high technology available to humanity in any field.

Technology can be viewed as an activity that forms or changes culture. Additionally, technology is the application of mathematics, science, and the arts for the benefit of life as it is known. A modern example is the rise of communication technology, which has lessened barriers to human interaction and, as a result, has helped spawn new subcultures. The rise of cyber-culture has, at its basis, the development of the Internet and the computer. Not all technology enhances culture in a creative way; technology can also help facilitate political oppression and war via tools such as guns. As a cultural activity, technology predates both science and engineering, each of which formalizes some aspects of technological endeavor.

Technology in Dynastic Egypt and as Index of Development

Significant advances in ancient Egypt during the dynastic period include astronomy, mathematics, and medicine. Their geometry was a necessary outgrowth of surveying to preserve the layout and ownership of farmland, which was flooded annually by the Nile River. Egypt also was a center of alchemy research for much of the western world (Parker, 2007; Pannekoek, 1961 and Evans, 1998).

A section of the Egyptian Book of the Dead, which was written and drawn on papyrus provides basic knowledge in this field. The word, *paper*, comes from the Greek term for the ancient Egyptian writing material called papyrus, which was formed from beaten strips of papyrus plants. Papyrus was produced as early as 3000 B.C. in Egypt, and sold to ancient Greece and Rome (Budge, 1990).

Egyptian hieroglyphs, a phonetic writing system, served as the basis for the Phoenician alphabet from which later alphabets were derived. With this skill and ability in writing and record keeping, the Egyptians developed one of the - if not the - first decimal system (Kaplan, 2004; Stocks, 2003 and Bard, 1999)

The city of Alexandria retained preeminence for its records and scrolls with its library. That ancient library was damaged by fire when it fell under Roman rule, and was destroyed completely by 642 B.C., leading to loss of a huge amount of antique literature, history, and knowledge.

Structures and construction: Buildings

Many temples from Ancient Egypt are still standing today. Some are in ruin from wear and tear, while others have been lost entirely. The Egyptian structures are among the largest constructions ever conceived and built by humans. They constitute some of the most potent and enduring symbols of Ancient Egyptian civilization. Temples and tombs built by pharaoh Hatshepsut, famous for her projects, were massive and included many colossal statues of her. King Tut's rock-cut tomb in the Valley of the Kings was full of jewelery and antiques. In some late myths, Ptah was identified as the primordial mound and had called creation into being; he was considered the deity of craftsmen, and in particular, of stone-based crafts. Imhotep, who was included in the Egyptian pantheon, was the first documented engineer (Ursula, 1989).

The Lighthouse of Alexandria on the island of Pharaohs

In Hellenistic Egypt, lighthouse technology was developed, the most famous example being the Lighthouse of Alexandria. Alexandria was a port for the ships that traded the goods manufactured in Egypt or imported into Egypt. A giant cantilevered hoist lifted cargo to and from ships. The lighthouse itself was designed by Sostratus of Cnidus and built in the third century B.C. (between 285 and 247 B.C.) on the island of Pharos in Alexandria, Egypt, which has since become a peninsula. This lighthouse was renowned in its time and knowledge of it was never lost (Forbes, 1966).

Monuments

Egyptian pyramids: The Nile valley has been the site of one of the most influential civilizations in the world with its architectural

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monuments, which include the pyramids of Giza and the Great Sphinx - among the largest and most famous buildings in the world (Forbes, 1966).

Giza Plateau, Cairo: The most famous pyramids are the Egyptian pyramids - huge structures built of brick or stone, some of which are among the largest constructions by humans. Pyramids functioned as tombs for pharaohs. In Ancient Egypt, a pyramid was referred to as *mer*, literally "place of ascendance." The Great Pyramid of Giza is the largest in Egypt and one of the largest in the world. The base is over thirteen acres in area. It is one of the Seven Wonders of the World, and the only one of the seven to survive into modern times. The Ancient Egyptians capped the peaks of their pyramids with gold and covered their faces with polished white limestone, although many of the stones used for the finishing purpose have fallen or been removed for use on other structures over the millennia.

