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科学与近世文化

Science and Modern Culture¹

“科学与近世文化”，这个题目是近人时常讲的。我今天开讲之前，先有两个申明。第一，这个讲演，是本年科学社讲演的总冒，所以不免普通一些。第二，我所讲的近世文化，并不包括东方文化在内，因为我们承认东方文化发生甚古，不属于近代的。那吗，我们所讲的是西方文艺复兴以后发生的文化了。近人对于这种文化，至少有几个普通观念。一说近世文化是物质的，譬如从前人乘骡车、马车，今人乘火车、电车，从前人点菜油灯，今人点电灯之类。一说近世文化是权力的，例如征服天然、驱水使电、列强相争、弱肉强食之类皆是。一说近世文化是进步的，例如机械发明日新月异，学术思想变动不居，从前几千年的进步，比不上近世几十年的多。这几种意思，我们承认他都可以代表近世文化的一部分，但是不能说可以总括近世文化的全体。要一个总括全体的说话，我们不如说近世的文化是科学的。诸君注意，我说近世的文化是科学的，和近人所说近世文化的特采是科学发明、科学方法等等，有点不同。因为前者是说近代人的生活，

¹ This note is left by the author in the source text to indicate the source of the reference: *Zhongguo Kexueshe* 中国科学 [The First Spring Lecture of Science Society of China] (Nanjing: the Nanjing Science Society, 1922).

无论是思想、行动、社会组织，都含有一个科学在内，后者是说科学的存在和科学的结果，足以影响近代人生活的一部分罢了。

“Science and modern culture” is a topic that is often spoken about.² Before I begin today, let me first make two points. Firstly, this talk, which is a general summary of this year’s Science Club talk, will therefore, inevitably, be a bit simple. Secondly, when I speak of modern culture, I do not include Oriental culture, which arose very early and does not belong to the modern era. Therefore, we are talking about the culture of the West after the Renaissance. There are at least a few common beliefs about such ideas in recent times. One is that modern culture is about material things, such as oil lamps in the past and electric lights in the modern era and travelling by horse and mule carriages in the past, and trains and trams in the modern era. Another says that recent culture is about power, such as the conquest of nature, the use of water and electricity, and conflicts between powerful states at the expense of weaker states. There is still the belief that modern culture is about progress, for instance, the invention of machinery, and the advancement of academic thought in that the progress of the last few thousand years is no greater than the advancement of the last few decades. We acknowledge that each of these beliefs can represent part of modern culture, but not all of it. If we want to summarize it, modern culture is a scientific culture. We should be aware that the science I am talking about is different from the scientific inventions and scientific methods that characterize modern culture. The former is around the life of modern people, including thoughts, actions and social organizations that should be governed by science. The latter is about the existence and the products of science exert considerable influence on part of people’s lives in the modern age.

² This note is left by the author in the source text to indicate the source of the reference: See Prof. Metcalf’s lecture at Oberlin University in *Kexue* 科学 [Science], Vol. 4(3); *Huang Changguo* 黄昌毅, *Kexue Gaishuo* 科学概说 [The Introduction to Science].

我们现在要说什么是什么文化。文化和文明少许有点不同。我很喜欢梁漱溟先生说的“文化是人类生活的样子，文明是人类生活的成绩”。不过吾想单说人类生活的样子，还不能尽文化两个字的含义，我的意思，要加入“人类生活的态度”的几个字，来包举思想一方面的情形，文化两个字的意思才得完备。照这样说来，文化有种类和程度的差别，但是没有绝对的标准。我们可以说某种人的文化是甚么样，程度是甚么样，但是不能说某种是文明人，某种是野蛮人，因为照我们上面所说的文化的定义，是讲不通的。但是我们提出近世文化，我们的意思却很明白的确，因为近世人生活的样子和对事物的态度是很明白的确的。近世文化和近世以前的文化，是极有分别，极容易看得出来的。所以我想把一切文明野蛮的话头打扫净尽，再来观察近世的文化。

We are now going to discuss what culture is. Culture and civilization have several differences. I like a quote by *Liang Shuming* (梁漱溟): “Culture is what human life looks like; civilization is what human life achieves.”³ My mere thought here is that human life does not fully represent the meaning of culture, and it is only when the “attitude of human life” is added to encompass the ideological aspect that the full meaning of culture is accomplished. There are different types and degrees of culture, but there are no absolute criteria. We can evaluate what a culture looks like and how far it goes, but we cannot say that a certain culture is civilized and a certain culture is barbaric, which would go astray from the definition of culture we spoke of before. Yet, when we refer to the phrase “modern culture”, our definition is clear, and so are the way of life and the attitude of people in the modern age towards life. There is a clear divide between modern culture and pre-modern culture. I would therefore conclude the discussion of pre-modern culture and start the introduction of modern culture.

