

# Some Reflections on the Role of Science in Human Civilizations

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## Abstract

Science is a crown result of human civilization. Science has been playing an indispensable role in improving the quality of human life and quenching human thirst for knowledge. Science is the foundation of technology, and together they are first productive force pushing forward economy in a human society. Without science and technology, we humans may not live longer than ever before or enjoy the ever-increasing comfort in daily life. This paper is a discussion on the relationship between culture and science as well as society and science (October). In his Course of Positive Philosophy, Auguste Comte proposed that in the long history of human civilizations, human beings have been experiencing theological (religious), metaphysical (conceptual), and positive (scientific) stages. We humans are right now in the period of science, which may not be the last stage of human civilizations [1].

**Keywords:** Sociology, Philosophy, politics, Human Civilizations, Role of Science, social world, economic growth.

## 1. Introduction

The word "Science" from its Latin origin means "knowledge." It is a systematic summary that builds and organizes knowledge in a certain area and in the form of testable explanations and predictions about the natural and social world [2]. There are at least two critical features for any of the scientific disciplines: explanation and prediction. The combination of knowledge of a science is able to explain the happenings and answer questions people may have. People are able to use the knowledge to predict what will happen tomorrow, either in the natural or the social world.

Another feature of science is its testability. Proposals, hypotheses, and theories, etc. must be testable, and findings based on them should be replicated over and over again. Measurement is at the core of the testing and replications, as it is the basis for the reliability and validity of any empirical research. Religious theories are not testable; Philosophical ideas are not testable. Therefore, they are not science. However, it does not mean that things that are not testable or replicable are meaningless. Sigmund Freud's theories on mind, libido, and Oedipus Complex, etc. are not testable, but they helped add to our knowledge on psychoanalyses.

Science is playing a critical role in human civilization. Science is the foundation of technology, and together they are first productive force pushing forward economy in a human society. Without science and technology, we humans may not live longer than ever before or enjoy the ever-increasing comfort in daily life. Each society the world knows the role

of science and technology in the economic growth spares no efforts investing in scientific research and technological development.

### 1.1. Science as a double-edged sword

However, science can be a double-edged sword, while it is upgrading civilization and promoting human life quality, it can be detrimental to biological humans. Take modern medicine as an example, we can live longer and longer in the future, thanks to the ever-innovated drugs and technology, e.g., antibiotics like penicillin, pain killers like Tylenol, vaccines for such as smallpox, Shingles, Pneumonia, and today, Covid-19. However, that we currently live longer and healthier does not necessarily indicate that our human future generations be better than us [3]. Modern medicine and pharmacy are diminishing our immune system, and the effects can be carried down to next generations. Future human may gradually become less robust against attacks from nature. Practicing "natural selection" and "survival of the fittest" by the reduction or caring for the weak may be unethical in today's world but may significantly improve the quality of the species.

Caesarian section is commonly practiced all over the world. The technology is aimed to save the life of both the mother and the newborn due to the narrow pelvic of the mother. However, some pregnant women request C-sections not because of life threatening or any medical reasons, and they are very likely to be allowed. Children of C-sections are likely to inherit the narrow pelvic genes, and this population may tremendously increase generation after generation. While making human life more comfortable and living longer, mod-

ern medicine is gradually digging graves for this intelligent species.

The paradox in modern medicine is a philosophical, political, as well as ethical issue. Current humans are striving for better like and they are less likely to consider the future world and the next generations. Using a Chinese proverb, it is “killing chickens and get eggs.”

Another example to illustrate the double-edged nature of science can be the lethal killing weapons. Killing weapons originated from the beginning of human civilization to conquer the wildlife and human enemies. Science helped upgrade the scale of lethality of the weapons. When Hiroshima and Nagasaki were bombed by the US with nuclear weapons in 1945, killing about 200,000 people in the two Japanese cities, people all over the world realized the atomic bombs are able to destroy the world. As a frontier scientist, Albert Einstein regretted his suggestions to US President Roosevelt to research on atomic weapons before the Germans harnessed this deadly technology. He said in the interview with Newsweek magazine that “had I known that the Germans would not succeed in developing an atomic bomb, I would have done nothing [4].

