
UNIT 15 From “BRAIN RESEARCH & HUMAN RESPONSIBILITY”

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15.0 OBJECTIVES

In this unit our aim is to give you practice in reading comprehension by (a) setting a passage dealing with brain and automata, and (ii) giving a glossary of difficult words, and questions on comprehension. We have also set exercises on some items of vocabulary. The section on grammar and usage introduces you to the use of contrastive conjunctions and adjectival clauses. For practice in writing, you must first take down the main points used in the passage set for reading comprehension, and then write a paragraph based on these points in about 150 words.

15.1 READING COMPREHENSION

15.1.1 Study Guide

The aim of this section is to help you to read with understanding and to expand your vocabulary. It has a reading passage, followed by a glossary. You should first read the whole passage silently and quickly to get the main points. Then you should read it once again, slowly and carefully, to comprehend all the details. You should also consult the glossary for the meanings of unfamiliar words and phrases from the contexts in which they appear.

After you have read and understood the passage, you must answer all the questions. You should then check your answers with the answers given by as at the end of the unit.

15.1.2 Passage for Reading

The great surge forward in brain science in the present century has resulted from a coincidence of advances on many different fronts. Developments in microscopy, including the art of selective staining of nerve cells, have told us more about the way cells interconnect than we know how to use. The rise of electronics has produced a whole battery of sensitive tools that allow us to stimulate, record and analyze the chatter of electrical activity that goes on in the ten-thousand million-strong neural population and even in the minute individual members of it. Workers in biochemistry and related fields have begun to trace intricate patterns of chemical interaction that add a new dimension to our already complex map of the brain and greatly enlarge the cabinet of drugs whereby its behaviour can be modified for good or ill.

But perhaps the most far-reaching influence on brain science has come from quite another direction. The need for automatic machinery to take the place of human operators in dangerous, boring or other-wise undesirable occupations has forced engineers and psychologists to co-operate in an unprecedented effort to understand and specify the mechanisms of intelligent action. Although this hybrid "Cognitive science"(whose components go by such names as "automata theory", "autonomies," communication and control theory, "cybernetics," and "artificial intelligence") is only a few decades old, it has already revolutionized the way in which brain scientists think of their problems. Let me emphasize that this does not mean they drew detailed comparison between brains and present-day computing machines.

Our present electronic computers work on quite different physical principles from the nervous system, and the difference between them and the brain are probably more significant than the resemblances. What it does mean is that the habits of thought of the automation engineer have powerfully shaped the kind of question brain scientists ask, and the kind of answer they may accept is satisfactory. It now comes as second nature to them to think of the brain as a protoplasmic way of engineering the kinds of information-processing functions that we have found necessary to produce intelligent, goal-directed behavior in our automata. The brain may well be more than that; but it is at least amenable to a great deal of detailed explanation in these mechanistic terms. Hypotheses framed in such terms have led to an astonishingly fruitful crop of experimental results, and they show every sign of continuing to do so. Conversely, the merchants of "artificial intelligence" are becoming ever more sophisticated in the kinds of tasks for which they can produce formal written instructions. In working out their ideas, they find that a computer serves as an invaluable "test bed," because it can relentlessly expose any flaws in a hypothetical model and allows them to discover(or obliges them to face)unexpected as well as expected consequences of their speculations.

(From **Brain Research and Human Responsibility** by Donald M.Mackay)

15.1.3 Note on the Author

Donald M.Mackay is Granada Research Professor in the Department of Communication at the University of Keele, staffordshire, England. He is a distinguished specialist in analogue computing and brain Psychology. He is a fellow of the Institute of psychology and a member of the Experimental Psychological Society, the Physiological Society, and the International Brain Research Organisation.