说到近世与前代分界的所在，我们晓得欧洲史上有一个极重要的时代，就是文艺复兴时代。文艺复兴这个字，英文是 *Renaissance*，本来是“复生”的意思。欧

³ This note is left by the author in the source text to indicate the source of the reference: See *Liang Shuming* 梁漱溟, *Dongxiwenhua Jiqi Zhixue* 东西文化及其哲学 [East-West Culture and Its Philosophy].

洲的文化，在中古时代，简单没有甚么可言，所以历史家又叫中古时代是黑暗时代。到了十三世纪的时候，为了种种的原因，那黑暗沉沉的中古人心，忽然苏醒过来，文学、美术、宗教、政治都先后起了一个大改革，开了一个新面目。科学的复兴，也就是文艺复兴的一个结果。但是别的改革和开创，自然也影响近世人的生活，并且为生活的一部分，可是终没有科学的影响和关系于近世人生的那么大。这有个原故。这个原故，就是科学的影响，完全在思想上；科学的根据，完全在事实上；科学的方法，可以应用到无穷无尽上。有了这几层原因，我们说近世文化都是科学的，都是科学造成的，大约也不是过甚之言。

The era that sets the modern age apart from the previous ages is the Renaissance, a very important period in European history. The original meaning of “Renaissance” is “rebirth”. The Middle Ages are also called the Dark Ages by historians as European culture in the Middle Ages was plain and had nothing to brag about. In the thirteenth century, a variety of reasons were attributed to the sudden awakenings of human minds. Subsequent reforms took place in literature, art, religion and politics, hence starting a new phase. The revival of science was one result of the Renaissance. Though other reforms and innovations affected the lives of people in the modern age, and became an integral part of their life, such reforms and innovations were overshadowed by the impact of science on people’s lives. Science influences the human mind; science is based on facts; scientific methods can be broadly applied. For these reasons, it is not an exaggeration to claim that the culture in the modern age is scientific because it is built on science.

近世的文化，可谓复杂极了，要举出几件来证明科学和他们的关系，可不容易，并且不免有挂一漏万之讥。但我们可以把中世纪的研究学问的方法，举一两件，和近世的比较，科学和近世文化的关系，就愈加显明了。

The culture in the modern age is so complex that it is rather difficult to cite a few examples to prove the relationship between science and culture, and it cannot escape from being mocked for incomplete and irrelevant quotations. But if we can give one

or two examples of the thoughts and methods of study in the Middle Ages, a comparison of them with those in the modern age can further clarify the relationship between science and culture in the modern age.

第一，中世纪的人，相信上帝创造宇宙事物，都有一定的计划，人在宇宙间，也是计划的一部分，所以有的生而为王公，也有的生而为奴仆，都是天命有定，人对于己身的地位，是不负责任的。因为这样，当时的人心，都归向宗教，只想求死后天堂的快乐。生前的痛苦，他们略不在意。打破这样的宇宙观，最有力量，是哥白尼 (Copernicus) 的地动说。哥白尼的地动说，在当时出现，有两种意思。第一，表示当时的人心，对于宗教上地为中心的说法，已敢于起怀疑的念头。第二，地动说的最后胜利，是科学战胜宗教的起点。那已经动摇的人心，得了这种自信力，自然愈趋于开放与自由方面了。

First, people in the Middle Ages believed that God had a fixed plan of creating things in the universe, and people in the universe were also a part of that plan. Therefore, it was determined by God that some people were born to be princes and some slaves. People assumed few responsibilities for their own social status. Because of this, people of that time were all religious, desiring only pleasures from heaven after death. They cared little about their sufferings in life. The most powerful thought that broke our view of the universe was heliocentrism from Copernicus. His theory had two meanings at that time. First, it meant that people of the time dared to be skeptical about the religious belief of Geocentrism. Second, the final triumph of heliocentrism marked the beginning of the triumph of science over religion.⁴ The shaky minds of people tended to be more open and liberal because of the confidence gained from science.