The Red Pyramid of Egypt (26th century B.C.), named for the light crimson hue of its exposed granite surfaces, is the third largest of Egyptian pyramids. Menkaure's Pyramid, likely dating to the same era, was constructed of limestone and granite blocks. The Great Pyramid of Giza (2580 B.C.) contains a huge granite sarcophagus fashioned of "Red Aswan Granite." The mostly ruined Black Pyramid dating from the reign of Amenemhat III once had a polished granite pyramidion or capstone, now on display in the main hall of the Egyptian Museum in Cairo (see Dahshur). Other uses in Ancient Egypt include columns, door lintels, sills, jambs, and wall and floor veneer.

The ancient Egyptians had some of the first monumental stone building (such as in Sakkhara). How the Egyptians worked the solid granite is still a matter of debate. Patrick Hunt has postulated that the Egyptians used emery shown to have higher hardness on the Mohs scale. Regarding construction, of the various methods possibly used by builders, the lever moved and uplifted obelisks weighing more than 100 tons. Any rigid object used with an appropriate fulcrum or pivot point to multiply the mechanical force can be applied to another object.

This is also termed mechanical advantage, and is one example of the principle of moments. The principle of leverage can also be derived using Newton's laws of motion, and modern statics (Forbes, 1966).

Obelisks: Obelisks were a prominent part of the architecture of the ancient Egyptians, who placed them in pairs at the entrances of temples. In 1911, *Encyclopedia Britannica* wrote, "The earliest temple obelisk still in position is that of Senwosri I of the XIIth Dynasty at Heliopolis (68 feet high)". The word "obelisk" is of Greek rather than Egyptian origin because Herodotus, the great traveler, was the first writer to describe the objects. Twenty-seven ancient Egyptian obelisks are known to have survived, plus the *unfinished obelisk* being built by Hatshepsut to celebrate her sixteenth year as pharaoh. It broke while being carved out of the quarry and was abandoned when another one was begun to replace it. The broken one was found at Aswan and provides the only insight into the methods of how they were hewn.

The obelisk symbolized the sun deity, Ra, and during the brief religious reformation of Akhenaten, was said to be a petrified ray of the Aten, the sun disk. It is hypothesized by New York University Egyptologist Patricia Blackwell Gary and *Astronomy* senior editor Richard Talcott that the shapes of the ancient Egyptian pyramid and obelisk were derived from natural phenomena associated with the sun (the sun-god, Ra, being the Egyptians' greatest deity) (Tomkins, 1971). It was also thought that the deity existed within the structure.

Pillars

The Egyptians also used pillars extensively. It is unknown whether the Ancient Egyptians had kites, but a team led by Mory Gharib raised a 6,900-pound, 15-foot (4.6 m) obelisk into vertical position with a kite, a system of pulleys, and a support frame. Maureen Clemmons developed the idea that the ancient Egyptian used kites for work. Ramps have been reported as being widely used in Ancient Egypt. A ramp is inclined plane, or a plane surface set at an angle (other than a right angle) against a horizontal surface. The inclined plane permits

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one to overcome a large resistance by applying a relatively small force through a longer distance than the load is to be raised. In civil engineering the slope (ratio of rise/run) is often referred to as a grade or gradient. An inclined plane is one of the commonly recognized simple machines (Forbes, 1966).

Navigation

Egyptian ship, 1250 B.C.: The use of rope truss to stiffen the beam of ships in the red sea was very prominent. The Ancient Egyptians had knowledge to some extent of sail construction. This is governed by the science of aerodynamics. The earliest Egyptian sails were simply placed to catch the wind and push a vessel. Later Egyptian sails dating to 2400 B.C. were built with the recognition that ships could sail against the wind using the side wind. Queen Hatshepsut oversaw the preparations and funding of an expedition of five ships, each measuring seventy feet long, and with several sails. Various other instances of Egyptian sailing vessels exist, also (Wikander, 2000).

Although quarter rudders were the norm in Nile navigation, the Egyptians were the first to use stern-mounted rudders.

Irrigation and agriculture

Irrigation, as the artificial application of water to the soil, was used to some extent in Ancient Egypt, a hydraulic civilization (which entails hydraulic engineering). In crop production it is mainly used to replace missing rainfall in periods of drought, as opposed to reliance on direct rainfall (referred to as dry land farming or as rainfed farming). There is evidence of the ancient Egyptian pharaoh Amenemhet III in the twelfth dynasty (about 1800 B.C.) using the natural lake of the Fayûm as a reservoir to store surpluses of water for use during the dry seasons, as the lake swelled annually as caused by the annual flooding of the Nile (Wikander, 2000).