15.1.4 Glossary

(The numbers refer to the lines in the reading passage.)

surge :	progress
resulted :	come about, happen, as a natural consequence
coincidence :	events happening at the same time
advances :	progress
fronts :	fields (or areas of activity)
microscopy :	a science of studying very small things with the help of a microscope
selective staining :	to colour some parts so as to show composition and structure of nerve cells
electronics :	study and application of phenomenon of electrons (as in radio/television etc.)
stimulate :	excite, rouse
chatter :	indistinct sounds, noise
neural population :	nervous system
biochemistry :	chemistry of living matter
intricate :	complex
interaction :	acting on each other
cabinet of drugs :	several medicines
far reaching :	significant
human operators :	workers
undesirable :	objectionable, of a kind not to be welcomed in society.

specify :	mention definitely
hybrid :	mixed, from parents of different species or variety
cognitive science :	dealing with human brain
automata :	a machine capable of functioning independently of any direct or immediate stimulus from outside
cybernetics :	the study of communication and control mechanisms in machines and in living creatures
decades :	series of ten years
analogies :	likeness
resemblances :	similarities
shaped :	influenced
second nature :	acquired tendency that has become instinctive
amenable :	liable or subject
mechanistic terms :	in mechanical terminology
hypotheses :	plural of hypothesis ; ideas or suggestions put forward as starting points for reasoning or explanation
astonishingly :	surprisingly
fruitful crops :	useful results
conversely :	on the other hand
merchants :	researchers or engineers
artificial intelligence :	computing machines (e.g. computers)
sophisticated :	complex, advanced
invaluable :	precious
test bed :	something on which one can conduct experiments
relentlessly :	mercilessly
flaws :	faults

15.1.5 Comprehension Questions

Exercise 1

Answer the following questions on the passage you have read (section 1.1.2). You may refer to the passage again to find the answers. After you have written the answers, you should check them with the answers given by us at the end of the unit.

1. Name the disciplines which have helped brain science to make progress in the present century.
2. In what ways have developments in microscopy helped brain science?
3. What aspects of the human brain does electronics study?
4. In what way is research in biochemistry and related fields able to modify the behaviour of the brain?
5. What factors have influenced brain science most?
6. What did the engineers and psychologists try to find out jointly?
7. Why is cognitive science called 'hybrid'?
8. What revolution has cognitive science brought about?
9. In what ways have automation engineers influenced the brain scientists?
10. Is the brain completely analysable in mechanistic terms?
11. What has led to an astonishingly fruitful crop of experimental results?
12. Who are the merchants of artificial intelligence?
13. How does a computer help the merchants of artificial intelligence?

15.2 VOCABULARY

Exercise 2

Refer back to the passage and find synonyms (i.e. words with similar meanings) for the following words. The synonyms can be found in the line number indicated against each word.

Example	Word	Synonym	
1.	Faults	(1.50)	flaws
2.	Progress	(1.2)	_____
3.	Excite	(1.7)	_____
4.	Mixed	(1.22)	_____
5.	Likeness	(1.29)	_____
6.	Yield	(1.44)	_____
7.	Precious	(1.49)	_____
8.	Reveal	(1.50)	_____
9.	Guesses	(1.53)	_____

Exercise 3

Look at the underlined parts of the following words from the passage:

Undesirable

Unprecedented

Unexpected

The Un- in these words is called a prefix. Pre means before; a prefix, therefore, is what comes before a word. Prefixes generally change the meaning of a word. Un- changes a word to the negative. Undesirable means something 'not worth having'. Similarly, Unprecedented and Unexpected mean 'never done or known before', and 'not expected' respectively.

Look at more negative prefixes in English.

Prefix	Meaning	Example
Un-		Unhappy, unmagnetized
In-		inaccurate, incomplete
In-	not,	impossible, important
Il-	not good	illegitimate, illiterate
Ir-	not	irrelevant, irregular
non-	not connected with	non-programmable
mis-	bad, wrong	mispronounce
dis-	Opposite feeling, opposite action	disagree, disconnect
anti-	Against	anti-social
de-	reduce, reverse	demagnetize, decode
under-	too little	underestimate, underpaid

Make the following words negative by adding the appropriate prefix :