⁴ Heliocentrism (also known as the Heliocentric model) is the astronomical model in which the Earth and planets revolve around the Sun at the center of the universe. Historically, heliocentrism was opposed to geocentrism, which placed the Earth at the center. Rushkin, Ilia. "Optimizing the Ptolemaic Model of Planetary and Solar Motion". *History and Philosophy of Physics*. (6 February 2015): 1. <https://doi.org/10.48550/arXiv.1502.01967>.

第二，中世纪的时候，学术界所崇奉为宗主的，只有两部书，一是《圣经》，一是亚里士多德的哲学。亚里士多德的书，未经文艺复兴以前，还是从阿剌伯文翻到拉丁，残缺不完和晦乱屏杂的弊病，是不可免的。当时的学者，正要利用他的残缺晦乱，来造成一种纠缠诡辩的学问。后来文艺复兴，学者都讲究读希腊原文，又竭力去搜求遗稿，亚里士多德及许多希腊、罗马的学术，才渐渐彰明起来。还有一层尤为重要的，中世纪的学者，凡研究什么学问，都是根据书本，绝不去研究实物。比如说到一个动物，他们只说《圣经》上是怎样怎样，却不想《圣经》上说的在千百年前的帕勃斯坦(Palestine)，他们所说的与当时的欧洲，时间和地域都不同，何以见得可以引证的？当时有个首出的科学大家，叫罗皆·培根 (Roger Bacon, 1214—1294)，最反对这种研究法。他说：“研究一天的天然物，胜读十年的希腊书”。又说：“我们不可尽信所闻所读的。反之，我们的义务，在以最仔细的心思，来考察古人的意见，庶几于其缺者补之，误者正之，但不必粗心傲慢就好了。”罗皆·培根虽然这样的主张和实行，但当时的人还不肯听信他。后来哥白尼的地动说，也是用这种方法的结果。哥白尼写信给他的朋友，说他的地动说成立的经过，历了五个阶级。这五个阶级是：

Secondly, in the Middle Ages, only two books were revered as patriarchs in the academic world — the Bible and Aristotle's philosophy. Before the Renaissance, Aristotle's books had only been translated from Arabic to Latin and were inevitably fragmented and confusing. The scholars of that time took advantage of the fragmented excerpts and created sophistry. Thanks to the Renaissance, scholars began to read the original Greek texts and searched for remnant manuscripts. As a result, the ideas of Aristotle and other Greek and Roman scholars were gradually refined. On the other hand, what is of particular importance is that scholars in the Middle Ages obstinately did their study from books rather than from real objects. For example, they would claim that the Bible had described a kind of animal, but they never realized that the Bible had named Palestine hundreds of years ago. How could they make quotations when the description and sayings about Palestine thousands of years ago in the Bible were different from Europe in the Middle Ages in terms of time and region? Roger Bacon (1214-1294), a prominent scientist of that time, was most opposed to this

method of research. It was remarked by him, “A day’s study of natural objects is better than a decade of reading Greek books.” Furthermore, he argued that “We cannot entirely believe in what we hear and read. By contrast, it is our duty to examine the opinions of the ancients with the most careful mind. Although Roger Bacon advocated and applied this theory, the people of his time did not believe in him. Later, Copernicus’s theory of geodynamics was also the result of this method. Copernicus wrote to his friends that his theory of geodynamics had been established through five stages:

1. 对于陀伦密 (Ptolemy) 旧说的不满意。
2. 搜索所有的书籍，看有没比他更好的学说。
3. 自己研究的结果，成立了一个地动的假说。
4. 用种种观察来证明这假说的对不对，对了才承认他成一个学说。
5. 用这新学说，把从前晓得的许多事实都联贯起来，成有条理有统系的知识。

1. He was dissatisfied with the old treatises of Ptolemy.
2. All the books were searched to see if there existed a better theory.
3. A hypothesis of Heliocentrism was established as the result of his own research.
4. Observations of different approaches were made to prove whether the hypothesis is correct, and only the correct one can be acknowledged as a theory.
5. The new theory was connected to numerous facts that were previously known, thus forming a structured and systematic framework of knowledge.