Glasswork

Egyptian knowledge of glassmaking was advanced. The earliest known glass beads from Egypt were made during the New Kingdom around 1500 B.C. and were produced in a variety of colors. They were made by winding molten glass around a metal bar and were highly prized as a trading commodity, especially blue beads, which were believed to have magical powers. The Egyptians made small jars and bottles using the core-formed method. Glass threads were wound around a bag of sand tied to a rod. The glass was continually reheated to fuse the threads together. The glass-covered sand bag was kept in motion until the required shape and thickness was achieved. The rod was allowed to cool, then finally the bag was punctured and the rod removed. The Egyptians also created the first colored glass rods which they used to create colorful beads and decorations. They also worked with cast glass, which was produced by pouring molten glass into a mold, much like iron and the more modern crucible steel (Ursula, 1989).

Astronomy

The Egyptians were a practical people and this is reflected in their astronomy in contrast to Babylonia where the first astronomical texts were written in astrological terms. Even before Upper and Lower Egypt were unified in 3000 B.C., observations of the night sky had influenced the development of a religion in which many of its principal deities were heavenly bodies. In Lower Egypt, priests built circular mud-brick walls to make a false horizon where they could mark the position of the sun as it rose at dawn, and then with a plumb-bob note the northern or southern turning points (solstices). This allowed them to discover that the sun disc, personified as Re, took 365 days to travel from his birthplace at the winter solstice and back to it. Meanwhile in Upper Egypt a lunar calendar was being developed based on the behaviour of the moon and the reappearance of Sirius after its annual absence of about 70 days heliacal rising.

After unification problems with trying to work with two calendars (both depending upon constant observation) led to a merged,

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simplified civil calendar with twelve 30 day months, three seasons of four months each, plus an extra five days giving a 365 year day but with no way of accounting for the extra quarter day each year. Day and night were split into 24 units each personified by a deity. A sundial found on Seti I's cenotaph with instructions for its use shows us that the daylight hours were at one time split into 10 units, with 12 hours for the night and an hour for the morning and evening twilights. However, by Seti I's time day and night were normally divided into 12 hours each, the length of which would vary according to the time of the year (Parker, 2007).

Key to much of this was the movement of the sun god, Ra, and his annual movement along the horizon at sunrise. Out of Egyptian myths, such as those around Ra and the sky goddess, Nut, came the development of the Egyptian calendar, time keeping, and even concepts of royalty. An astronomical ceiling in the burial chamber of Ramesses VI shows the sun being born from Nut in the morning, travelling along her body during the day and being swallowed at night.

During the Fifth Dynasty, six kings built sun temples in honour of Ra. The temple complexes built by Niuserre at Abu Gurab and Userkaf at Abusir have been excavated and have astronomical alignments and the roofs of some of the buildings could have been used by observers to observe the stars and calculate the hours at night and predict the sunrise for religious festivals.

The Dendera Zodiac was on the ceiling of the Greco-Roman temple of Hathor at Karnak. Claims have been made that precession of the equinoxes was known in Ancient Egypt prior to the time of Hipparchus. Some buildings in the Karnak temple complex, for instance, were oriented toward the point on the horizon where certain stars rose or set at key times of the year. Because of the precession, the stars in one "constellation" or section of the sky would be seen to be first in the nightly display each night until the precession moved along to the next section being first, with the previously-first constellation below the horizon until the arch was completed. A few centuries later,

when precession made the orientations of the buildings obsolete, the temples were rebuilt (Pannekoek, 1961; Gary and Talcott, 2006).

Medicine

The Edwin Smith papyrus is one of the first medical documents still extant, and perhaps the earliest document which attempts to describe and analyze the brain: given this, it might be seen as the very beginnings of neuroscience. However, medical historians believe that ancient Egyptian pharmacology was largely ineffective. According to a paper published by Michael D. Parkins, 72% of 260 medical prescriptions in the Hearst Papyrus had no curative elements. He also submits that sewage pharmacology first began in ancient Egypt and was continued through the Middle Ages, and, while the use of animal dung can have curative properties, it is not without its risk. Practices such as applying cow dung to wounds, ear piercing, tattooing, and chronic ear infections were important factors in developing tetanus. Frank J. Snoek wrote that Egyptian medicine used fly specks, lizard blood, swine teeth, and other such remedies which he believes could have been harmful.