1. Satisfied	_____	2. Animate	_____
3. Congruous	_____	4. Refutable	_____
5. Accustomed	_____	6. Construed	_____
7. Admissible	_____	8. Probable	_____
9. Legible	_____	10. Believable	_____
11. Collegiate	_____	12. Fortune	_____
13. Deed	_____	14. Own	_____
15. Replacable	_____	16. Palatable	_____
17. Inherit	_____	18. Malarial	_____
19. Removable	_____	20. Different	_____
21. Forestation	_____	22. Embark	_____
23. Valuation	_____	24. Climax	_____
25. Poper	_____	26. Carbonise	_____

15.3 GRAMMAR AND USAGE

15.3.1 Conjunctions

This section will introduce you to the concept of conjunctions, and give practice in contrastive conjunctions. Conjunctions are words that join words, clauses etc. These words are also known as linking or joining words. 'And', 'but', 'because', 'although', 'conversely' are examples of conjunctions used in the present passage. When the writer wants to express that what has been said before is true or correct, but what follows is, in contrast, also true or correct, the following conjunctions are used : but, although, though, however, nevertheless, on the other hand, inspite of, nonetheless, despite that, even if, even though.

Examples for some of these conjunctions are given below :

1. He is slow but he is sure.
2. Although a computer can only respond to a certain number of instructions, it is not a single-purpose machine.
3. Though he didn't help me, I was not angry with him.
4. All were against him, nevertheless he did not change his policy.
5. Even if you don't like him you can still be polite.
6. The quality of the goods was excellent. However, the prices were for too high.

Exercise 4

Now join the following groups of sentences. Use the words underlined at the beginning of each group. You may omit words and make whatever changes you think are necessary in the word order and punctuation of the sentences :

But

1. A computer can replace people in dull, routine tasks.
It has no originality.
2. Moving-iron meters can measure AC voltages without a rectifier. Moving-coil meters with rectifiers are preferred.

Although

3. All metals are conductors. Some metals don't conduct well.
4. The unit of capacitance is farad. Capacitance is usually measured in microfarads or picofarads.

However

5. A fuse is the simplest and the cheapest protection. For accurate and repetitive operation a circuit breaker is used.
6. In an ideal transformer there will be no loss. In practice there is always some loss.

On the other hand

7. The control unit transmits coordinating control signals and command. The arithmetic-logical unit performs the arithmetic and logical operations called for in the instruction.

8. He failed. He continued to work hard.

Even if

9. You have studied French for ten years. You won't get an interpreter's job.

10. She is eating alone. She spends hours cooking dinner.

15.3.2 Adjectival Clauses

Read the following sentences from the present passage :

1. The rise of electronics has produced a whole battery of sensitive tools that allow us to stimulate, record and analyse
2. Workers in biochemistry and related fields have begun to trace intricate patterns of chemical interaction that add a new dimension to our already complex map of the brain

Both the underlined sentences are examples of adjectival clauses. The adjectival clause in the first example qualifies the noun phrase 'sensitive tools' and in the second example 'intricate patterns'. Note that in the first case the adjectival clause follows the noun phrase it modifies, whereas in the second case it is separated by several words. If the adjectival clause is separated from the noun/nounphrase/ pronoun it modifies it may be difficult for the reader to decide which part of the sentence the adjective clause is modifying. For example, in the second example cited above the reader may think that the adjectival clause is modifying the nounphrase 'chemical interaction' because of its proximity to the adjectival clause. Consequently, to help the reader, the writer must place an adjective clause as close as possible to the word(s) that it is modifying.

Relative pronouns that refer to person may differ from relative pronouns that refer to things. Generally, 'who' is used for persons 'which' for things. You can use 'that' for both persons and things.

For example, the following sentences

A millimeter is an instrument. The instruments is used for measuring small currents.

Can be combined by using either 'which' or 'that' :

A millimeter is an instrument which (or that)is used for measuring small currents.

Exercise 5

Now combine the following sentences by using 'who', 'which' or 'that' :

1. The coil is connected in series with a resistor.
The resistor has a value of 240 ohms.
2. Desert perennials have special features.
These features enable them to survive as plants for several years.
3. She spoke to someone else.
He had saved her life.
4. He found this news in a magazine.
The magazine is now lost.
5. Workers require illumination of 300 lux
The workers assemble heavy machinery.
6. Manganin is a metal.
This metal has comparatively high resistance.
7. A programmer is a person.
He prepares programmes to solve problems.

