The literal indicative mood <u>Judgements</u>.

A TEXT- BOOK OF LOGIC

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TO
MY FATHER

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PREFACE

The time has not arrived when it is possible or
desirable to write a text-book of logic for elementary
students which departs very considerably from the
course that has been defined by university require-
ments in various parts of the world. Both in Eu-
rope and in America instruction in this subject has
to a large extent been controlled by what may be
called the classical tradition of which Aristotle and
Mill are the two fountain heads. In some quarters
this fact has operated as a hardship, and has led
to open, if rather one-sided, criticism of the subject's
educational usefulness, on the one hand, and has
directed attention to and aroused interest in the
real and supposed defects of the traditional logical
doctrine, on the other. The position both of those
who maintain the conservative attitude, and of those
who would substitute for the old some new kind of
logic, is capable of defence up to a certain point,
and there is no doubt that the stirring of the ca-
demic waters on this subject will result at some
time in a larger freedom in the choice of the mate-
rial and methods of logical instruction, and to that
extent will reduce the possibility of attributing to
the subject the imperfections of temper and under-
standing of those who teach it.

I hold no brief for traditionalism in logic, and
while I sympathise with and, according to my

ability, appreciate the value of much that the advo-
cates of the newer logics have contributed to our
knowledge of the methods by which the human
mind reaches truth, I have never been able to dis-
possess myself of the belief that the older logic
in some measure had enabled me to understand what
the newer logic had to say. Were I an artist, it
would be my desire to paint the ocean, just because,
I imagine, it is so constantly changing and withal
so eternally the sama A similar interest may
stimulate one to observe, in all the ways that modern
logic is making familiar to us, the wonderful change-
fulness and practical resourcefulness of the mind's
approach to truth ; but if one were to identify logic
with the observation and description of these shift-
ing phenomena, he would be in the position of the
man for whom the ocean was no more than the
waves that rose and fell and broke upon its bosom.
The human mind has a determinate structure, and
it is with that structure, so far as it is displayed in
the field of knowledge, that logic aims to make us
acquainted. And I do not believe that it has been
reserved for our own times to utter the only true
words on this subject, nor that we can afford to neg-
lect the teaching of the ancients. Aristotle defined
logic and formulated many of its methods in a way
that has given life to the subject for over two thou-
sand years, and much that is modern takes its point
of departure, either by way of criticism or refining,
from what he wrote in the beginning of the science's
existence. It is not to be understood, of course,

that the traditional doctrine stands in no need of
critical examination. The reverse is the fact. The
enormous increase of knowledge in the modern era
makes it necessary. But how are criticism and
revision possible if the subject is, as some seem to
think, wholly illusory, or if we remain in absolute
ignorance of the doctrine upon which criticism and
revision are to be directed?

It seems, therefore, that for some time to come
logic will continue, in the main, to be traditional,
and that books of logic will have to conform to the
requirements that are determined by that fact.
But there are all sorts and degrees of conformity,
and I confess to a liking for that kind and degree
which is not inconsistent with the exercise of the
largest liberty of one's academic conscience. It
would not be surprising, consequently, if it were

discovered that I had allowed the present situation
in logic to sit lightly upon me, and that, where it
seemed desirable, I had departed in method and doc-
trine from traditional views. It is I believe in some
such way as this, rather than in assuming a critical,
not to say captious, attitude toward the whole of
traditional logic that the best interests both of the
subject and of those who study it can be advanced.

It is hardly necessary to say that the present
book as a whole is the product of experience in
teaching logic to elementary and advanced students
of the subject, No one, I am convinced, should
attempt to write a text-book in any subject, and
certainly not in logic, who has not learned in the

practical way of teaching it where its main difficul-
ties are found, and who has not had an oppor-
tunity afforded him of devising methods of overcom-
ing them. For, in the first place, a text-book must be
written for the student, that is, for one who is
presumed not to know anything about the subject
of which it treats and, for him, the greatest service
that it can render is to stimulate an interest in the
problems with which it deals. But also it should
be an instrument in the hands of the teacher which
facilitates the task of teaching, and adapts itself
to the purposes that he may hold before himself
and the class. However far my book may be from
completely fulfilling these objects, I hope it has
entirely escaped the capital offence of substituting
itself, in the regard and thought of the student, for
the teacher, and that it can not be accused of
helping to degrade the teaching function to the
mere level of hearing a recitation. I trust, there-
fore, that there are many sections that will be
found to require the generative touch of the teacher,
and that what in his hours of preparation may
appear to the student as a valley of dry bones will
be vitalized by the teacher into living forms in the
hours spent in the lecture room.

I have given to the judgment a prominence in
the order of topics which I think is required for a
true comprehension of the problem of logic, and
have distinguished between it and the proposition
for the purpose of indicating the class of questions
which any attempt to express our judgments in

words quite naturally suggests. If I am not mis-
taken, current controversy in philosophy would
sometimes have been simplified, if indeed the occa-
sion for it were not entirely removed, if it had been
distinctly recognised that the judgment is not the
proposition, and that the problems of each are quite
distinct. A close relationship must, of course, be

recognised between judgments and propositions, but
I am not without hope that the separate treatment
of these topics will meet with the approval of my
colleagues, although it results in placing at the
very beginning what must be regarded as one of the
difficult chapters of the book. I do not believe that
the judgment chapter is insuperably difficult; it is
not more difficult, for example, than is the neuro-
logical material to which the psychologist introduces
his students at the very outset of their studies. And
I may say that the effort has been made to present
the subject in a manner as simple as is consistent
with the real complexity and difficulty of the prob-
lem. With a simplification which falsifies a topic in
the interests of easing the task of student or teacher
I have as little sympathy as I have with the reverse
method of creating or magnifying difficulties for the
good of the learner's academic soul. But we must
cultivate in ourselves and in those we teach the
ability to recognise a difficulty when and where it
exists, and to face it with determination, and this
requires from teacher or pupil neither apology nor
praise.

With respect to other features of the book, I
may, perhaps, be expected to say something in justi-
fication of the relatively detailed account that has
been given of the fallacies. There is, in fact, little
to say, and that little I trust will appear quite super-
fluous to any one who has read the chapters in
question. Both the mode of treatment and the
amount of space given to the subject have been
determined by the belief that the problem of falla-
cies has not received as a rule the recognition that
it deserves, and that it has not been correlated to
the main logical doctrines in a sufficiently organic
way. I do not wish to be understood to mean that
the chapters given here are at all adequate in these
respects to the importance I conceive the subject
to have. I have, however, sought to avoid leaving the
impression that the subject has no practical or pos-
itive significance, and have endeavoured to keep the
whole discussion in close relation to the body of
logical doctrine developed in the preceding chapters.
To leave the student with some degree of respect
for the topic as a whole seems to me to be decidedly
worth attempting, especially when the student is
one who is making acquaintance with the subject
for the first time. It will also be found, I think,
that the two chapters in which the fallacies are dis-
cussed lend themselves readily to the purposes of a
review of the main logical problems, and that the
new point of view from which these problems are
considered, the point of view, namely, of the sources
of error that lurk in the processes of logical thinking,

will not only relieve the review from the banalities
that usually attach to a twice performed task, but
may be found to make the problems themselves more
articulate and significant. At any rate, if we begin
our logical studies with the object of finding out
what is meant by truth, and what are some of the
forms in which truth exists, one would think that
a discussion of error or at least an examination of
some of the forms in which error exists, would
serve to emphasise the importance and the character
of logical problems. And, I confess, it seems to me
that no amount of technical skill in the manipulation
of technical formulae can compensate for any failure
to perceive that the problems of logic originate in
the effort to think and to express ourselves clearly
and correctly, and that, therefore, the science that is
devoted to the study of the principles of clear and
correct thinking is one in which any person that has
any pretense to education should have an interest.
And in this connection I may add that the questions
on the text appended to each chapter are designed
as much to stimulate such an interest as to test a
student's acquaintance with the details of the dis-
cussion; and if any apology for printing them or
for making them so numerous is needed, I can only
reply that my own students say that they have
found them useful.

I confess to a certain compunction in offering
to the public a book on logic which fails to discuss
in a systematic way the so-called laws of thought,
although I have never felt the necessity of apolo-

gising to myself for failing to expound to my ele-
mentary students so recondite a subject. I really
have never found that any attempt to interest be-
ginners in logic in this problem was satisfactory
either from my own or from their point of view.
The book, therefore, does in this particular conform
to my practice, and the justification that may be
offered is that it is pedagogically and scientifically
preferable for the student to discover some problems
for himself in the course of his studies than to force
them in a more or less artificial manner upon his
attention. There are places in the text where the
subject here in question is quite near the surface,
and if it happens to break through, the wise teacher
will surely not fail to take advantage of his oppor-
tunity.