这个方法，就是现在所说的科学方法。但当时的人，如像罗皆·培根、哥白尼、盖理略 (Galileo) 等，虽是用了这种方法，研究天然界的现象，已经有了许多贡献，他们不过是自辟蹊径，各行其是，到了弗兰西斯·培根 (Francis Bacon, 1561—1626) 才大声疾呼，主张两个根本的重要观念。一个是征服天然，一个是归纳方法。他说：“知识即权力。”又说：“人类的责任，是要把他的权力推广扩大到天然界上去，在天然界上建一个新国家。”又说：“要征服天然必须先

服从天然，就是用科学的方法，发明天然的律令。”他又把当时的学问分成三类，一是奇术(Fantastic learning)，二是辩论(Contentious learning)，三是文采(Delicate learning)。他说这三类都不是学问的正当方法，都不能得真知识。要得真知识，只有一个方法，就是用归纳方法。归纳的方法，简言之，是用事实作根据，推出一个通则，再用观察和试验证明那通则的不错，这就是科学方法的大概。现在科学的门类虽多，研究的方法，总不出这个范围。培根这种主张，算是给科学一个很好的基础。所以培根自己虽然不是科学家，我们说到科学的创造者，总要数他呢。

This is currently known as the scientific method. Although people of that time, such as Roger-Bacon, Copernicus, Galileo and others had already made substantial contributions by studying natural phenomena, they were just taking different approaches in their individual investigations. Only Francis Bacon (1561-1626) was strongly in favor of two fundamentally important concepts, among which one was the conquest of nature, and the other was inductive reasoning. “Knowledge is power”, “The responsibility of humans is to take control of the natural world and establish a new state there.” and “Obeying nature is the prerequisite to conquer nature. In other words, we must use scientific methods to discover the natural laws.” were all the quotes of Bacon. He also divided the learning of that time into three categories, including Fantastic, Contentious, and Delicate learning. He said that these three categories were improper learning strategies, which could not lead to true knowledge. In addition, only by applying inductive reasoning was there a way to discover the truth. In brief, inductive reasoning was a way to infer a general rule based on facts, and then prove the correctness of the general rule through observation and experiments. This gives an overview of the scientific method. Nowadays, although there are multiple disciplines in science, the methods of research remain within this framework. Bacon’s claim has laid science on a well-defined foundation. Though not a natural scientist, Bacon is often referred to as the father of science.

上面所说的，是科学的一点起源，就是对于文艺复兴这个时代，我们觉得有两个意思。一个是科学的发生，或者说是复兴；一个是近代和古代的分界。这两件事情并不是偶然遇合的，是有第一件才有第二件的。我们现在要看科学与近世文化的关系是怎么样。

What has just been discussed in this article is a little content about the origins of science. This era, the Renaissance, has two meanings. Firstly, it represents the emergence of science or the revival of science. Secondly, it represents the division between the modern age and ancient times. These two points do not coincide by chance; it is with the first that the second comes into being. We turn next to the relationship between science and modern culture.

前面已经说过，文化这两个字是空洞的，就是我们说什么物质的文化、精神的文化，也是空洞的。所以我们要谈近世文化，最好拿几件具体的事体来说。玛尔芬 (Marvin) 说得好：有三件东西最足以表示人类的进步。一是知识，二是权力，三是组织。我们现在就拿这三样来看科学有什么关系。

As has already been said, the word “culture” is hollow. What we say about material and spiritual culture is also hollow. When we talk about modern culture, we need to give concrete examples. As Marvin puts it, there are three things that can adequately represent the progress of mankind: knowledge, power and organization.⁵ Let us now explore how these three things are related to science.

第一讲到知识，我们晓得现代的知识，不但是范围比较的广，就是他的性质，也比较的精确些。现在很平常的事理，如像蒸气的应用，电力的制造，生物的演进，疾病的传染，都非中世纪以前的人所能梦见，固不消说了。就是古时圣哲所发明，历代学者所传述，如希腊人的物质起源论，中国人的五行生克说等，虽是

⁵ This note is left by the author in the source text to indicate the source of the reference: Marvin, The Living Past.