As a major part of human civilization, science has been challenged in recent decades by another growing civilized values: ethics and morality. The atomic bomb is at the spotlight of the issue. The development of nuclear weapons is a crime against the human race, but the same time is a protection for the national security. The lethal experimentation on humans by the Unit 731 of the Imperial Japanese Army in China during the WWII was a crime and aimed to win the war. Findings from the guinea pigs in the labs in lieu of humans cannot be fully generalized to the latter. The dilemma is between scientific findings and human rights protection. The former should not be accomplished at the expenses of human rights or even lives, and over protection of human rights is definitely hindering the progress of research.

Stanley Milgram tried to study obedience in human behavior and used community individuals and deception in his libationary in early 1960s [5]. Hypotheses were supported at the expenses of human rights as well as risks of lawsuits. Laud Humphreys studied homosexuality with hundreds of deceived gay men as subjects [6]. Through participant observation and in-depth interviews, valuable information was obtained on homosexuality which otherwise was impossible. However, none of this type of studies is allowed anymore, as human rights protection is becoming first priority in any scientific research. Ethics and morality, as growing civilized social values in the way of scientific research, forces science to slow down.

## 1.2. Science and scientific research

Science is knowledge or a system of knowledge covering general truths of the operation of general laws especially as obtained and tested through scientific method [7]. Both natural and social sciences, either basic or applied, are founded with the same concepts: testable explanations and testable predictions. Cognitions, feelings, speculations do not count

in the science. All observations and conclusions are based on facts and only facts, and empirical observations are the only sources for generalizations.

Scientific theories and scientific research are reciprocal. They go hand in hand. Research originates from a theory, and theory is supported, revised, or denied by research. This forms an endless reciprocity. There are at least four levels of scientific research, hierarchically ordered from low to high like this: 1) Description, 2) Correlation, 3) Causal relation, and 4) Theoretical conceptualization. All scientific inquiries start with descriptive analyses on a certain knowledge area. Then people become interested in the relations of variables. That is not enough for other curious people, and they need to know causal relations of the correlated matters. We always tend to attribute an effect to some cause. Theory building that happens on top of description, correlation, and causation is the upmost level of scientific research, and therefore theories are the cream of the crop in a scientific discipline.

Mathematics is a science and is at the core of modern science. Mathematics is a language, a language to describe the logical relations among observations. Without mathematics, we are not able to tell the nature of the relations or the degree of the differences. Without mathematics, scientists are not able to communicate in either research or conclusions. Mathematics is the jewel of a crown. Statistics, a form of mathematics, is often used in social science search, such as in sociology.

## 1.3. Sociology as a science

Modern science is divided into natural and social sciences. While natural science is the study of the physical world, social science is about human behavior and functioning of societies. Sociology is considered a science because it is based on facts, measurements, and empirical observations, all the methods used in natural science investigations, to draw conclusions of the social world. Coining the word “sociology,” Comte claimed sociology the “social physics” [2].

Other social sciences in the modern times include anthropology, economics, political science, human geography, psychology, etc. With overlapping to some extent, each of the social science disciplines is an accumulation of knowledge in a certain area, and with sociology as their basis for theoretical conceptualizations.

As a science, sociology relies on measurement. There are four levels of measurement hierarchically from simple to complex: nominal, ordinal, interval, and ratio. A nominal measurement is categorical, diachronous, true or false, or either/or. No quantitative difference is assigned to each value in a nominal variable. An ordinal measure is a little more complicated from the nominal. Also called ranking order, an ordinal measure bears quantitative difference in each category, either from high to low or from low to high. The interval and ratio levels of measurement continue the trend of complication by adding equal quantity to the categories in the ordinal variable and then an absolute zero to an interval measure.