With respect to the general outcome of such a
course in logic as is outlined in this book, it is
enough to say that I should be exceedingly disap-
pointed if the way had not been prepared for an
intelligent study of the larger treatises on the sub-
ject, and if the door had not been opened, though
only a little way, through which the student might
pass to a study of the perennial problems of phil-
osophy itself. About the former point, it is only
necessary to say that the lists of advanced refer-

ences at the end of the chapters, limited as they
necessarily had to be, are intended to invite indi-
vidual students and whole classes to read more
widely and on a more elevated plane discussions of
the problems which are considered in the text, and

to which reference is also made in the first lists of
books. An experiment on the possibility of profit-
ably using books of an advanced character might
be made by the student himself in connection with
those parts of the text which fail to interest or
profit him. I shall not be surprised if very often
the presumably .more difficult reference turns out
in the end to be the simpler statement. If any
one should doubt the value of logic as an introduc-
tory approach to the problems of philosophy, which
is the second point mentioned above, I can only say
that so long as those problems continue to depend,
to the extent that they actually do, upon logical
construction, there is absolutely no possibility 01
understanding what the problems are, much less of
contributing to their solution, if one has not ac-
quired a mastery of the instruments of logical think-
ing. But not only is this true in respect of philos-
ophy narrowly interpreted; an acquaintance with
logical methods is also important if we who are not
philosophers in the techincal sense of the word are
to take an intelligent attitude toward our own lives.
Toward such an end, I hope some contribution has
been made by the mode in which the logical problem
has been conceived, and by the manner in which it
has been worked out.

For those who are acquainted with the liter-
ature of the subject, it is not necessary for me to
name the sources of my chief indebtedness, and for
those who are not, such a proceeding would savour
of a vain parade. I shall, therefore, content myself

with the statement that I have learned from the
masters of many schools, and have retained a grate-
ful affection for them all. As I am not conscious of
being a partisan, I presume that even those who
have taught me most would hardly recognise me as
one of their disciples. The public, consequently, will
be in no doubt when it comes to /apportioning praise
or blame for what is here set down, although it is
evident, so that he who runs may read, that it is
not all made up out of my own head. I have quoted
when necessary, I have also paraphrased, I have
refused neither suggestion nor illustration when any
of these methods furthered the object I have can-
stantly held before me in writing these pages. I
want, therefore, to thank all who by their published
writings have rendered themselves liable to this
sort of -literary piratage. I am also indebted to col-

leagues for particular services which it is a pleasure
to acknowledge. Professor Rudolph Pintner has
read many of the chapters in the first half of the
book, and made suggestions which have improved
the form over that in which they were originally
cast. Mr. A. P. Weiss made the drawings for all
the figures, and also read some of the sections on
induction. Professor David R. Major has read all
the chapters in manuscript and in proof. I feel that
his criticisms and suggestions have been invaluable.
It is certainly not for the want of friendly and
intelligent advice that I may sometimes have erred
in aim and execution. The final stages of the proofs

have been entirely in Dr. Major's hands. I take
this opportunity to acknowledge assistance that has
been generously rendered.

Eltham, Kent. A. E. D.

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CHAPTER I

THE PROBLEM OF LOGIC

The Starting Point. It is customary to begin the
exposition of a branch of knowledge with a state-
ment and explanation of its definition. This is a
useful mode of procedure when it can be presumed
that those for whom one writes have previously
acquired an elementary knowledge of the subject to
which the definition relates. But since no such pre-
sumption is made in regard to those who may be
expected to read this book, we shall postpone for
the present the task of formulating a definition of
logic. Meanwhile, we shall discuss a number of
topics, all of which throw light upon some feature
of the problem of logic, and each of which will con-
tain suggestions as to the nature of the subject to
the exposition of which this book is devoted. And
we shall find it convenient to begin our discussion of
these topics by asking what is the subject-matter
of which logic, in all its various stages and branches,
is the study.

Each Science has a Different Subject-Matter. It
will, perhaps, help to emphasize the importance of
this inquiry if we recall, first, that a science presup-
poses the existence of a special kind of material,
called its subject-matter; and, second, that each
science has a different subject-matter. For example,
in geology we learn about the structure of the earth's

(i)

surface ; in physiology, about the functions of living
organisms. Physics is a study of bodies in motion ;
and geometry, of figures in space. In these, and in
similar cases, the subject-matter of the science is
the material which the scientist observes and de-
scribes.

The Thought Element in Knowledge. If we con-
sider further how the several sciences are con-
stituted, it soon becomes evident that the mate-
rial selected for study is only one condition of
the existence of a science. The scientist must also
think about his material before his knowledge con-
cerning it can have the characteristics of scientific
knowledge. He must, for one thing, arrange, or, as
it is said, classify, the material that he has collected.
It is not, however, the purpose of this section to
describe the methods that the scientist employs in
studying his material. At present, we wish to call
the student's attention to the fact that the attainment
of any kind of knowledge is impossible without an
active exercise of the thinking processes, and to
warn him that the passive flow of images and ideas
through consciousness must not be mistaken for
thinking. It is true that without images and ideas
there can be no thought; but thinking consists in

comparing objects with one another, in differen-
tiating the like from the unlike, in combining them
into more complex wholes, in relating in many and
diverse ways these wholes to each other, etc. Think-
ing, in other words, is a specialised sort of mental
activity, an activity that taxes to the utmost, and

frequently brings into play, all the abilties with
which the human mind is endowed. It is the supreme
task to which the many have been called; but
if we regard it lightly, or presume that it can be
accomplished without toil, or if we erect our own
incapacity or indolence into a reason for the useless-
ness of the endeavor, we must abandon the hope of
joining the company of the few who are chosen. It
is, therefore, with good reason that logic directs
attention to the function of thought in human knowl-
edge, for thinking is the one way, the only royal
road, to the goal of an educated life. To think about
the objects of one's experience is, then, necessary
if knowledge is to exist; but thinking, it must also
be borne in mind, is "not a passive suffering of some-
thing, but a doing of something with" these objects.
Or, as Wundt has expressed it, "jedes denken ein
Wollen."

Not only, then, must we think if we are to attain
scientific knowledge ; we must also think in order to
attain knowledge that, in the strict sense, cannot be
described as scientific. Illustrations of the truth of
this statement may be found in history, economics,
jurisprudence, as, indeed, it may be in all those other
studies which, like these, are interested in the ways
in which the various needs of men are met in a social
organisation. It would seem, then, that wherever
we have knowledge, whether it be in the form of the
natural or the historical sciences, as these others
may be called, we have a witness to the ways in
which the demands for thought have been met. In

brief, unless we think about the material that obser-
vation brings, knowledge cannot exist ; and, further,
it is what we think that converts this material into
definite species of knowledge.

The following illustration may throw additional
light upon the statements of this section, and empha-
sise the importance of thought for all forms of
human knowledge. We all know what a picture puz-
zle is, a collection of odd-shaped and variously
coloured pieces of cardboard which, when put to-
gether in their proper relations, form a complete
and consistent whole. All of us, moreover, have
experienced difficulty in putting the pieces of card-
board together so that the hidden pattern or picture
is made evident. If, now, we study a case like this,

we may observe that the difficulty we had in bring-
ing out the pattern was not due to the lack of any-
thing in our material, all the pieces, we shall sup-
pose, were before us, and were capable of being
fitted to one another in an appropriate way. But
the task of putting them together in the proper way
was by no means easy. Where was the source of our
difficulty ? We cannot attribute it to our material ;
and most of us would agree that it was due to our
inability to see which parts should come next and
next and next. If anyone chanced to observe us at
our task, he probably would have heard us exclaim,
'How stupid I am!' 'What's the matter with me!'
'Why can't I see it!' That is to say, he would have
heard us blaming ourselves, and finding fault with
the things we were doing to the material with which

we were working. What bearing, one may ask, does
this have upon the question before us? Just this,
that if we are to solve the simplest problem, thought
must be brought to bear upon the material which
constitutes the subject-matter of that problem.
When we do not succeed in doing this, and when,
for any reason, we are baffled in our endeavour to
make out the nature and relations of the material
we are studying, a special emphasis is thrown upon
the thought factor, the one which, under more favor-
able conditions, is liable to be lost sight of entirely.
In this we are like children who look about their
world delightfully oblivious of the fact that the eyes
provide them with the light of all their seeing. It is
only when the eyes fail that one becomes conscious
of their existence. Similarly, when knowledge fails
an unsuspected factor of knowledge gains promi-
nence, and to this factor, to which attention is thus
drawn, we give the name thought.

What we mean by Knowledge. The student who
has read carefully the foregoing paragraphs will
understand what we mean when we say, we are
always thinking about something. The italicised
words call attention to the two factors in knowledge.
There is the object, the million-starred heavens,
or the one solitary maiden, on the one side : and, on
the other, our thoughts about this object. Both
these elements object and thought are neces-
sary to knowledge. Objects that no one thinks about
are only the materials of knowledge, and thoughts
that are not thoughts - about something in par-

ticular can hardly be called thoughts at all. It is
only when our thoughts are thoughts-about-objects
that we give them the name of knowledge. This
statement holds so generally that by knowledge of
any sort whatsoever poetry or legend or history
or science or just every-day opinion we may be

understood to mean our thoughts-about-objects.
Accordingly, from the standpoint of our analysis,
knowledge=object-f thought. In later sections, we
shall have more to say about these two factors of
knowledge.