沿习多年，并且用作说明一切事理的根据，但是照现在看来，还是不算知识。我们拿现在的化学上所发见的八十余元素，和希腊人的水、火、气、土四元质相比较，自然看得出他的笼统不精。拿现在化学上物质的变化分合和物理学上因果相生的定律，和中国人的五行旧说相比较，才晓得他的糊涂无理。这是因为甚么？因为有了科学而后我们的知识得了两个试金石，要经得这试验的，我们才承认他是知识，所以那些不够成色的，都立不住脚了。我所说的试金石，一个是根据事实，一个是明白关系。希腊人说什么东西都是由水、或火、或气、或土变成的，但是我们晓得他并非事实。在炼金化学(Alchemy)的时代，大家都信水可变土，但是我们晓得并非事实。我们晓得他不是事实，也是从实验得来的。讲到关系一方面，我想许多迷信都是由不明白关系发生。比如我们说“础润而雨”，我们晓得础润并不是雨的原因，不过因为雨还未降以前，湿气先在础石上凝聚了，所以有润的现象。照这样说来，础润虽不是雨的原因，却也可做一个雨的先兆，因为他中间是有共同的关系的。但是信那风水五行的说法，说祖坟墓得好，后人就会发迹，京城多开一个城门，天下就有兵乱，请问那关系在什么地方呢？科学的贡献，就是把事实来代替理想，把理性来代替迷信，那知识的进步，也正是从这点得来的。

The first is knowledge, and what we know about modern knowledge is not only broad in its scope but also precise in its inherent nature. Things that are very common now, such as the use of steam, the generation of electricity, biological evolution, and the transmission of infections, were not things that people in the Middle Ages could have dreamed of, let alone been talked about. Even though the inventions of the philosophers in ancient times and the accounts of scholars through the ages, such as the ancient Greek theory of the origin of matter and the Chinese Five Elements Theory, have been handed down for many years and can be taken as the foundation to explain all matters, they are considered as knowledge by science either. When we compare the eighty elements now found in chemistry with the four elements of water, fire, air and earth proposed in ancient Greek culture, it is easy to see that the Greek concept of the elements was not precise.⁶ If we compare the Chinese Five Element

⁶ The ancient Greek concept of four basic elements, these being earth, water, air, and fire, dates from pre-Socratic times and persisted throughout the Middle Ages and into the Renaissance, deeply

Theory with the present composition and decomposition reactions in chemistry and the law of causations in physics, we realize the absurdity of Five Element Theory. Why? It is because with science our knowledge can be tested through two touchstones. Those that have been tested we can call them knowledge, and those that have not passed the tests cannot be called as knowledge. The touchstones I am referring to are facts and the explicit relationships of cause and effect. The ancient Greeks claimed that substances were made up of the four elements, which we know is not true. In the age of alchemy, people believed that water could be turned into earth, which is also not true. We can deny these results because we have done experiments. When it comes to relationships, many superstitions arise from a lack of clarity about the relationships of cause and effect. For example, we say “when the rocks are moist, there will be rain.” We know the rocks do not bring the rain, but the rocks are wet due to condensed moisture before the rain. Therefore, wet rocks can be a precursor to rain because there is a connection in between. However, Five Elements Theory says that a good location of the grave will promise good fortune for the descendants, and inappropriate numbers of gates in the capital of the country will bring wars. Where on earth do such relationships lie? The contribution of science is to replace imaginations with facts and superstitions with reason. This is precisely how knowledge progresses.

第二，讲到权力，自然是就我们所能驾驭的力量和那力量所及的远近而言。历史家说石器时代的人能掷石子在几丈外的地方去击杀野兽，他的文化已经比石器时代以前的人高了许多，因为他的权力，已经远到几丈外了。照这样看来，近代人的权力，比从前的人大的地方，至少有几处。一为征服天然，最显著的例就是距离的缩短。我们古人看了长江，就说“固天所以限南北”，现在轮船火车到处通行，就是重海连山，也不能隔人类的往来了。再则，物产的增加，因为机器的应用和天然障害的战胜，也是近世的一种特别现象。如 1810 到 1862 五十年间，世界上煤的产额，由每年九百万吨增到一万四千万吨。由 1850 到 1882 三十二年

influencing European thought and culture. Curd, Patricia. “Presocratic Philosophy”. In Zalta, Edward N. (ed.). *Stanford Encyclopedia of Philosophy* (Fall 2020 ed.).

