FROM LEARN-TO-READ
TO READ-TO-LEARN

当代高级科技英语

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前　言

成功的英语学习者其英语大都经历了从精确走向模糊再从模糊走向精确的过程。英语学习的早期阶段学习者对所学的内容有明确无误的理解。随着学习内容的增加，随着接触的英语资料范围的扩大，学习者就进入了似懂非懂的阶段。这一阶段我们称之为LEARN-TO-READ 阶段。这并不是说学习者的英语水平反不如以前了，而恰恰说明学习者的英语水平已经到了一个相当程度，但是这一程度尚不足以把英语作为真正的交际工具使用。在此基础之上急需解决的是从模糊上升到新高度上的精确。这一阶段我们称之为 READ-TO-LEARN 阶段。这一阶段完成了，学习者的英语才可以说真正具有了实用价值。

大学英语四级教学基本上属于 LEARN-TO-READ 范畴。这方面在教材上教法上都已成形。四级之后学生虽已掌握了听说写等基本知识和技能，但是其英语距离实际应用还有一定的距离。本书就是为了缩短这个距离帮助学习者完成真正读懂原文而编写的。本书所选文章均为未经任何删改的外刊完整科技论文。出自当代国际上权威科技期刊：NEW SCIENTIST，SCIENTIFIC AMERICAN，AMERICAN SCIENTIST 等。文章中讨论的问题是每个科技工作者不论其专业若何都应该了解至少是知道的当代科学前沿问题或基本理论方面的热点问题。我们希望学习者通过此书将不但会读而且读会科技文献原文，获取知识；会写科技论文摘要；掌握科技论文的基本撰写方法；扩大词汇量 1500—2000 个。本书课文有一定难度，提请读者注意两个动词：to be 和 to do。英语中的句子虽不可胜计但谓语动词却不外乎 be 或 do。将这一点把握住了，再难的句子也不难理解了。我们希望本书能够弥上我国现行科技英语教材编写中的一个小小缝隙。

本书选材范围广，伸缩性强，既可作为大学英语四级后的学生准备六级考试之用，也可以作为研究生，科技英语专业、英语专业高年级学生、教师及具有中高级英语水平的科技工作者提高英语能力使用或参考。

本书讲义曾在哈尔滨科学技术大学从88级到92级四级后使用并在大庆石油学院部分地试用，学生们对此提出一些宝贵意见，在编写和正式出版过程中得到学校和出版界等多方帮助，借此出版之际作者对此深表谢意。

本书第1篇、第3篇、第4篇、第6篇、第9篇、第12篇由于宪英执笔；第2篇、第5篇、第10篇、第13篇由张秋霞执笔；第7篇、第8篇、第11篇由单兴缘执笔。最后由单兴缘统稿，张明君主审。作者虽然本着"增损一字重千金"的精神，错误之处仍恐难免，敬请专家、读者批评指正。

编　者

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目　　录

1. The importance of being emotional

Recent theories in cognitive psychology allow us to understand that emotions are not especially irrational. Rather, they are important in the management of our goals and actions ——***Keith Oatley***

WE are ambivalent about our emotions. Sometimes they seem to make us think in a distorted way. To say that someone is being emotional is to be insulting. But on the other hand, we regard emotions as important to our humanity. To be without them would be less than human.

This ambivalence is depicted in science fiction. Mr Spock of *Star Trek* is superintelligent and without emotion. But he is a lonely figure—not the person to identify with as one boldly goes across the universe[1]. So the question is, do emotions impede rationality? If we were fully rational, would we need them? Would an intelligent being from another planet have emotions? Would a robot? Are emotions an important part of being human?

And if so, how?

Perhaps science can help to answer such questions. Most important here has been the work of Charles Darwin. His book published in 1872, *The Expression of the Emotions in Man and the Animals*, touches on a fundamental dilemma about the nature of emotions, and the way we view them.

Darwin thought of emotional expressions as vestiges of patterns of action that once were useful, but are so no longer. Earlier studies of anatomical vestiges had provided evidence for evolution. We have, for instance, a row of vertebrae at the base of our spine which indicate that our ancestors had tails. Now that we are tail-less, these bones have no function. It is the same with emotional expressions, Darwin argued. He wrote that their study "confirms to a certain limited extent the conclusion that man is derived from some lower animal form".

With this theory, Darwin gave support, perhaps unintentionally, to an intuition already strong in Western culture, that emotions are subverters of reason, matters for infants and beasts, but scarcely to be approved of in adult humans.