Knowledge is Systematic. If we consider our
thoughts-about objects with some care, we shall ob-
serve that they tend constantly to become fixed,
orderly, and systematic. This is not an accident ; it
is rather of the nature of a demand that we make
upon ourselves and our fellows, so much so that we
dismiss with a shrug of the shoulders the thoughts
of any one who fails to meet it with a fair degree of
success. We may say, then, that we are all alike in
having ordered thoughts ; we differ only with respect
to the degree of success that we attain in intro-
ducing that particular kind of order that makes our
thoughts most effective. For example, there is a
great difference in the coherence of the thoughts of
an insane or feeble-minded person and those of the
average normal person. In the former case, we
observe both a frequent change of the subject of his
thought, and an obvious looseness of connection be-
tween one thought and another, even when these
refer to the same subject. Sometimes the only con-

nection that can be observed between one thought
and another is the similarity in sound of the words
in which the thoughts are expressed. On the other
hand, we expect to find the average normal person
able to think in such a way that the connection be-
tween one thought and another follows the line of
the essential connections of one part and another of
the subject about which he thinks. When this is the
case, we call the person's thinking 'systematic',
systematic, that is, in the sense that the order of his
thoughts is warranted by the nature of the subject
to which his thoughts refer.

Now it may be interesting and profitable to note
what are the conditions of systematic thinking.
There are three that, from the logical standpoint,
require mention. First, there is the difference,
native and acquired, in the ability of individuals sys-
tematically to develop by thinking any subject in
which they may be interested. We recognise the
fact that one person is more highly endowed in this
respect than another in such every-day expressions
as: 'He's just smart'; 'All there is to say is, he's
got brains.' But we also recognise the fact that we
are all capable of improvement, however excellent
or mediocre our native endowment may be. The
great national organisations for the education of the
young are a recognition of this fact. But, of course,
all that we can hope to do by education is to diminish
the difference between one individual and another;
we do not expect to overcome the advantage that
lies on the side of the person who adds to a high

native endowment a careful and industrious train-
ing. The second condition of systematic thinking
is found in the fact that not all the subjects about
which we think seem capable of being systematised
with the same degree of completeness. For example,
we do not find in the social sciences the same degree
of coordination that we find in the natural sciences ;
and, in a general way, we may attribute this to the
greater complexity of the subject-matter of the for-
mer as compared with the latter.

It may be observed, thirdly, that not every
occasion that calls for thought is met best with the
strictest and most thorough exercise of our thinking
ability. If we compare, for example, the thoughts
of the man of business with those of the economist,
or the thoughts of the politician with those of the
political scientist, we shall see that they differ, not
necessarily in proportion to the abilities of the indi-
viduals to think, nor directly with respect to the
difficulties of the subject-matter about which they
think ; but the occasion that sets the thinker his par-
ticular task sets also the limits within which the
task is to be carried out. The same thing is true up
and down the line of our every-day observation and
experience. The man, for example, who carried
over into social life the passion for precision, accu-
racy, and completeness that properly belongs to a
scientific publication would be voted a bore, just as
surely as the man who worked in his laboratory with
the leisurely and lax methods of a man of the world
would be pronounced a failure. Circumstances alter

cases ; and logic observes that in any of the depart-
ments of human life where thought is called for, it
is only the degree of systematic thinking appro-
priate to the circumstances that it is ever necessary
to attain.

Logic and the Knowledges. In our discussion of
what knowledge is we have seen that knowledge may
exist in many different forms, varieties, depart-
ments, or branches. For example, engineering, psy-
chology, bacteriology, literature, biology, etc., are so
many different forms of the one tiling we call knowl-
edge. For this reason, it would be better, simpler,
and more concrete if we were to accustom ourselves
to speak of these subjects as ^knowledges' whenever
we wished to refer to the plurality of the depart-
ments of knowledge. We have a precedent for this
usage in that we speak more often of the sciences
than we do of science. By knowledges, therefore,
we mean the several varieties, forms, or kinds into
which knowledge has been observed to falL Now
we may observe that, historically, most of the other
subjects of knowledge existed before logic was for-

mulated into a science. Mathematics, astronomy,
physics, zoology, political and social philosophy, for
example, are must older branches of knowledge than
logic. And if to this we add the fact that logic came
into existence as a result of a study of the methods
of these sciences, we shall see that it was the exist-
ence of the knowledges that made logic possible
rather than the existence of logic that made them
possible. Hence, it would seem to be true that while

every form of knowledge may be cultivated and may
flourish independently of logic, logic cannot even
begin to be unless some of the forms of knowledge
have already established themselves.

The Subject-Matter of Logic. What, now, we
may ask, is the relation of logic to the two factors
of which all knowledge is comprised? And, first,
what is its relation to the subject-matter of the other
sciences? The question needs only to be asked to
be answered ; for it is obvious, in the light of what
has already been said, that no two departments of
knowledge study the same material. Logic, there-
fore, cannot study the same subject-matter as any
other science without losing its identity by becoming
absorbed in that science. For example, if logic were
to study the origin, growth, and function of political
institutions, the result would be, not a new knowl-
edge, but an old one under a new name. Political
science and logic would then be the same things. In
like manner, if logic were the study of plants it
would be identical with botany. Further illustra-
tion is not necessary. The subject-matter of logic
is not identical with that of any one of the other
knowledges. What, secondly, is its relation to the
thought factor which, as we have seen, is present
in all knowledge? Our answer is that it is this
thought factor in the various knowledges that logic
makes the direct object of its study. But logic's
relation to this thought element is different from
that of any of the other sciences. In the several
knowledges, thought is the means by which the

qualities and relations of objects are described and
explained. Ordinarily, we are no more aware of its
presence, than we are of the pane of glass through
which we look out upon the landscape that lies out-
side our window. But if, for any reason, we become
curious to know how thought does its work, to find
out whether it follows any method, we should then
set thought before our minds as a distinct object of
study, and the resulting knowledge would be called
logic. That is to say, logic arises when the thought
factor which is present in all knowledge is set before
the mind as a subject of investigation. Thought
then becomes the material of a special study, and the

name of that study is logic.

Logic as Scientia Scientarium. We have just seen
that logic is the science that is interested in the way
in which thought does its work in the several fields
of knowledge. Now we have previously seen that
we are not everywhere equally successful in system-
atising our thoughts-about-things. Some branches
of knowledge are more loosely, and some are more
closely, organised. This fact we may attribute in
part to the greater complexity of the subject-matter
of some of the knowledges. History, for example,
is a less exact science than is physics just in propor-
tion to the greater complexity of the material that
it studies, and to the difficulty of bringing its mate-
rial under controlled observation. Now, in this con-
nection, the question arises Do the several depart-
ments of knowledge equally well provide guidance
for the formulation of logical doctrine? If some

branches of knowledge are better articulated than
others, should we not expect that the former would
illustrate the methods of thinking more perfectly
than those branches that have not taken on the same
degree of coordination; and, further, if we can
find any group of knowledges that stands pre-emi-
nent in this respect, should we not save time and
trouble by making it the basis of our study of logical
doctrine? Such questions have been asked, and it
has been customary to answer them in the affirm-
ative. Thus logicians, from the days of Aristotle
to the present time, have expounded the subject of
logic with their eyes on the methods adopted by the
better articulated sciences ; and, by some, the study
of logic has been confined to an examination of the
methods that have proved useful in reaching the
truth in such sciences. From this point of view,
logic has been looked upon as a science that lies hid-
den in the various sciences, very much as the pattern
lies hidden in a picture puzzle. All that needs to be
done, according to this view, is to bring logic into
the light that it may direct the labors of future
workers in the field of the sciences. It is in this
sense that logic is spoken of as scientia scientiarum :
it is the science of sciences in the sense that it under-
lies and gives direction to all the work that science
undertakes to do.

The Humanistic Influence in Logic. That view of
logic which identifies it with the study of scientific
method has always been considered a little partial
and extreme, and it is doubtful if Aristotle, who

was the first and greatest of the formulators of
logical doctrine, and whose authority has been ap-
pealed to in support of this position, would subscribe

to it. It is probable, as Minto has shown, that in organising his logic, Aristotle had in mind, as much the formulation of the rules of dispute in the social life and court procedure of his times, as the systematisation of the methods of thought in the body of the scientific knowledge of his day. However that may be, it is certain that our own times are witnessing a marked humanistic reaction against a stiff and formal view of logic, and modern logicians are looking to the less exact forms of knowledge for enlightenment as to the way in which the business of thought is carried on ; indeed, their study now extends to the ways in which difficulties arise and are overcome in our everyday life. This extension of the field within which the logician pursues his studies cannot be taken as an evidence of indifference to a strictly logical doctrine ; rather must it be viewed in the light of what is taking place in other departments of knowledge where an investigation of the simpler, more primitive, forms has been found to elucidate much that was obscure in the more complex forms of the subject-matter studied by these departments. In zoology, for example, interest in the simpler organisms has flooded with light our understanding of the more complex ones, and in psychology the study of the mental processes of young children and of the feeble minded has added to our understanding of the adult, normal mind. Hence it

is felt that if we consider those methods of thought which, in some of the sciences and in the ordinary business of life, have not taken on a strictly rigid form, we shall be able to understand the nature of thinking in a more satisfactory manner than if we confined our observation to those sciences in which the highest degree of precision in methods had been attained.

Relation of Logic to Psychology. We have used the term 'thought' in the foregoing pages in a somewhat broad way. It has meant, in general, the mental factor which is never absent from the knowledge experience. Now the question may arise whether in claiming thought, in this sense, as the special subject-matter of logic we have not confused logic with psychology. For what is psychology if it is not a study of mental processes?