间，世界上铁的产额，由每年四百万吨增到两千万吨。又由 1830 到 1880 五十年间，欧美的商务，增加了八百倍。这都是前四五十年的统计，到近年来，增加的数目必定更要大了。再次，则各种病菌的发明，人类生命的延长，也是征服天然的一个好例。由 1851 年到 1900 年英国人的平均寿数由二十六岁零五六增到二十八岁零九，美国人的寿数由二十三岁零一增到二十六岁零三三，我们战胜天然的权力，不是可惊吗？又不但战胜天然，我们并且能补天然的不足。再举两件事为例。我们平常所希望不到的，不是插翅而飞和长生不老的两件事吗？不晓得到了 1896 年，美国的蓝格列 (Langley) 竟在华盛顿颇陀玛克(Potomac)河上，用机械的力量，把一个比空气重一千倍的飞机，飞升起来，从此空中的飞行就逐渐进步，现在竟成了普通的交通事业了。返老还童的问题，据最近奥国医士斯坦那黑(Steinlach)的报告，也从生理学上，寻出了可能的方法，并且屡试有效。我们这种权力，岂不是自有人类以来所未曾有的吗？但是这些权力，都是由知识的组织和应用得来，自然又是科学的产物。

Secondly, when it comes to power, it refers to the power we can harness and how much of that power can do things. Historians say that people in the stone age could still stone and kill wild animals from a few meters away, which shows that its civilization is quite an improvement on previous generations, for his power could extend to a few meters away. In this way, the human power in the modern age is greater, in several ways, than that of previous generations. First of all, it is the conquest of nature, most obviously in the reduction of distance. The ancient people of China saw the Yangtze River and said that “the country is separated into the north and the south because of the river”; now as ships and trains can travel everywhere, even crossing mountains and seas, human communication will never be impeded. Second, the application of machinery and the overcoming of natural obstacles have brought an increase in production, also a phenomenon of the modern age. For example, between 1810 and 1862, the annual production of coal in the world had increased from nine million tons to fourteen million tons. From 1850 to 1882, the world’s iron production had risen from 4 million tons to 20 million tons per year. From 1830 to 1880, the

trade volume between Europe and the United States surged by 800 times.⁷ These were the statistics accumulated from the past forty or fifty years, and the figures of increase in recent years are bound to be larger. Third, the discoveries of germs have extended life expectancy, a good example of the conquest of nature. From 1851 to 1900, the average life expectancy of the British increased from 26.056 years to 28.09 years, and the average life expectancy of a US citizen increased from 23.01 years to 26.33 years. Isn't it amazing that we have the power to conquer nature? We can not only conquer nature, but also find ways to make up for our natural inadequacies. There are two other examples here. Are flying and immortality not what we have desired? How can we imagine that in 1896, Langley of the United States used mechanical power to lift up an airplane a thousand times heavier than air on the Potomac River in Washington, D.C.? Since then, flying has progressed and grown to be a public transportation industry. As to rejuvenation, Austrian doctor Eugen Steinach recently reported that he had discovered a physiological method for rejuvenation, which had proven to be effective through tests.⁸ Such a power to make up for our natural inadequacies has never existed since the beginning of mankind, but all the powers we possess now are derived from the organization and application of knowledge, and naturally the products of science.

第三要说社会组织。我们晓得近代的社会，除了组织复杂，远非从前所可比拟之外，还有几个特采，是我们不能不注意的。一是平民的特采，就是所谓德谟克拉西。这平民的倾向，有两个意思：一是政治上独裁政制的推倒，与参政权的普及；二是社会上机会的均等，和阶级制度的打消。这两个意思的发生，一方面因为机器的发明，生了工业革命，又因工业革命过后，物产增加，一般的人有了产业和劳力，自然发生了权利的要求；一方面也因近代的人心，趋于合理的；对于天然的势力，尚且不肯贸然服从，要求一个征服的方法，对于人为的组织，自

⁷ This note is left by the author in the source text to indicate the source of the reference: Seignobos, *History of Contemporary Civilization*.