8. Tapes and disks are memory devices.
They can be stored away for future use.
9. A computer is electronic devices.
It processes information.
10. Starter motor brushes are made of carbon.
The carbon contains copper.

15.4 WRITING

In this section we shall give you practice in paragraph writing.

Exercise 6

Write down the main ideas in the passage you have read in this unit and then write a paragraph of about 150 words. Don't forget to give a suitable title to the paragraph.

Main ideas

1. _____
 2. _____
 3. _____
 4. _____
 5. _____
- .
- .
- .

Paragraph

Title

.....
.....
.....
.....
.....

15.5 LET US SUM UP

In this unit we have given practice in

- i) understanding a science passage dealing with brain and machines,
- ii) finding out words having similar meanings,
- iii) negative prefixes in English,
- iv) distinction between the use of 'who', 'which', and 'that' in adjectival clauses,
- v) contrastive conjunctions such as 'but', 'however', 'although', and

- vi) writing a short paragraph based on the main ideas found in the reading comprehension passage used in this unit.

15.6 ANSWERS TO THE EXERCISES

Exercise 1

1. Microscopy, electronics, biochemistry, engineering and psychology.
2. Developments in microscopy have taught the art of selective staining of nerve cells, and how the cells are interconnected.
3. Electronics studies the electrical activity that goes on in the nervous system of the human brain.
4. It has developed new drugs to control human behaviour.
5. Brain science has been influenced most by the need for finding out automation machinery to save human beings from dangerous, boring or undesirable occupations.
6. The engineers and psychologists tried to find out the mechanics of intelligent action of human beings.
7. Cognitive science is called hybrid because it is the result of two disciplines, namely, psychology and engineering.
8. Cognitive science has made brain scientists look at their problems from a fresh perspective.
9. The automation engineers have shaped the kind of questions brain scientists ask, and the kind of answers they may accept as satisfactory.
10. No.
11. Hypotheses formed in mechanistic terms have led to a fruitful crop of experimental results.
12. The merchants of artificial intelligence are automation engineers.
13. A computer helps the merchants of artificial intelligence to try out their speculations.

Exercise 2

2. advances, 3. stimulate, 4. hybrid, 5. analogies,
6. crop, 7. invaluable, 8. expose, 9. speculations.

Exercise 3

1. dissatisfied, 2. inanimate, 3. incongruous, 4. irrefutable,
5. unaccustomed, 6. misconstrued, 7. inadmissible, 8. improbable,
9. illegible, 10. unbelievable, 11. non-collegiate, 12. misfortune,
13. misdeed, 14. disown, 15. irreplaceable, 16. unpalatable,
17. disinherit, 18. anti-malarial, 19. irremovable, 20. indifferent,
21. deforestation, 22. disembark, 23. undervaluation/devaluation,
24. anti-climax, 25. improper, 26. decarbonise, 27. decalcification,
28. understaffed, 29. non-metallic, 30. illegal.

Exercise 4

1. A computer can tasks but it originality.
2. Moving-iron meters.... rectifier but moving-coil meters preferred.
3. Although all metals..... some metals... well.
4. Although the unit of.... farad, capacitance is.... picofarads.
5. A fuse is.... protection. However, for.... used.

6. In an ideal.... no loss. However, in practiceloss.
7. The control....command, on the other hand, the arithmetic..... instruction.
8. He failed, nevertheless....hard.
9. Even if you years, you won't.... job.
10. Even if she..... ,she.... dinner.

Exercise 5

1. The coil.... resistor which (or that) has a 240 ohms.
2. Desert....features which (or that) enable....years.
3. She spoke....else who(or that) had saved....life.
4. He foundmagazine which (or that)....lost.
5. Workers who (or that) assemble heavy machinery require....lux.
6. Manganin....metal which (or that)resistance.
7. A programmer..person who (or that) prepares problems.
8. Tapes....devices which (or that) can beuse.
9. A computer....device which (or that) processes information.
10. Starter motor.... carbon which (or that) contains copper.