Now there are two ways in which we may distinguish between logic and psychology. In the first place, we may remark that there is a quantitative difference between the two. Grant, for the time being, that the subject-matter of both these sciences falls within the field that we usually designate as mental, it may, nevertheless, be said that not all that is mental is included in the scope of logical inquiry. Logic is interested mainly, if not exclusively, in what are called the cognitive processes; that is, in those processes in and through which we either affirm or deny something. But cognition in the

strict sense, cannot claim to be more than a very
small part of one's mental life. The latter, and so

the field of psychological inquiry, includes, in addi-
tion to knowledge or cognition, other kinds of men-
tal processes, e. g., feelings, emotions, volitions. The
whole field of the conscious life lies open to the in-
vestigation of psychology; but logic is interested
chiefly in that part of it that is called cognition, and
in the other parts only so far as they help us to
understand what human knowledge is.

In the second place, we may remark that although
logic and psychology both study the cognitive proc-
esses, they do not study them from the same point
of view. Psychology is satisfied when it has de-
scribed and explained the mental changes that take
place in a cognitive process. Logic is concerned, not
with the natural history of cognition, but with cog-
nition as an instrument by means of which the world
of reality minds and things is understood. That
is, the images and ideas which make up any cognitive
process, and which psychology endeavours merely to
describe and explain, are, from another point of
view, taken to represent objects in the real world;
and it seems to be the function of these images and
ideas to place those who have them in communica-
tion or contact with objects which exist in some sort
of independence of these images and ideas. It is this
character of images and ideas as affording us a
knowledge of a world of objects that is the stand-
point of logic, and which enables us to distinguish
the logical from the psychological method of dealing
with the cognitive processes. Logic is not interested
to know what images and ideas are present in con-

sciousness, but whether the images and ideas that
we entertain are true, that is, afford us accurate
knowledge of the objects which they represent and
to which they point. Or, to put it more succinctly,
logic studies the conditions of the truth or falsity
of our ideas, a problem which, for psychology, is
quite indifferent or non-existent.

Logic as an Art. It is sometimes said that logic is
an art as well as a science. The meaning of this
statement can be made clear, if we bear in mind
that the term 'art' is used in two senses. In the
first and most common meaning, it refers to the
developed skill that one acquires through practice
of a set of more or less mechanised movements. If,
for example, you go into a machine shop and watch
the workmen at their tasks, you will find them en-
gaged in different activities, and displaying varying
degrees of skill. It is this ability to do a given task
with some degree of proficiency that we call the

workman's art. Art is, then, a specialised ability
to do. On the other hand, there is an ability, much
more specialised than the mechanic's, which con-
sists in the perception of how a task should be done,
but which does not necessarily carry with it an
ability to perform it. The engineer, for example,
is able to plan and superintend building enterprises,
although he does not have the ability of the work-
men upon whom he must rely if these enterprises
are to be translated into steel and brick and stone.
The skilled workman and the engineer display two
different orders of practical ability, and we may

speak of each one of them as possessing and prac-
ticing an art.

Now, when logic is spoken of as an art, it is well
to be clear whether we are using the term art in the
first or in the second of the two meanings just dis-
tinguished; whether we are thinking of logic as
giving to its students the ability to think correctly,
or whether we are thinking of it as giving its stu-
dents the ability to detect the correctness and incor-
rectness of arguments. We are inclined to the
opinion that, in the case of logic, these two meanings
cannot be separated, and that in learning the regu-
lative principles of logic we are at the same time
acquiring the ability to order our thoughts in a log-
ical manner. The reason for this opinion, briefly
stated, is that the study of logic is and must remain
unprofitable to anyone who, while he is studying it,
does not practice the methods of logical thinking.
The meaning of this statement will become clearer
as we proceed, but it should be taken by the student
as a suggestion that the way to gain a knowledge of
this subject is to think each step logically as it is
unfolded in the successive chapters. For example,
we shall presently be speaking about terms, and we
shall call such things as, 'the Sultan of Turkey/
'good,' 'H 2 S0 4 ,' 'man/ terms. Now, it is obviously
impossible for anyone to memorise, or even to make,
a list of the things that logic calls terms. The only
alternative, therefore, is for the student to acquire
the ability to think term, to understand what a

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term is. When he has done this, he will have to
employ this acquired ability in all his subsequent
study, so that it never becomes rusty through dis-
use. The same remark applies to all the topics of
which logic treats. In this sense, therefore, the
study of logic is at the same time practice in the
methods of logic; and it is because we cannot ac-
quire a knowledge of the correct methods of thought
without at each step practicing these methods that

logic may be said to be an art in both of the senses
defined in the beginning of this section.

What Logic is. We may now, with a summary
of the foregoing discussion in mind, undertake a
statement of what logic is. We have seen (1) that
logic presupposes the existence of knowledge in one
or more of its several forms, and that it has sus-
tained this relation to the other knowledges from
the very beginning. Aristotle, as we said, was
prompted to write his treatises on logic from the
desire that, along with the improvement in the
sciences and arts, there should go the consciousness
of the method by which, in these fields, conclusions
were being reached. Logic, therefore, was not an
invention of new instruments of research and knowl-
edge, but the formulation and systematisation of
those that in use had already proved their effective-
ness. Consequently, we said (2) that when logic
sets about its task, it distinguishes between the sub-
ject-matter and the thought element in the knowl-
edges, and erects the latter into a separate object
of study. Logic, therefore, is a study of the relation

of thought to human knowledge. But, in this con-
nection, we had to point out (3) that the interest of
logic in thought is different from that which the
several knowledges have in it. The knowledges aim
to reach conclusions that increase our understanding
of the nature of the objects they select for study.
It is true that this increased understanding is
reached by thinking; but, so long as results are
reached, the scientist is no more concerned with
thought than is a farmer with the engine that drives
the machine that threshes his grain. This is not
the case with logic. It studies thought with a view
to finding out its methods of work. From this point
of view, therefore, we may say that logic is a science
of the methods of correct thinking. But (4) if logic
is to be guided by the best examples, it will naturally
be interested in the methods of the natural sciences.
The influence of this interest of logic in the natural
sciences has been to restrict unduly the scope of log-
ical inquiry, and thereby to give to logic an impor-
tance that originally did not belong to it. The
restriction is seen in the definition of logic as a study
of scientific method, and the new importance it thus
assumes is expressed in its claim to be the scientia
scientiarum, the science that makes all the other
sciences possible and real. In this connection, we
pointed out (5) that this view could not claim the
support of the earliest writers on the subject, and
that in our own times a positive reaction against it
has set in. The form that the reaction has taken is
to extend the field of logical observation so as to in-

elude not only the more highly specialised sciences,
such as physics and chemistry, but also those that
are less fully developed, such as the biological, social,
and historical sciences. From this standpoint, logic
is a study of the methods of human knowledge of
whatever kind the knowledge may happen to be. In
the section on psychology and logic we saw (6) that
thought may be studied in two quite different ways.
We may study thought, for example, as a series of
consciousnesses made up of various elements and
possessing various attributes. This is psychology.
If, however, we study the function of thought in
affording us a knowledge of the real world, we are
led to a very different result, and the kind of knowl-
edge thus reached will be logical rather than psycho-
logical in character. For logic, that is to say,
thought has a meaning over and above what thought
is as an item in a stream of consciousness. What
thought is or is like is one thing, and what thought
means and does it another. It is from the latter
point of view that logic studies it. If, therefore,
meaning, as one writer says, is a "product of thought
in its relation to reality, or of reality in relation to
thought," logic may be defined as a science of the
development of meaning, or, more briefly, as the
science of meaning.

Only one more point need be raised, namely, in
what sense logic is a science at all. In the last sec-
tion we saw that logic is an art in the sense that
engineering is an art, but we also saw that as such

it is an art in a somewhat special sense. It is, if
we may say so, an intellectual art, an art that con-
sists in knowing how certain things should be done.
In this respect, logic, to use Minto's illustration of
the Aristotelian logic, may be likened to "Cavendish
on Whist," a book that states the rules and illus-
trates the methods of playing the game. We have
done ample justice to this feature of logic, and the
student is not likely to lose sight of its importance
as we proceed. But we now ask whether it is also,
in any sense, a science; in the sense, for example,
that physics and chemistry are sciences. Now we
ought to be clear that these sciences do not exist for
the purpose of providing rules that students may
follow in performing laboratory experiments. If
this were the whole extent of the scientific character
and purpose of these subjects, they would differ in
no respect from the practical sciences in which we
learn how certain things are done. If, however, we
consider these sciences more carefully we shall see
that they ^aim to formulate principles or laws, and
that it is only as the experiments enable us to ascer-
tain these principles that they have their perfect
work. So we may say with respect to logic. It has its
experimental side, and it formulates rules and states
the methods of correct thinking ; but it goes beyond
this and tries to express the laws or the principles
to which every concrete case of thinking actually

conforms. In the light of this fact, we may conve-
niently bring this chapter to an end with the state-

ment that logic is a study of the methods of correct
thinking and of the principles on which these meth-
ods are based.