A nominal variable is the most easily observed and is placed at the bottom of the complexity in measurement, but it is

closest to the truth and nature of the fact. Sociology came from philosophy and acted as positive philosophy. The more refined variance in the scientific measurement, the larger the discrepancy from philosophy to the social science. Therefore, the complexity order of the four levels of measurement needs to be reversed. Sociology, with its refined measurement with increasingly greater variance and sophisticated statistical techniques, is describing and explaining the social world in a superficial way [8].

Qualitative methodology is less favored in sociology today, but that maybe closer to the nature of the relations sociologists are looking into, than a quantitative method can be. Between the qualitative difference and quantitative variance, we may anxiously want to the former. Sociology as a social science is challenged by its limitations.

#### 1.4. Science and its limitations

We humans are currently living in a world dominated by science. Too many people in the world, science is truthful and almighty, and science is a belief and the worship. Emile Durkheim defines religion as “a unified system of beliefs and practices relative to sacred things, that is to say, things set apart and forbidden—beliefs and practices which unite in one single moral community called a Church, all those who adhere to them” [3]. To the four elements of definition of religion, science has a set of beliefs, a set of rituals, something sacred to worship, and organizations, and science can be a religion. When people treat science as a religion, which is very possible, there will be at least two consequences: they can explore scientific issues with great passion so as to obtain tremendous achievements, and they may also rule out or ignore other existences in human life and therefore get stuck in their way to the unlimited knowledge.

After the theological and metaphysical stages, positivity looks like the final step of human civilization by Comte’s theorem. Science now is treated by some as a belief or a religion and regarded as almighty. To confront this belief, I need to list some of the limitations of science.

Science has so far helped humans understand the natural and social world to a great extent. We can see the sky and travel to the space; we can see the cell and divide the material to neutron; we can retrospect the past and learn what happened thousands of years ago; we can also predict things hundreds of years ahead, thanks to science. However, our knowledge of the natural and social world is all based on observation. The empirically evidenced observations are only from the five physical senses of human being and their extended senses such as the human-made instruments like telescope, microscope, radio, ultrasound, CT, MRI, Carbon-14, to name a few. Without our physical senses and the tools that extended our senses, we know nothing.

Our knowledge of the natural and social world is limited by our physical observation. There are numerous things we want to know but science cannot offer an answer, such how large the universe is, what the limit of human existence is, where human being came from, if there is soul, or if God exist. Science cannot answer these questions no matter how curious we humans are, because they are all beyond mea-

surement and beyond observation. Science is superficial and cannot answer all questions we humans have and cannot solve all the problems humans have now. Science cannot be the final solutions to human knowledge. In long run, humans should not be detained by science and should be openminded, should look forward, and should see and predict beyond science can tell us.

#### 1.5. Science and politics

Science is not borderless. Most scientists in the world take the pride of their fatherland. Science is the first productive force and science is the basis of economy. The United States in the past century recruited the best talents all over the world and let them become US citizens and serve the country. Research findings are shared through publications and to some extent. Academic espionage from each country serves its economy.

Since World War I, hundreds of thousand top scientists all over the world including Einstein fled to the United States, for a better life and academic freedom. Most of them became US citizens to serve the immigrated country. Is it possible for them to keep their original citizenship and continue to work as an elite scientist? The answer is “No,” as it is almost impossible.

Einstein wrote a letter to urge than President of the United States to develop the atomic bomb, in fear of Nazi Germans who may produce the first lethal and mass killing weapon. It is ideal for science to be neutral, value free, and borderless, but it is in fact unrealistic.

In the long history of human civilizations, human beings have been experiencing theological (religious), metaphysical (conceptual), and positive (scientific) stages. We humans are right now in the period of science, which may not be the last stage of human civilizations. What is the next? Comte did not tell. Here we may need our sociological imaginations [8].

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