⁸ The original name in the source text is misspelled. It should be Steinach, an Austrian doctor who developed the "Steinach operation" or "Steinach vasoligature", the goals of which were to reduce fatigue and the consequences of ageing and to increase overall vigor and sexual potency in men. Christopher Turner. "Vasectomania, and Other Cures for Sloth". *Cabinet Magazine*. (Spring 2008).

然也有一个合理的解决，那些“天赋君权”的说话，自然不能管束他们了。弗兰克林 (Franklin) 的墓志说他“一只手由自然界抢来了电力，一只手由君主抢来了威权”，最能表明这一种意思。可见平民主义和科学是直接间接都有关系的。第二个特采，是他范围的广大。从前的社会组织，仅限一地一域或少数人的，现在的组织，不但非一地一域，就是国界种界，也不能限制了。如像近来各种团体的国际组织，各种主义的世界同盟，都是大组织的表示。这有几个原因：一是交通进步，空间时间的距离比从前缩小了好些。二因各处的生活有趋于一致的倾向，因此他们的问题也有些大同小异。三因学术经验的证明，知大组织的利便与可能。这三种原因，又是大半和科学有关系的。第三个特采，是效率的讲求。我们晓得近世工业的组织 and 机器的应用，是要用力少而成功多。以少量的用力，得多量的结果，就是高的效率，反之，效率就低了。这种讲求效率的意思，不但用在工业上，就是社会上一切组织，也都是这个意思所贯注。大概做到这一步的，我们说他是新组织，不然，事业虽新，组织还是旧的罢了。但是一件事业效率的高低，非从那件事极小的部分加以研究，不会明白。这种分析研究的方法，也就是科学方法。所以现在有所谓科学的工场管理法，就是这种特采结晶了。

The third point is on social organizations. It is known that the organization of modern society is far more complex than those organizations in previous ages. Besides, some other features cannot be ignored. The first one is that the involvement of the common people, or so-called democracy, has two levels of meanings: one is the overthrow of the political dictatorship and the popularization of suffrage (the right to vote); the other one is the equal opportunities in society and the abolition of the class system. The occurrence at these two levels can be attributed to two factors. One is that the industrial revolution came into being owing to the invention of machinery. After the industrial revolution, there has been an enormous increase in the production of goods. As common people owned property and labor, they naturally demanded rights. On the other hand, people in the modern age opt to think rationally; since they have not yet been so hasty to submit themselves to the forces of nature, they were inclined to have human organizations with reasonable solutions and throw off the shackles from the divine right of kings. Franklin's epitaph that "He snatched lightning from the

sky and the scepter from tyrants” best illustrates this meaning.⁹ In consequence, populism and science are directly or indirectly related. The second feature of social organizations lies in their vast scope. In the past, social organizations were limited to a single area or a small number of people, but now they are not even confined by national boundaries. For example, the recent international organizations of various groups and the world alliance of various doctrines are all signs of large organizations. There are several reasons for the grand scope of these organizations: first, the progress in transportation has shortened the distance both in space and time. Second, people all over the world confront similar problems owing to their convergent lifestyles. Third, academic experience has demonstrated the benefits and possibilities of large organizations. These three reasons are largely related to science. The third feature emphasizes efficiency. We are aware that the organization of industry and the application of machines in the modern age is to exert less effort to create more productivity. High efficiency is defined as utilizing little effort to get a large volume of results, and vice versa, low efficiency. This emphasis on efficiency is not only applied to industry, but also to all organizations in society. For those efficiency-oriented organizations, we probably refer to them as new organizations. Otherwise, despite the newness of the cause, the organization is still out of date. However, understanding the efficiency of a cause requires research at a very small scale. The scientific method is how we analyze and conduct our research. Therefore, the so-called newly established scientific workshop management is the result of this feature.

我们现在把上面所讲的总结起来，在知识、权力、组织这三方面，近代的进步，都比较从前最为显著、最为特别，那么，我们就说这三种进步是近世文化的

⁹ This sentence was not written by Franklin himself but was coined by Anne- Robert-Jacques Turgot (1727-1781), a French statesman and economist, who invented this motto in Latin “Eripuit Coelo Fulmen Sceptro Que Titannis”. It was often quoted about Benjamin Franklin, although he protested that the phrase gave him too much credit. <https://philamuseum.org/collection/object/50130>.