At the same time, he admitted that emotional ex-

pressions are important for human welfare. He stopped short of saying that they have functions—that is, that they have evolved because they are adaptive in some way[2]. To do so would have contradicted his observation that many emotional expressions are not functional in many circumstances. He collected evidence of activity that was superfluous to efficient action: tears that do not serve to lubricate the eyes, hair that stands on end, adding nothing to the skill of an attack, laughter that seems not to improve the execution of any task. He would have been fascinated by the expressions of people talking on the telephone.

So we are left with a problem: how can emotions be important, when their expressions can happen, whether or not they serve any purpose, and sometimes seem irrational?

Darwin, of course, was primarily interested in expressions of emotion as evidence for evolution. But the issues he explored point to another direction which helps to resolve the paradox. It is this: mammals and birds often find themselves in situations where they lack appropriate patterns of behaviour—when they are not fully adapted to an environment that has changed or when no habit or instinct fits a situation. Could emo-

tions be important as part of the solution to the problem of what to do at these junctures? Could they be useful because they prompt us towards certain types of action when perhaps we should do something, but lack a well-adapted way of acting?

Over the past 20 years or so, cognitive psychologists have begun to answer "Yes" to such questions. They have studied phenomena of the kind that Darwin described, but perhaps because they no longer need to argue as staunchly as he did for the theory of evolution, they have come to a conclusion more appropriate to understanding emotions themselves. It is that emotions are not just vestiges of an infantile and bestial history. They are important now in our lives, in the everyday management of action.

The issue turns out to be a very general one. It would apply not just to us, but also to Martians, or to general-purpose robots. It would apply to any intelligent being that makes new goals and plans as it goes along, if that being had only imperfect knowledge and other limitations of its resources, if it had a number of goals that were not always mutually consistent, if it needed to cooperate with others.

Ronald de Sousa, in *The Rationality of Emotion*,

puts the problem like this: we are neither completely determinate machines, nor angels with pure and rational wills. We are somewhere in between. Let me enlarge on this idea.

We can think of insects as being equipped with patterns of action shaped by natural selection for their particular form of life, and perhaps for particular patterns of interaction with other members of their species. Insects have so-called fixed action patterns that are triggered by stimuli, and this arrangement works well for them. An insect can be thought of as a little automaton, programmed by genetics. These action patterns can be directed in various ways, but the basic patterns are wired in. Where the insect does learn something—for instance, where an object is—it is mainly by a process in which the relevant information is inserted in slots that accept these data. Similarly, although we may think a swarm of bees seems "angry", this may be an inappropriate assumption. More probably, the members of the swarm are displaying action patterns that have been triggered off. In general, insects do not have much need for emotions.

By a comparable argument, there is even less question of whether present types of robot have emotions.

The reason is that a robot is an engineering means of achieving just one goal at a time. Like many such solutions, it requires the world to be simplified somewhat. The wheel was certainly a good idea, but to work properly it has needed parts of the Earth's surface to be made hard and flat. Similarly, robots work well, but only in the simplified situation for which they are designed, perhaps to assemble a part of a car. In their world, nothing unexpected happens. They can be programmed fully and rationally, precisely because they must fulfil one single function at a time, in a known and simplified environment.

We are not insects or robots—but neither are we gods. If we were, we would be all knowing, all seeing, omnipotent. For such beings, nothing unexpected could happen. Everything would be subordinated to a grand design, and a rational will. Instead, we are somewhere in between, neither automata nor omnipotent beings. We act with a degree of voluntariness and rationality, but because we are not all knowing our actions often have consequences we do not anticipate. Moreover, we have not one grand design, but many rather smaller goals, which are not always clear cut or compatible with each other. Sometimes when we act in pursuit of one of

them, something happens that is relevant to another. And, rather than being like ants whose interactions with other ants are programmed, people make arrangements in the tasks that they share with others, and these may turn out differently from any one person's plans.

To understand emotions, we need to know when and where we tend to experience them. In fact, we tend to experience them at just the points that happen frequently to higher animals including humans, but hardly ever to automata or gods. They arise when something unexpected happens, a situation to which we are not fully adapted, an event at which two different concerns clash, or when someone else does something more or less than we expected.

So we need some mechanism that can do three things. First, it must be able to handle interruptions and potential interruptions. It must signal when something urgent happens, or something that makes it necessary to abandon a plan, or when we must respond to some person with whom we have joint interests. At the same time, if we are doing something important to us, this same mechanism should screen out events of lower priority, and help us to continue with what we are doing.

Secondly, when a potential interruption does arise, the mechanism must be able to change priorities, and manage the problem of whether and how we should make a transition from one activity to another.