Mummification of the dead was not always practiced in Egypt. Once the practice began, an individual was placed at a final resting place through a set of rituals and protocol. The Egyptian funeral was a complex ceremony including various monuments, prayers, and rituals undertaken in honour of the deceased. The poor, who could not afford expensive tombs, were buried in shallow graves in the sand, and because of the arid environment they were often naturally mummified (Budge, 1969).

Other developments

The Egyptians developed a variety of furniture. There in the lands of ancient Egypt is the first evidence for stools, beds, and tables (such as from the tombs similar to Tutenkhamen's). Recovered Ancient Egyptian furniture include a third millennium B.C. bed discovered in

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the Tarkhan Tomb, a 2550 B.C. gilded set from the tomb of Queen Hetepheres, and a 1550 B.C. stool from Thebes.

Some have suggested that the Egyptians had some form of understanding electric phenomena from observing lightning and interacting with electric fish (such as the *Malapterurus electricus*) or other animals (such as electric eels). The comment about lightning appears to come from a misunderstanding of a text referring to "high poles covered with copper plates" to argue this, but Dr. Bolko Stern has written in detail explaining why the copper covered tops of poles (which were lower than the associated pylons) do not relate to electricity or lightning, pointing out that no evidence of anything used to manipulate electricity had been found in Egypt and that this was a magical and not a technical installation.

The single representation of the image, called the "Dendera light" by some alternative suggestions, exists on the left wall of the right wing in one of the crypts of the Hathor temple

Those exploring fringe theories of ancient technology have suggested that there were electric lights used in Ancient Egypt. Engineers have constructed a working model based on their interpretation of a relief found in the Hathor temple at the Dendera Temple complex. Authors (such as Peter Krassa and Reinhard Habeck) have produced a basic theory of the device's operation. The standard explanation, however, for the *Dendera light*, which comprises three stone reliefs (one single and a double representation) is that the depicted image represents a lotus leaf and flower from which a sacred snake is spawned in accordance with Egyptian mythological beliefs. This sacred snake sometimes is identified as the Milky Way (the snake) in the night sky (the leaf, lotus, or "bulb") that became identified with Hathor because of her similar association in creation.

Technological Progress: 19th Century to 21st Century

The British Industrial Revolution is characterized by developments in the areas of textile manufacturing, mining, metallurgy and transport driven by the development of the steam engine. Above all else, the

revolution was driven by cheap energy in the form of coal, produced in ever-increasing amounts from the abundant resources of Britain. Coal converted to coke gave the blast furnace and cast iron in much larger amounts than before, and a range of structures could be created, such as The Iron Bridge. Cheap coal meant that industry was no longer constrained by water resources driving the mills, although it continued as a valuable source of power. The steam engine helped drain the mines, so more coal reserves could be accessed, and the output of coal increased. The development of the high-pressure steam engine made locomotives possible, and a transport revolution followed.

The 19th century saw astonishing developments in transportation, construction, and communication technologies originating in Europe, especially in Britain. The Steam Engine which had existed since the early 18th century, was practically applied to both steamboat and railway transportation. The first purpose built railway line opened between Manchester and Liverpool in 1825, the Rocket locomotive of Robert Stephenson being one of the first working locomotives used on the line. Telegraphy also developed into a practical technology in the 19th century to help run the railways safely.

Other technologies were explored for the first time, including the Incandescent light bulb. The Portsmouth Block Mills was where manufacture of ships' pulley blocks by all-metal machines first took place and instigated the age of mass production. Machine tools used by engineers to manufacture other machines began in the first decade of the century, notably by Richard Roberts and Joseph Whitworth. Steamships were eventually completely iron-clad, and played a role in the opening of Japan and China to trade with the West. Mechanical computing was envisioned by Charles Babbage but did not come to fruition. The Second Industrial Revolution at the end of the 19th century saw rapid development of chemical, electrical, petroleum, and steel technologies connected with highly structured technology research.

The 20th Century technology developed rapidly. Communication technology, transportation technology, broad teaching

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and implementation of Scientific method, and increased research spending all contributed to the advancement of modern science and technology. Due to the scientific gains directly tied to military research and development, technologies including electronic computing might have developed as rapidly as they did in part due to war. Radio, radar, and early sound recording were key technologies which paved the way for the telephone, fax machine, and magnetic storage of data. Energy and engine technology improvements were also vast, including nuclear power, developed after the Manhattan project. Transport by rocketry: most work occurred in the U.S. (Goddard), Russia (Tsiolkovsky) and Germany (Oberth). Making use of computers and advanced research labs, modern scientists have Recombinant di-ribonucleic acid (DNA).

