物理专业
英语阅读文选

上册

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What Is Scientific and Technical English

When you read a piece of scientific and technical writing in English for the first time, or when you first hear scientists or engineers talking in English, you may find it very difficult to understand what is written or spoken, particularly if you have learned English as a language of everyday conversation and of literature. You may think that there is a special kind of English which is used only in science and technology and which has to be learned as a separate language. You may also feel that somehow the English of science and technology is much more difficult than everyday English. In fact, technical English does differ from everyday English, because of the specialized contexts in which it is used and because of the specialized interests of scientists and engineers. But the differences do not present any great problems once they have been recognized.

The following passage illustrates some of the features of technical English:

Dr. Brown Good morning, Mr. Smith. Can I take your coat? Awful weather, isn't it? Do sit down. Cigarette?

Mr. Smith No, I don't smoke, thanks very much.

Dr. Brown Well, I've been looking into your enquiry about the corrosion trouble you've been getting in the control valve. I'm sorry you've had trouble -- quite unexpected -- but I think we have the answer. The most probable cause of corrosion at a metal-to-metal junction immersed in an ionized fluid is electrolytic.

In this passage, Dr. Brown begins by talking informally to his visitor, but when he talks as an expert about his specialized subject--corrosion--his way of talking changes. His statements are impersonal, his style of speech is formal and he uses many technical terms.

Now here is an example of scientific writing in English.

If the coordinate X of a particle moving on the X-axis is given as a function of time, the velocity can be found by differentiation, from the definition $V=dx/dt$. A second differentiation gives the acceleration, since $a=dv/dt$. We now consider the converse process: given the acceleration, to find the velocity and the cordinate. This can be done by the methods of integral calculus. We shall discuss first the indefinite and then the definite integral.

Suppose we are given the acceleration $a(t)$ as a function of time. Then, since

$$\frac{dv}{dt} = a(t),$$

we have

$$dv=a(t)dt, \quad \int dv=\int a(t)dt,$$

and

$$v= \int a(t)dt + C_1,$$

where C_1 is an integration constant whose value can be determined if the velocity is known at any time. It is customary to express C_1 in terms of the velocity v_o when $t=0$.

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The whole of this passage is in formal style, with a very high concentration of technical terms and a number of physical and mathematical symbols.

The Scientific Attitude

What is the nature of the scientific attitude, the attitude of man or woman who studies and applies physics, biology, chemistry, geology, engineering, medicine or any other science?

We all know that science plays an important role in the societies in which we live. Many people believe, however, that our progress depends on two different aspects of science. The first of these is the application of the machines, products and systems of applied knowledge that scientists and technologists develop. Through technology, science improves the structure of society and helps man to gain increasing control over his environment. New fibres and drugs, faster and safer means of transport, new systems of applied knowledge (operational research) are same examples of this aspect of science.

The second aspect is the application by all members of society, from the government official to the ordinary citizen, of the special methods of thought and action that scientists use in their work.

What are these special methods of thinking and acting? First of all, it seems that a successful scientist is full of curiosity — he wants to find out how and why the universe works. He usually directs his atention towards problems which he notices have no satisfactory explanation, and his curiosity makes him look for underlying relationships even if the data available seem to be unconnected. Moreover, he thinks he can improve the existing conditions, wheth- er of pare or applied knowledge, and enjoys trying to solve the problems which this involves.

He is a good observer, accurate, patient and objective and applies persistent and logical thought to the observations he makes. He utilizes the facts he observes to the fullest extent. For example, trained observers obtain a very large amount of information about a star(e.g. distance, mass, velocity, size, etc.) mainly from the accurate analysis of the simple lines that sppear in a spectrum.

He is sceptical — he does not accept statements which are not based on the most complete evidence available — and therefore rejects authority as the sole basis for truth. Scientists always check statements and make experiments carefully and objectively to verify them.

Forthermore, he is not only critical of the work of others, but also of his own, since he knows that man is the least reliable of scientific instruments and that a number of factors tend to disturb impartial and objective investigation.

Lastly, he is highly imaginative since he often has to look for relationaships in data which are not only complex but also frequently incomplete. Furthermore, he needs imagination if he wants to make hypotheses of how processes work and how events take place.

These seem to be some of the ways in which a succe- ful scientist or technologist thinks and acts.

Pure and Applied Science

As students of science you are probably sometimes puzzled by the terms 'pure' and 'applied' science. Are these two totally different activities, having little or no interconnection, as is often implied? Let us begin by examining what is done by each.

Pure science is primarily concerned with the development of theories (or, as they are frequently called, models) establishing relationships between the phenomena of the universe. When they are sufficiently validated, these theories (hypotheses, models) become the working laws or principles of science. In carrying out this work, the pure scientist usually disregards its application to practical affairs, confining his attention to explanations of how and why events occur. Hence, in physics, the equations describing the behaviour of fundamental particles are said to be examples of pure science (basic research), having no apparent connection (for the moment) with technology, i.e. applied science.