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QUESTIONS

1. How do the various sciences differ from one another?
Illustrate.

2. What function has thought in the several sciences, and
what reason can you give for your answer?

3. What do you understand by knowledge, and into what
two factors may all knowledge be analysed?

4. What is meant by calling knowledge systematic?

5. Upon what three factors does the systematisation of
knowledge depend?

6. Is all knowledge equally systematic? Illustrate.

7. What is meant by 'knowledges'?

8. "It is the knowledges that make logic possible." Ex-
plain.

9. What is the subject-matter of logic? What is the rela-
tion of this subject-matter to the other sciences?

10. What is meant by calling logic scientia scientiarum?

11. Describe the humanistic reaction in logic, and how does
it affect our view of the subject?

12. In what two ways do logic and psychology differ from
one another?

13. What two meanings may be given to the term art?

14. Is logic an art as well as a science? Explain.

15. Summarise the various definitions of logic in this chap-
ter, and state clearly the points of view from which these
definitions are made.

EXERCISES

1. Point out the subject-matter in the case of any six
subjects with which you may be acquainted.

2. Show the relation that thought has to each of the sub-
jects chosen for your answer to the previous question.

3. Cite concrete instances of the way that thought be-
comes a problem in the pursuit of various kinds of
knowledge.

4. Illustrate how observation of the ordinary modes of
conversation may advance our knowledge of the log-
ical processes.

5. Use concrete examples to show the limitations to which
logic would be subject if it confined itself to the study
of the scientific mind.

6. Give instances of the practical value that is claimed for
an acquaintance with logical doctrine.

CHAPTER II

THE JUDGMENT

The Meaning of Thought. Before carrying our
study of the logical character of the thought proc-
esses, begun in the last chapter, into greater detail,
we wish to call attention to two simple and obvious
considerations. In the first place, we may observe
that the objects that come before us in the course
of our experience present a great variety of charac-
teristics. The object of which we are aware may
be part of the material world, the starry heavens ;
it may be part of the common human life that today
we share with our fellows, the rush of the ambu-
lance in its race with death; it may be part of the
inner individual life, the secret and incommuni-
cable thing that a man sees when he sits down face

to face with himself. In short, the object may be
anything from "the choir of heaven to the furniture
of earth ;" but whatever it is, it is an object because,
and in so far as, we have experience of it. We shall
use the term object, then, to denote that of which
we have experience, without respect to the kind of
object it is, or the kind of experience in and through
which it may be said to exist. But this leads to a
second remark. There are, as we intimated just
now, a variety of ways in which we experience, or
react to, or are aware of objects. The terms per-
ception, memory, imagination, feeling, volition, are

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the names of some of the more familiar ways of
reacting to objects. Thus we may perceive an
object, or remember it, or imagine it, or be affected
pleasantly or unpleasantly by it, or do something
because of it. All these are, of course, familiar
experiences, and we do not need to be psychologists
to be aware of the fact that the object assumes a
somewhat different character for the different activ-
ities through which it is experienced. That is to
say, the object as we perceive it, or remember it,
or imagine it, or are pleasantly or unpleasantly
affected by it, or do something because of it, has a
slightly altered aspect in these several modes of
reacting to it.

Now it will probably help us to understand the
problems of this chapter if, at the outset, we observe
that the recognition of this implication of objects
in all or most of our conscious processes has led to
a certain looseness in our use of the term thought.
By some, especially among the psychologists, thought
is the name that has been employed to denote the
various kinds of mental processes, perception,
imagination, feeling, desire, emotion, etc. James,
for example, speaks of the 'stream of thought/ a
phrase in which the term thought, as he tells us, is
used for "every form of consciousness indiscrim-
inately." In a somewhat more restricted sense, the
term thought or cognition is used, in distinction
from feeling and conation or striving, with which
it is intimately associated, as the name for one of
the ultimate modes of consciousness. It appears in

this sense in the writings of Stout and Ladd. When
employed with this meaning, it denotes all those
mental activities, such as perception, memory, con-
ception, etc., in which we are, in one way or another,
concerned with the nature of objects. "It covers,"
as Stout says, "all modes and degrees of being aware
of or cognisant of an object." A still more special-
ised use of the term is that which limits its appli-

cation to those processes whereby we designate objects merely as the objects that are, at the present moment, under consideration. To think, to use James' definition of conception, with which the term thought in this sense is practically synonymous, is to "identify a numerically distinct and permanent subject of discourse;" to mark it off from other objects, and to make it the bearer of whatever attributes or relations that our 'thoughts-about' it may show that it actually possesses.

The three meanings just distinguished of the term thought are doubtless closely connected from the psychological point of view. For if psychology be regarded as "the science of the processes whereby an individual becomes aware of a world of objects and adjusts his actions accordingly," and it is so regarded by Stout, it is perfectly obvious that the several mental processes must be viewed, in themselves and in their relations to one another, as modes of conscious activity which further, more or less directly, that acquaintance with objects which all the three statements of the meaning of thought alike emphasise. We need not consider whether,

and, if so, in what sense all the fundamental mental processes serve the purpose of establishing- and improving our acquaintance with things; whether, for example, the so-called affective processes are correctly interpreted in this way. It will be enough if we recognise that certain processes can be grouped together, and can be regarded as having for their distinctive function the discriminating and relating of the objects of experience. If we approach the problem of thought from this point of view, we see that the term thought, in the second and third meanings distinguished above, have a peculiarly close relation. According to the second meaning, thought is a continuous process which, beginning in perception, culminates in what the psychologist calls judgment and reasoning. Without denying that thought is dependent upon the more elementary processes of perception, the third meaning limits the application of the term to the later processes in which, more particularly, we acquire what was described in the previous chapter as 'knowledge-about' objects. For the one, thinking is the name for a process in which perception, memory, imagination, conception and judgment may be found to function; for the other, it is a name by which conception and judgment are specifically signified. In whichever of these two contrasted senses the term is used, each implies, what is undoubtedly the fact, that there is no unique faculty of thought, that thought is a complex process in which a number of mental activities combine to give us a knowledge of objects, and that, while some

of these activities enable us to identify distinct and
permanent subjects of discourse, others carry us
beyond this to the knowledge of a system of existing
things in which numerous terms and relations are
discernible.

Judgment and Thought. Now when we consider
the subject of thought from the standpoint of logic,
it is in the third of the meanings already distin-
guished that, in the main, we shall use the term.
Thought will thus signify the processes of judgment
and reasoning, those processes in which the cogni-
tive process as a whole culminates. Logic, that is
to say, is particularly interested in the terminus
ad quern of the thought-process, in the goal toward
which our desire for knowledge points; and it
studies the process of reaching the goal only when
a knowledge of such process enables it to determine
the nature and grounds of the validity that is
claimed for thought. Thinking thus comes to be
regarded by logic as having a character which is
liable to escape notice so long as we keep strictly to
the psychological point of view, the character of
assertion. And in order to give prominence to this
feature of thought, logicians are more apt to speak
of judgment than they are of thought. Thinking,
as we have seen, is a mental process in which the
psychologist distinguishes a number of constitutive
processes, perception, memory, etc. Judgment,
as it is used by the logician, regards the thought
process as being concerned with the specification
of a content, the assertion of which is logically the

characteristic thing about a judgment. The content
of the thought process is taken up by the judgment
and constituted the subject-matter of assertion.
Thus the experience, say, of red calls from the psy-
chologist the statement that, like all sensational
experiences red cannot be described, but must be
experienced if any one is to know what the word
signifies, that it is produced by the action, on the
rods and cones of the retina, of ether waves of a
certain length, and that these changes are continued,
by way of the optic nerve, in a manner that is little
understood, to the occipital lobe which is the cortical
centre of the visual consciousness. For the logician,
the particular patch of colour called red merely
exists, and the acknowledgment of it as existing,
by the individual who experiences it, is what is
meant by assertion or judgment. The red is the
content of the processes which are described by the
psychologist, and it is this content that is asserted
as the subject-matter of the judgment. Whatever,
then, exists as content of thought, may become the
subject-matter of a judgment; and we may, there-
fore, define a judgment, broadly, as an assertion of
the qualities and relations of the object of thought.
A word or two may be necessary at this point
to guard against a possible misunderstanding of

what is meant by assertion as the central fact of
the logical judgment. In current usage, to assert
means to express in words the thoughts and opin-
ions that we entertain about things. It is commonly
employed as the equivalent of 'to say something.'

In logic, assertion has nothing to do with speech.
We may, of course, express what we assert, but
we can assert without putting into words, or into
any other set of social symbols, the qualities and
relations of the object of thought. The question we
are now considering, moreover, has nothing to do
with the problem whether, as individuals, we can
think without words. It is a simpler matter than
that; and all that we say is that no one, merely
because he judges, is bound, in order to give his
judgment the character of assertion, to put into
language the truth or fact that his judgment em-
bodies. On the contrary, by assertion we mean the
attitude of mind in which, for that mind itself,
there consciously exists such an acquaintance with
an object that, in itself and its relations, it is dis-
tinguished from other objects with which it occurs
in a common field of knowledge. For example, I
may be looking over a collection of curiosities that
a friend has accumulated from the four corners of
the earth. I look at the objects one after the other,
and find that each is a strange and unintelligible
thing, and, as I put it back into its place, it is soon
lost in the mass of the other strange and unintel-
ligible things. If, however, I should find in the col-
lection an object that is familiar, there would be,
under the circumstances supposed, a mental tang
and 'feel' toward it that would make it, as I put
it, too, back in its place, stand out from the rest, -
its identity would not get lost in the multitude of
strange things. What makes the difference in this

case is my mental attitude toward it, a mental
attitude that, in this instance, is called recognitive
judgment. In logic, the mental attitude in which
we find the characteristic feature of the judgment
is described as assertion. Whenever we judge we
assert, and whenever we assert we put marks upon
the objects that come before us by which they attain
unique distinction.