Despite the fact we have just entered into the 21st century, technology is being developed even more rapidly. Marked progress in almost all fields of science and technology has led to massive improvements of the technology we currently possess, the rate of development in computers being only one example at which the speed of progress continues forward, leading to the speculation of a technological singularity occurring within this century. Current ongoing developments include research into the scramjet, nanotechnology, bioengineering, nuclear fusion, new developments in amour, advanced materials and a plethora of other fields, leading to speculations among some circles of the development of devices such as powered armor in the near future.

Measuring technological progress

Many sociologists and anthropologists have created social theories dealing with social and cultural evolution. Some, like Lewis H. Morgan, Leslie White, and Gerhard Len ski, declare technological progress to be the primary factor driving the development of human civilization. Morgan's concept of three major stages of social evolution (savagery, barbarism, and civilization) can be divided by technological milestones, like fire, the bow, and pottery in the savage era,

domestication of animals, agriculture, and metalworking in the barbarian era and the alphabet and writing in the civilization era.

Instead of specific inventions, White decided that the measure by which to judge the evolution of culture was energy. For White, "the primary functions of culture" is to "harness and control energy." White differentiates between five stages of human development: In the first, people use energy of their own muscles. In the second, they use energy of domesticated animals. In the third, they use the energy of plants (agricultural revolution). In the fourth, they learn to use the energy of natural resources: coal, oil, gas. In the fifth, they harness nuclear energy. White introduced a formula $P=E*T$, where E is a measure of energy consumed, and T is the measure of efficiency of technical factors utilizing the energy. In his own words, "culture evolves as the amount of energy harnessed per capita per year is increased or as the efficiency of the instrumental means of putting the energy to work is increased". Russian astronomer, Nikolai Kardashev, extrapolated this theory creating the Kardashev scale, which categorizes the energy use of advanced civilizations.

Lenski takes a more modern approach and focuses on information. The more information and knowledge (especially allowing the shaping of natural environment) a given society has, the more advanced it is. He identifies four stages of human development, based on advances in the history of communication. In the first stage, information is passed by genes. In the second, when humans gain sentience, they can learn and pass information through by experience. In the third, the humans start using signs and develop logic. In the fourth, they can create symbols, develop language and writing. Advancements in the technology of communication translates into advancements in the economic system and political system, distribution of wealth, social inequality and other spheres of social life. He also differentiates societies based on their level of technology, communication and economy: 1) hunters and gatherers, 2) simple agricultural, 3) advanced agricultural, 4) industrial, 5) special (like fishing societies).

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Finally, from the late 1970s, sociologists and anthropologists, like Alvin Toffler (author of *Future Shock*), Daniel Bell and John Naisbitt have approached the theories of post-industrial societies, arguing that the current era of industrial society is coming to an end, and services and information are becoming more important than industry and goods. Some of the more extreme visions of the post-industrial society, especially in fiction, are strikingly similar to the visions of near and post-Singularity societies.

Conclusion and Implications

People's use of technology began with the conversion of natural resources into simple tools. The pre-historical discovery of the ability to control fire increased the available sources of food, and the invention of the wheel helped humans in travelling in and controlling their environment. Recent technological developments, including the printing press, the telephone, and the Internet, have lessened physical barriers to communication and allowed humans to interact on a global scale. In many societies, technology has helped develop more advanced economies (including today's global economy) and has allowed the rise of a leisure class.

However, not all technology has been used for peaceful purposes; the development of weapons of ever-increasing destructive power has progressed throughout history, from clubs to nuclear weapons. Many technological processes produce unwanted by-products, known as pollution, and deplete natural resources, to the detriment of the Earth and its environment. Various implementations of technology influence the values of a society and new technology often raises new ethical questions. Examples include the rise of the notion of efficiency in terms of human productivity, a term originally applied only to machines, and the challenge of traditional norms.

Philosophical debates have arisen over the present and future use of technology in society, with disagreements over whether technology improves the human condition or worsens it. Neo-Luddism, anarcho-primitivism, and similar movements criticize the pervasiveness

of technology in the modern world, claiming that it harms the environment and alienates people. Proponents of ideologies, such as trans-humanism and techno-progressivism, view continued technological progress as beneficial to society and the human condition.

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