Applied science, on the other hand, is directly concerned with the application of the working laws of pure science to the practical affairs of life, and increasing man's control over his environment, thus leading to the development of new techniques, processes and machines. Such activities as investigating the strength and uses of materials, extending the findings of pure mathematics to improve the sampling procedures used in agriculture or the social sciences, and developing the potentialities of atomic energy, are all exmaples of the work of the applied scientist or technologist.

It is evident that many branches of applied science are practical extensions of purely theoretical or experimental work. Thus the study of radioactivity began as a piece of pure research, but its results are now applied in a great number of different ways -- in cancer treatment in medicine, the development of fertilizers in agriculture, the study of metal-fatigue in engineering, in methods of estimating the ages of objects in anthropology and geology, etc. Conversely, work in applied science and technology frequently acts as a direct stimulus to the development of pure science. Such an interaction occurs, for example, when the technologist, in applying a particular concept of pure science to a practical problem, reveals a gap or limitation in the theoretical model, thus pointing the way for further basic research. Often a further interaction occurs, since the pure scientist is unable to undertake this further research until another technologist provides him with more highly-developed instruments.

It seems, then, that these two branches of science are mutually dependent and interacting, and that the so-called division between the pure scientist and the applied scientist is more apparent than real.

How Scientists Solve Problems

A famous modern philosopher has said, "Science begins in wonder and ends in wonder." Can you figure out what he meant? He has saying that scientists begin a study by wondering how, or why, something happens. The study ends with scientists wondering how to approach the new problems revealed by their discoveries.

From ancient myths and legends you know that men have always tried to figure out why and how things happen. They have always wondered about the rising and setting of the sun, the moon, and stars. They have been puzzled by the regular occurence of the seasons. They have wondered about death and illness.

When these early peoples saw something they could not understand, they invented explanations. They said a sick person was invaded by demons. A sudden midsummer hailstorm causing damage to growing crops was the work of an evil witch. Plagues and droughts were punishments by angry gods.

In general, people have wondered about things that happen regularly, such as the change of seasons, or the appearance of night and day, or the growth of corn. They have also wondered about occasional events that hurt or helped them. The terrifying experiences of disease, crop failures, drought, and floods had to be explained. Once the wise men, the priests, or the witch doctors gave an explanation, the events seemed somewhat less terrible.

Until a few hundred years ago, people usually explained strange events as the result of supernatural forces. There were gods of sea, air, and forest; demons, and devils. The workings of their strange powers could never be foreseen. It was felt that disaster could be prevented only by making sacrifices to the gods or devils, or by muttering strange incantations.

About 300 years ago, modern science began. This science was a wonderful new way of finding out how and why things happen. It was based upon observation, upon experiment, and upon measurement. It was also based upon beliefs. Some of these beliefs have not yet been proved. Perhaps they never will be. Nevertheless, these beliefs are the foundation of modern scientific work.

Scientists believe, for example, that things happen in a regular and orderly way everywhere in the universe. This means that events in our physical world can be predicted. If you cut your finger, it will bleed. If you throw something up into the air, it will fall to the ground.

A scientist describes these regular and orderly ways as scientific principles. Scientists believe that every event in the physical world can be explained by these scientific principles.

During the first moon shot in 1958, the Pioneer did not follow the course it was supposed to follow. The space scientists did not say, as early men might have said, that some angry god had interfered. Instead they studied the Pioneer's flight and went back over their plans to see what had gone wrong. We believe that there are natural causes for everything that happens in our physical world.

Scientists find the world a fascinating place. They want to know more and more about why things happen as they do. Some scientists are especially interested in making new materials; they work in chemistry. Others are interested in heat, light, or electricity; they work in physics. Others want to know what happens inside the cells of plants or the human body. They work in the field of biology.

There are two kinds of work that scientists do. Some of them do basic research, which is pure science. They investigate the basic principles that govern our physical world. Other scientists work in applied science. These scientists use the findings of pure science. They might, for instance, develop an air-conditioned space suit to safeguard astronauts.

Workers in basic research are not concerned with whether or not their work has any practical value. They hope it will have, but their principal job is to find out the truth. The important thing to note is that applied science depends mainly on pure science. If our nation work in pure science slow down, the inventions of engineers, technicians, and applied scientists will slow down, too. practical scientists need new ideas to work with.

Many scientists spend much of their time in laboratories or field observations. Other scientists never go near a laboratory. Albert Einstein worked in his study with pen and paper, or with chalk and blackboard.

Scientists also use libraries. There are literally hundreds of scientific journals and magaxines in which scientists report their work. Many scientists can read French and German reports. A few can read Russian.

When a scientist starts work on a new problem, he may begin by studying what other scientists have done. This reading may give him the answer to his problem. It may give him reports of experiments that he can try. It may give him ideas to try out for the first time.

Every year there are hundreds of scientific meetings where scientists talk over their problems, their work, and their findings. Science is endless. It stretches far out into the future. As one famous scientist has said, "No invention is perfect. Nothing has been done that cannot be done better."