Thirdly, because some events are both important and unanticipated, we might want to reprogram ourselves in the light of whatever new knowledge we have acquired as a result of these events. This would be learning of a kind that is not just taking on specific data, but which involves making new plans or modifying existing goals. The mechanism must allow us to concentrate on reprogramming ourselves, even though the urgency of the moment has passed.

These functions correspond rather closely to what happens with emotions. Emotions happen when certain events affect our goals. Here we need to distinguish between emotions and moods. Emotions arise suddenly, and they last for seconds or minutes. Moods are emotional states that may be more vague, and they last for hours or days. The distinction between emotions and moods is like that between two types of muscular activity: contractions, which change the position of a limb, and muscle tone, which maintains posture. Discrete emotions are concerned with changing something, and

moods with maintaining something.

Emotions have five salient characteristics: first, they usually include an involuntary urge to act; secondly, there is often some bodily perturbation; thirdly, there is usually distinctive conscious feeling; fourthly, recognisable expressions of emotion, such as smiling or frowning, occur; and fifthly, thonghts may come to mind involuntarily and may reverberate for some time. We can explain these five characteristics by the idea that emotions manage transitions, or potential transitions, between different goals and plans.

Focusing on the first of these characteristics, most theorists now agree that emotion must be understood in relation to action. Emotions involve readiness and involuntary predispositions to act. Philip Johnson-Laird, of the Medical Research Council's Applied Psychology Unit at Cambridge, and I have devised a cognitive theory to explain some of these issues. We propose that all our various emotions are based on just a few distinctive mental states that go with readiness for action, and that each is set off when we evaluate an event in relation to our goals®.

We suggest that events are evaluated, consciously or unconsciously, in terms of the following categories:

the achievement of minor goals in solving problems as they arise; the loss of a goal; the frustration of a plan or goal by some person or circumstance ; a conflict of goals including conflict with a goal of self-preservation; and the perception that something or someone is noxious. Each evaluation produces a mental state that is a basic emotion. The nearest English terms are happiness, sadness, anger, fear and disgust.

If we are happy, we are ready to keep going with what we were doing, and we may adopt expressions such as smiling. If sad, we become ready to do nothing for a while, perhaps hoping to be rescued, or hoping to change our plans. Perhaps we cry. If angry, we prepare to make redress of some kind. If frightened, we may freeze, or prepare to flee, or perhaps even to fight. If disgusted, or experiencing the interpersonal form of disgust known as hatred, we withdraw and may sneer and belittle the person concerned.

The mechanism is not that of the fixed action pattern—the stereotyped behaviours performed by some animals in some situation. In a changeable environment, we could not be properly programmed in advance. But neither do we depend solely on ordinary thinking, which is slow and prone to error—in any

case, we seldom have the necessary knowledge to come to a rational conclusion. Instead, evolution seems to have provided us with an intermediate mechanism that involves being able, at each juncture, to make ready one of several small repertoires of action.

The mechanism must enable us to evaluate a situation, to interrupt what we are doing, and to move towards actions that are appropriate to a recurring type of juncture. The mechanism simplifies the choices available to us. Then, once the moment of what to do immediately is passed, the same mechanism may prolong the state into a mood—a period in which we may think consciously about what has happened, and plan what to do next.

Although there are just five basic emotions, there is an indefinite number of specific emotions, each made up of the basic emotions plus information about what caused it, or to whom it is directed. So being in love is a kind of happiness directed towards another person, with sexual implications. Jealousy, on the other hand, is based either on hatred or perhaps on anger, and caused by a possibility of being displaced from a love relationship by a third person. Johnson-Laird and I believe that the semantics of nearly 600 English words for emotions

can be understood in this way.

We propose that it has been cognitively efficient for people to be ready to evaluate events in these five basic ways, and that evolution has selected for these states. When events evoke any one of the five, appropriate habits and any genetically programmed instincts are made ready.

Take, for example, the initiation of fear: let us say that we use "fear" for a discrete emotion, and "anxiety" when it is prolonged into a mood. Some part of the whole cognitive system—everything that enables us to perceive and think—detects a danger. There may be no single thing to do that is best, no fixed action pattern. But on the other hand there is usually neither the time nor knowledge to think through the best course of action. So evolution has equipped us with an intermediate mechanism based on an emotion. The recognition of a danger, in relation to the concerns about ourselves that we have, triggers a state of fear which summons, as it were, a small suite of action patterns derived from genes and habit.

As Jeffrey Gray of the Institute of Psychiatry in London has proposed, the actions that are prompted include stopping what we were doing when we become