Other Mental Attitudes Akin to Judgment. It may
help to emphasise the assertive character of the
judgment if we distinguish certain other attitudes
which, like assertion, have received, in the develop-
ment of language, definite verbal forms. Judgments,
it should be observed, are always expressed in the
indicative mood, and what they assert is always true
or false. On the other hand, interrogatives, imper-
atives, optatives, and exclamations do not assert,

and therefore are not judgments, but express either
an inquiry, a command, a wish, or an emotion. Of
the wishes that optatives express we can say that
they are reasonable or unreasonable. The com-
mands of imperatives can only be obeyed or dis-
obeyed. Our interrogatives formulate inquiries and
call for an answer. Exclamations are word ges-
tures that express our emotional attitudes toward
situations. But while interrogatives, imperatives,
optatives, and exclamations are not judgments, they
imply attitudes of mind which, if asserted, would
be judgments. The rhetorical question, 'Is thy ser-
vant a dog?' doubtless implies an assertion, and is
equivalent to 'Thy servant is not a dog.' But not

only the rhetorical, but any question may be inter-
preted in a similar way. For to ask a question
would be meaningless unless we thereby implied
that something can be asserted of its subject, and
it is to this something that the question, in a general
way, points. If, for example, I ask, 'Is that a fire?'
I imply that it is a fire, but not in the way that
would warrant me in asserting it as a fact. With
imperatives the case is different. 'Come,' 'Do this,'
cannot be said to be either true or false, and they
imply assertion only if imperatives are indicated
actions that have reference to a situation which
they either help or hinder. Imperatives, that is, get
their meaning from a context that exists in the
mind of the person issuing the command, a context
which must rely for its development upon the action
of the person to whom the command is addressed.
The implied judgment, therefore, may be thrown
into the hypothetical form thus: 'If you do the
thing commanded, such and such things will happen.'
Commands, that is, are abbreviated antecedents of
hypothetical judgments. Optatives express a desire
for some state or condition which is thought of as
possible, though not, at the moment the wish is
entertained, as actual. They imply the assertion
of definite objects as the objects of desire. In this
way we must interpret, for example, 'Would that I
were dead!' It implies that 'to be dead at this
moment' is really a desired object. Such exclama-
tions as 'Absurd!' 'Impossible!' are predicates of
implied judgments, and by them, besides expressing

our personal attitudes, we are also characterising
situations.

Judgment and Groundless Statements. Before

proceeding to develop other features of the judg-
ment, as this has been defined in the previous sec-
tions, there is a class of statements about which we
are called upon to say something if only for the

sake of clearing our exposition of the subject under discussion from unnecessary ambiguity. We have seen that assertion is the main characteristic of judgment, and that what a judgment asserts is some quality or relation of the objects about which we think. It would seem quite obvious, therefore, that unless we think about some object or other, there can be, for us, no such thing as judgment. Judgment implies thought, and thought implies something thought about.

In contrast to judgment, as thus understood, we are confronted with a class of statements which simulate judgments, but which fall short of being true judgments because they are not based on the thinking of the person who makes them. We may cite in illustration not only the parrot-like statements of the class-room recitation, but the ill-informed and often misleading expressions of opinion that many of us allow ourselves to make with confidence on all sorts of subjects about which we know relevantly nothing. The certainty that attaches to such statements has little or nothing to do with their subject-matter; it usually rests upon the

confidence we have in 'authority' of some kind or other. For instance, students rarely call in question the statements they find in their text-books, and consequently they are ready to state as true anything they read in them for no better reason than that it is 'in the book.' Indeed, most of us entertain, and express to others, beliefs that are based solely upon statements we have read in some magazine or newspaper, or have heard in a public address or in private conversation. To communicate, in this way, the opinions of others is doubtless a valuable social function, but the statements in which another's views are given currency should not be confused with judgments in the sense in which this term has been defined. We may, for want of a better word, distinguish these statements as groundless assertions, for what enables us to distinguish them from true judgments is the fact that, in respect of the latter, we are always more or less conscious of the reasons for what the judgment asserts. Our judgments are, as it is said, grounded judgments, and the grounds of the judgment are the reasons that thought can give for the particulars asserted by the judgment. For, as we have seen, the asserted particulars are always what thought reveals as true of the subject thought about.

The distinction that we have drawn in this section between groundless statements and judgment corresponds, in a general way, to that which appears in the history of Greek speculation as the distinction between 'opinion' and 'knowledge.'

Practical and Theoretical Aspects of Thought.
Whether we use the term thought in the broadest
of the meanings already distinguished, or in one of
its more restricted senses, it is undoubtedly true
that we cannot fully describe the experience that
the term denotes without recognising the fact that,
along with those differentiations which the object
of thought undergoes, for example, in perception,
in ideal representation, and in ideational thought,
tendencies of a practical sort are aroused which not
only accompany the thinking process, but, in part,
give it the character and direction which it undoubt-
edly possesses. Thus the psychologists have been
accustomed to recognise that instinctive impulses
are present in perception which tend to place the
percipient subject in relation to external objects;
that in ideal representation active tendencies of the
kind called desires are directed toward objects
which, not being actually present, are held before
consciousness as an end to be realised; and that in
ideational thought the process of generalisation for-
mulates ideals which are sometimes of so complex
a character that, while they may become the objects
of individual desire, they are attainable only as the
result of social cooperation. Whether, therefore, in
its simpler or more complex forms, thought seems
to have, not only an aspect which is directly con-
cerned with the definition of an object, a theoretical
aspect, but also a practical aspect, a certain conative
tendency whose function it is to direct the process

of thinking and to give its content a definite charac-
ter and objective.

Relevant Assertion. From the point of view we
have now reached, we may indicate certain features
of the logical judgment which correspond, in a gen-
eral way, to this distinction in the nature of think-
ing itself. The function of judgment we have said
is assertion. We have now to point out that when-
ever assertion satisfies the logical conditions of
truth, and is not mere or groundless assertion, it is
seen to have two characteristics both of which are
included under the single term 'relevant.' More
explicitly stated, judgments, in the logical sense of
that term, are always relevant assertions, and their
relevancy is based upon, and is the logical expression
of, the theoretical and practical aspects of the
though process which were indicated above. Judg-
ments, in other words, always refer to some object,
and fulfill some need of the person asserting the
judgment. Whenever they do either or both of these
things, our judgments are said to be relevant asser-
tions. Briefly stated, judgments are assertions that
are relevant (1) to the motives that operate to
produce them, and (2) to the material by which
they are called forth and to which they refer.

To consider the first meaning of relevancy, that
which refers to the motives that operate to produce
our judgments, we may say that this is concerned
with the reasons why any one judges at all. If,
then, it were asked why any one judges, the answer
would be that one cannot 'get along' without it. In

a broad way, the life of thought is based in and
grows out of our practical needs. As an illustration
of what this statement means, we may refer to the
development of agriculture in the history of civil-
isation. Before agriculture had become one of the
institutions of human society, men no doubt were
confronted with the problem of food supply, and
they met this problem in a way that was fairly
satisfactory until the accumulation of various forms
of wealth made a predatory and wandering life both
irksome and unprofitable. When, for instance, the
domestication of animals had become an accom-
plished fact, this not only made a wandering life
more difficult, but it also exposed the primitive com-
munity to greater loss through drought, long jour-
neys, and marauding attacks from hostile and mer-
cenary tribes. But unless fruits and cereals could
be domesticated, as animals had been, there was
before the primitive community the necessity of
seeking food where it grew, whatever the risks and
losses that might be incurred. Now it takes but a
little imagination to see that the great difficulties
that beset tribes advancing from a wandering to a
settled mode of life would act as a stimulus to their
thought, and would engage their thought in the
direction of these difficulties themselves. It may
seem to us who have grown up under settled con-
ditions of life a simple matter to perceive the prob-
lem and the solution of which it was capable. But
before the food supply of man and beast could be
raised, within a restricted area, by man's efforts

from seeds, there was required exactly that develop-
ment of the thought processes which the mainte-
nance of the institution of agriculture calls for at
the present day. What, therefore, we may say is
that the principle of this illustration, namely, that
our needs stimulate the judging activity and direct
it toward an understanding of whatever threatens
the satisfaction of these needs, is capable of indefi-
nite extension ; and that the incentives to knowledge
become more numerous and diverse as, with the
growth in complexity of our social life, obstacles
are multiplied, and needs increase in number or
change their form. Thus, over the whole course
of our experience, thought not only interprets the

environment, but determines the particular adjust-
ments that, under change of environment, are neces-
sary if the varying needs of life are to be met.