表现，可不可呢？又因为这三种进步都是科学直接的产物或间接的影响，我们若是拿他们来代表近世文化，我们要说明的科学和近世文化的关系，是不是可算做到了呢？我对于这些问题的答案是：我们上面所说的知识、权力、组织都是生活的样子，我们还有一个生活的态度。生活的态度，是我们对物的主要观念和作事的动机。我们晓得科学的精神，是求真理。真理的作用，是要引导人类向美善方面行去。我们的人生态度，果然能做到这一步吗？我们现在不必替科学邀过情之誉，也不必对于人类前途过抱悲观，我们可以说科学在人生态度的影响，是事事要求一个合理的。这用理性来发明自然的秘奥，来领导人生的行为，来规定人类的关系，是近世文化的特采，也是科学的最大的贡献与价值。

Now we can draw a conclusion that the progress in the modern age is far more significant and unique than before in these three aspects as knowledge, authority and organization. In other words, can we suggest that these three advancements represent the signs of modern culture? Since these three advancements are direct products or indirect impacts of science, if we use them to symbolize modern culture, has the relationship between science and modern culture been illustrated? Regarding the aforementioned concerns, my response is that knowledge, authority, and organizations—as already mentioned—are the attitudes of life. Attitudes towards life are also our perceptions of objects and motivation for our actions. It is acknowledged that the spirit of science is to search for the truth, whose function is to guide humans to aesthetics and goodness. Can our philosophy of life truly progress this far? It is unnecessary to give science praise that is unworthy of the name, and there is no need to be pessimistic about the future of humankind. We could say that the impact of science on our attitudes towards life is to demand reasonableness in all situations. Utilizing rationality to explore nature, to guide the behaviors of humans' lives and to regulate human relationships is not only the feature of modern culture, but also the greatest contribution and value of science.

再有一些人说近代的文化是权力的文化、竞争的文化，所以弄到前几年的世界大战。科学既是近世文化的根源，也应该负这个责任。对于这个非难，我们

可以引法国大医学家巴士台 (Pasteur) 在他的巴士台学社开幕时候的一段演说来解释，也就作我这次讲演的结论。他说：

眼前有两个律令在那里争为雄长，一个是血和死的律令，他的破坏方法，层出不穷，使多少国家常常预备着在战场上相见；其他一个是和平、工作、健康的律令，他那救苦去痛的方法，也层出不穷。

Some also argued that modern culture was also the culture of authority and competition, which triggered the Great War in previous years. Since science is the origin of modern culture, it should also take responsibility. In terms of this blame, we could quote a speech by a French doctor named Pasteur at the inauguration ceremony of Pasteur Institute as a conclusion for my speech. He reckoned that there were two laws competing with each other. One commanded blood and death, causing endless destruction and preparing nations for sending soldiers to the battlefields. The other law brought peace, productivity and health, providing ceaseless solutions for healings and savings.

一个所求的是强力的征服，一个所求的是人类的拯救。后者看见一个人的生命，比甚么战胜还重大，前者牺牲了千万人的性命，去满足一个人的野心。我们奉行的律令，是后一个，就在这杀人如麻的时代，还希望对于那前一个律令的罪恶，略加补救。我们用了防腐的药，不晓得救活了多少受伤的人。这两个律令中那一个能得最后胜利，除了上帝无人知道；但是我们可以说，法国的科学是服从人道的律令，要推广生命的领域的。

The former seeks the conquest of strong power, and the latter pursues the salvation of humanity. The latter regards a person's life as more significant than any other victory in the war, while the former sacrifices the lives of millions to satisfy one person's ambition. The law we pursue is the latter one. In this age of rampant killings, we also hope for a little remedy for the sins of the former law. The antiseptic medicine we used saved a large number of the injured. Except for God, nobody knows

which one of the laws can be the final winner. But from our perspective, what French science is working on is to follow the law of humanity and to promote the health of humans.

“服从人道的法律令，推广生命的领域”，不只法国的科学是这样，世界真正的科学是无不这样的。

“Follow the laws of humanity and promote the health of humans.” This holds true for both French science and science around the globe.

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