The relevancy of our judgments to the varying
needs by which they are called forth may be further
illustrated, and, for this purpose, let us suppose
that we have a hundred books, and that our problem
is what we are going to do with them. It is very
probable, first, that we shall want to have them all
in one place. Within the space allotted to them, we
are likely to arrange them under some scheme of
classification, authors, subjects, or what not.
Now why do we do this? Is it needless? By no
means. We are simply obeying in our manner of
dealing with the books a fundamental need for
order. But what particular order we impose upon
the books will depend upon the particular form that

the demand assumes. Thus, in the first instance,
we bring all the books together in one place; place
is the principle of our classification. In the second
instance, we have carried the matter further, and
have arranged the books, let us say, according to
subjects, subject-matter is a more specialised
form of the need for order which operates through-
out all our classifications. But if it is asked why
any order is necessary, we can only say that when
classified objects are more easily handled and used.
The point of the illustration is that, when we have
to deal with a hundred books, we are bound to think
about the books in terms of our interest in them.
Thus the first classification according to place might
be satisfactory to the housekeeper whose interest in
the books is aesthetic, as articles of furniture in a
room. The classification according to author would
satisfy the interests of the man whose manner of
speaking about books is, 'Oh, yes, I have Dickens,
Eliot, Thackeray, etc.' The scholar's interest is
most likely to be met by the arrangement according
to subjects. In each case, what we think about the
books, whether as articles of furniture, or as the
works of such and such authors, or as dealing with
given subjects, depends upon the interest we have
in them. And what is true in this particular in-
stance is true in every case of judgment. Our judg-
ments, in a word, are assertions that are relevant
to the interests out of which they are born.

The foregoing statement and illustrations of the
conditions under which the judging activity comes

into play indicate clearly enough what is meant by
the practical nature of all our thinking. But be-
cause the word practical is, in ordinary speech, so
intimately associated with the getting of material

goods, or with the removal of material hindrances,
the exact meaning of the statement that all judgment
is conditioned by the presence of practical needs is
liable to be given too narrow an interpretation. By
a practical need, it is true, we mean one that is con-
cerned with getting an anticipated good, or with
removing a present hindrance to further goods.
But the goods in question need not be material, and
in many cases are not material. We have no wish
to deny that man is an economic animal, and that
what we call property is based in and grows out of
his need for 'things/ But it is no less true that
man is a social animal, and that the various organ-
isations in which he is associated, the family, the
shop, the club, etc., have their foundation in the
needs which prompt men to associate with their
kind. The social is, no less than the economic, a
practical need. A similar line of remark applies also
to our science, art, and religion. There are, doubt-
less, intellectual, emotional, and volitional needs,
complex in their nature, and variously combined in
the instances just given, which impel men to seek
their satisfaction in the formulation of the objects
to which these needs point. Over the whole range
of life, then, situations are constantly arising in
which unsatisfied demands impel us to think, and
to think with reference to these demands. Nowhere

can this practical aspect of the judging activity find
more or more pertinent illustration than in a study
of the ways in which the human race has advanced
in the arts of civilised life. But to bring the truth
of this view home to ourselves, we need only to ask
if we, as individuals, ever think when the situations
in which we find ourselves are entirely satisfactory.
Even a student, very often, will not think until a
failure stares him in the face.

Turning now to the second meaning of relevancy,
we may say that judgments are assertions about
the material by which they are called forth and to
which they refer. In the development of knowledge,
our interests never become so one-sided that our
judgments are freed from the control of the mate-
rial through which these interests are to receive
their satisfaction. If, for instance, we were con-
scious of nothing but compelling interests, be those
interests psychologically never so definite, or if we
were moved by a vague catholicity of mind that
went out to everything in general, but took hold on
nothing in particular, judgment would be impos-
sible. There are states of mind that correspond
more or less closely to those just described, states
that are definite as to interests but indefinite, vague,
or empty as to their objects; and others that are
vague and indefinite in both respects; but no one
would think of calling these states cognition, or the

reactions they may involve judgments. What we
aim at in the judgment is to characterise an

object in such a way that it becomes better
known. The study of the judgment, therefore, is
a study of the relation of thought to its object.
Now, when one attempts to study the relation in
which thought stands to its object, one is partic-
ularly prone to two kinds of error. In the first
place, he is apt to think of the mind as a passive
mirror that reflects indifferently whatever is held
up before it. That is to say, he is liable to overlook
the presence in all knowledge of the interest factor
of which we have already spoken. If, however, he
escapes this pitfall, he is prone to go to the other
extreme and think of the mind as a magic mirror
that transforms out of all likeness to their own
nature the objects that pass in front of it. That is
to say, he is liable to overlook or underestimate the
material factor to which attention is now being
directed. Interests, as we have seen, do make our
judgments significant; but if they are to reach truth
they must also be brought under the control of
objective fact. No judgment can be regarded as
having reached truth which does not open to us the
nature of the object about which it undertakes to
inform us. The fact, therefore, about the judgment
is that, within the sphere of the interests that
stimulate the judging process, the character of
our assertions is limited by the nature of the mate-
rial or subject with which we are dealing. For
example, in writing this section of logic, I am
prompted by the desire to write in such a way that
the student who reads shall be able, with ordinary

attention, to understand the doctrine. But what
the doctrine is does not depend upon this interest;
what I say must be true of the subject we are dis-
cussing. However, this must be said, that what I
include and what I omit, what form the sentences
take, and what illustrations are used, are deter-
mined by the purpose and needs the section is in-
tended to serve. I cannot say anything I please
about the judgment, but I can examine it to see
how far it lends itself to the satisfaction of the
interests that lead me to write about it. We may
take any other illustration we please, and the same
thing will be found true. The difference, for ex-
ample, between history and romance, other things
being equal, is the difference between the way the
historian and the novelist feel themselves bound by
the character and order of the occurrences which
they narrate. The historian's purpose is to describe
a complex social situation as it actually existed, and
to develop the consequences, in the way of cause and
effect, of the situation thus depicted. The novelist's

treatment of the same material is much freer from
the control of the objective events within which, as
in a framework, his romance is made to move. But
it is only in the former of these two cases that truth
is the aim; the relative unimportance of this aim
in the novel accounts for the looser handling of the
historical material. We may, therefore, conclude
that interest or purpose sustains and directs the
whole process in which our judgments are formed,
and that what the judgment asserts, since all judg-

ments claim to be true, must derive its character
from the material which constitutes the subject-
matter of the process of judgment.

The Interest Factor in Knowledge. In the pre-
ceding section, we have seen that judgments are
assertions that are relevant to the interests or pur-
pose of the person who judges, and also to the
material or body of facts which, in the judgment,
receive a particular characterisation. Now it will
serve to further emphasise this distinction, if we
call attention more particularly to the way in which
these factors of knowledge are related to one an-
other. We may in general distinguish two cases.
There is first the case in which our interest in the
objects which we are led to observe is extrinsic to
the objects themselves, and, secondly, the case in
which it is primarily intrinsic.

To consider the former case, we may remark
that we are often led to observe and make asser-
tions about objects, not because of any particular
interest in the objects themselves, but because of
the relation in which these objects stand to other
objects in which we are interested. Let us take
as an example my observation of the shape, colour,
and arrangement of the roses in the vase that stands
upon the table at which I write. It is true, of
course, that I may be induced to observe them, and
to study their particular characteristics by reason
of an interest that is rooted in my knowledge of
floriculture. But, on the other hand, the attention
that I give to the flowers may be due, for example,

to my interest in the person who picked them and
placed them where, as I now write, they become
the object of my perception. Or, if this is not the
fact, my interest may grow out of my liking for a
patch of colour of any kind, or for the particular
combination of colours that the flowers present. In
the former of these suppositions, the interest is
social, and in the latter, it is aesthetic. In in-
stances like these, we may say that the object
sustains an interest that is extrinsic to itself, and
gives to the interest a longer life than it would

otherwise have. If, from this point of view, we
speak of the flowers at all we should say that they
were pretty, a judgment it is true, but one which
expresses one's feelings for the flowers rather than
one which tells anything about the flowers them-
selves. Such judgments are usually called value
judgments, judgments which express the value
or worth of the objects for the individual expressing
the judgment. We express multitudes of such judg-
ments in the course of our lives, and of a great deal
that is noblest and best in our experience we can
speak in no other way. The student will find that
most of the judgments that he expresses on morals,
art, and religion are what are called value judg-
ments ; judgments, that is to say, that are stimulated
by interests that are extrinsic to the objects about
which he judges.

If, now, we consider knowledge in the more
scientific meaning of the term, we shall find that
here the interest factor is intrinsic, that it is

grounded in the object in a way we have seen not
to be the fact in the class of cases just studied.
Scientific interest, in other words, is an interest in
objects for their own sake. Of course, it is some-
times said that interest or purpose is altogether
absent from our scientific activities, and that it is
this fact that distinguishes science from all other
kinds of knowledge. If all that has been written
about the disinterested nature of scientific study
were true, science would have been destroyed, before
this, at the hands of its friends. The fact is, how-
ever, as our study of the nature of knowledge has
shown, there is no knowledge which does not spring
from some form of human interest. It is not true,
therefore, that what we mean by science, in con-
tradistinction to what is not science, can be stated
in terms of its freedom from interests which
direct the course and prescribe the goal that science
aims to reach. What is true, on the negative side,
is that certain kinds of interests are detrimental
to the existence of science. But to deny the useful-
ness of certain kinds of interest, is certainly a very
different matter from denying all interest whatever.
For science, as was pointed out by Plato and Aris-
totle, would have no existence were it not for that
curiosity and wonder which is awakened very early
in all of us by the changing appearances in the
course of nature. It is this curiosity which, when
specialised, is the source of scientific interest, and
which, in its developed form, is an interest which
centres in the objects which it prompts us to study.

In other words, the interest which is the motive of
scientific effort appears in the form of a desire to

comprehend the nature and relations of the objects
of our experience. The better we understand these
objects, the more alive does our interest in them
become; and the more alert this interest, the more
keen do we become in our study of these objects.
The interest and the object of scientific work are
thus keyed to each other in a way that makes them
mutually supporting; and the further we study
their relations, the clearer does it become, as was
intimated above, that they are different aspects of
a single process. Scientific interest, then, is an
interest in objects for their own sake; it is an in-
terest that prompts us to ascertain all that can be
truly known about these objects.

The Object of Judgment. If we now pass from
the study of the relations of interest and subject-
matter upon which we have been dwelling, and
regard the judgment as an assertion about its
subject-matter, certain other features of the judg-
ment come into view. In our previous discussions,
we have had occasion to specify what is meant by
the subject-matter of the judgment, and this, it will
be remembered, was found to be identical with what,
from the psychological point of view, is denominated
the content of thought. Thought and judgment are
thought and judgment about some thing. Without,
therefore, the challenge of some thing neither
thought nor judgment takes place. But while
thought and judgment imply the existence of a

subject, neither, in the strict sense of these terms,
is identical with the existence of its subject. There
seems to be, therefore, some other feature of the
judgment which distinguishes it from mere aware-
ness, and it is this feature that we have now to
consider.

We may perhaps bring the question of discussion
distinctly forward by the aid of an illustration.
Let it, therefore, be supposed that I am gazing out
of the window while thinking about the distinction,
within the logical judgment, that it is now my desire
to state. I turn the subject about which I am
thinking this way and that, experimenting with it
until my interest in it begins to wane. What I
find, under the supposed conditions, is that the
more interest in the original subject wanes, the
more insistently do factors from other parts of my
environment obtrude on consciousness; and by and
by I find myself wholly engaged with some of these,
-the sloping hill side, the frozen lake, and the
lively company of girls and boys skating upon its
surface. In such an experience, what one observes
is that not only has there been a change from one
subject to another, from a logical problem to a
physical object, but also that changes of another
kind have accompanied those already indicated. The
two consecutive contents of the thought processes,
that is to say, have been followed by changes in the

character of what, in each instance, is asserted. I
do not find, in other words, that what I am thinking
when engaged with the logical problem fits in with,

or can be carried over to, the scene in the distance
which has now become the content of my thought.
Each content has its own appropriate set of asser-
tions. To assert of its subject significant qualities
and relations is what we understand to be the
object of the logical judgment. It will serve to
emphasise the distinction between the subject and
the object of judgment if we recall that Bradley
discriminates in the judgment between what he calls
the 'that' and the 'what.' By the 'that' of a judg-
ment we may mean the content or material of a
thought process, that is, the subject of the judgment
as we have used that term. By the 'what' may be
understood the complex asserted by the judgment.
For instance, the joyful scene upon the frozen lake,
of an illustration already used, is the subject-matter
of any judgment that I may make about it. In
Bradley 's terminology, it is the 'that' of the judg-
ment. If, however, I assert that there is danger
from the ice because of a thaw, and the children
should be warned, this would be the object or the
'what' of the judgment, the complex whole that it
is the business of the judgment to assert.

More recently a similar distinction has been
drawn by the Austrian psychologist, Meinong.
Meinong insists that we must not confuse in any
act of judgment that concerning which we judge,
and what we judge about it. The distinction that
is thus drawn for all judgments is that with which
we are familiar in the case particularly of legal

judgments. Let us say that a person is accused of
a crime. In such a case, we may ask, What is it
that the judge and jury are expected to judge? In
one sense, the object of their judgment is the
prisoner, and in another, it is, let us say, that he
is not guilty of the offense with which he is charged.
There seems, then, to be two objects of judgment,
and, as this inevitably leads to confusion, Meinong
thinks it important that they should be clearly dis-
tinguished. For that purpose, he proposes to use
the term 'object' to denote what we have described
as the subject-matter of the judgment, that is, in
the case supposed, the prisoner; and the term
'objective* to denote what we have called the object,
that is, in the case supposed, the verdict of the
judge and jury. Now Meinong is perfectly right
in saying that the object peculiar to the judgment
is what he calls the 'objective,' that the judgment
exists for the purpose of asserting something about
a definitely apprehended subject-matter, and he is

also right in calling attention to the importance of
fixing this distinction in an appropriate terminology,
because, in the absence of such terminology, of the
tendency to confuse the two kinds of objects.

The Universe of Discourse. In view of the course
that our discussion has taken up to this point, the
logical judgment may be defined as an assertion of,
or of something about, the objects of our experience.
We may, for example, assert that so and so is the
object of which, at the time the assertion is made,
we are thinking, or we may assert certain other

things, besides its existence, of such an object. In
each of these cases there is judgment because the
object is apprehended as having a particular char-
acter, of existence or something else. The judg-
ment, consequently, always implies a relational
content of some sort, that is, an object qualified in
a particular way, and it is such relational contents,
as we have seen, that it is the specific aim of the
judgment to ascertain and assert. If, for example,
the words 'dog,' 'automobile,' 'zeppelin,' are not mere
sounds, but significant terms, they must mean some-
thing more than they express ; either that something
not specified is 'dog,' 'automobile,' 'zeppelin ;' or that
the objects denoted by these terms exist ; or that they
have characteristics which distinguish them from
all other objects ; or that they stand in an indefinite
number of relations to each other, and to numerous
other objects. Each of these alternatives illustrates
the peculiar character of the judgment, since each
of them specifies a content of thought in which
relations of some sort are involved. The special
object of the judgment, as we have seen, is to
assert just such relational contents as these.

The question may now be raised whether this is
the whole story of the judgment, whether, that is,
the asserted content embodies the whole meaning
of an act of judgment. To this a negative reply
must be given. Such an answer is necessitated in
part by the fact, as we have seen, that our concrete
acts of judgment are not satisfied with the assertion
of any content, but only with those that are ger-

mane to the motives by which the acts of judgment
are controlled. But the negative answer is ren-
dered necessary also by the fact that the subject
qualified in the judgment, distinguished as the log-
ical subject, is only a part of the actual subject,
distinguished as the real subject, which the judg-
ment, taken as a whole, is understood to qualify.
If this is true, a judgment asserts only part of what
it means, and we must understand that the unas-
serted part of its content is related to the judgment

as the judgment's presupposition. On this view,
every judgment must be presumed to involve or
presuppose, besides and as part of what it asserts,
a wider range of fact in the light of which the
particulars which form the content of the judg-
ment's assertion are to be interpreted. The range
of fact presupposed by any of our judgments is
described in logic as a universe of discourse.

The meaning and truth of this statement will be
readily seen in a simple illustration. Any proposi-
tion which contains, for example, the term 'style'
is at once recognised to mean one thing if the topic
of conversation is current modes of dress, and that
when the topic of conversation is literature it means
something quite different. Thus, if we take the fa-
miliar saying, Le style c'est I'homme, in abstraction
from all contexts, its meaning is certainly ambig-
uous ; and the only hope of removing this ambiguity
is to restore the saying to a context in relation to
which it can be significantly asserted. Or, to borrow
an illustration from Major in discussing a closely

related topic from the psychological point of view,
we may say that "if one is engaged with astronom-
ical matters, the word 'star' means a heavenly body.
. . . But if the general topic of our discourse is
theatres or ball games or decorations, the meaning
. . . of 'star' will likely be very different." From
these and similar illustrations it is evident that the
meaning of what is asserted in any judgment is
rendered particular as much by virtue of what it
presupposes, that is by its universe of discourse, as
by what it definitely asserts. We may say, conse-
quently, that it is the intention of every judgment
to acknowledge the truth of what it asserts in the
sphere of what the judgment presupposes, that is,
in some definitely implied universe of discourse.
To apply this view to another case, we may say that
the statement, 'Mr. Wilson was elected by the pop-
ular vote of the people,' asserts a fact that qualifies
in a unique way the political history of the United
States, and not a fact that sets Mr. Wilson, by
virtue of his election to the presidential office, apart
from his fellow citizens. Mr. Wilson's citizenship
is unaffected by his election, and, therefore, it can-
not be in respect of this that our judgment is sig-
nificant, but the election does determine in a par-
ticular way the political history of the Republic,
and this, therefore, must, in logical terms, be the
universe of discourse within which our judgment
of the election must be understood to fall.

It follows from this view of the j'udgment that
the universe of discourse implied by any judgment

exists always in a relatively indeterminate and
incomplete form. This statement does not mean,
although it is sometimes true, that particular judg-
ments indicate only vaguely the universe within
which their meaning is asserted. It means rather
that, in the particular which the judgment asserts,
the universe is found to be either not determined
at all, or not to be determined with an explicitness
that renders it serviceable for an immediately con-
trolling purpose. Whatever degree of determinate-
ness the general field or subject presupposed by any
of our judgments may have, that field or subject
can be used as a universe only if it is thought
capable of receiving, through judgment, a more
concrete and determined form. But it also follows
from the view we are developing that judgments
themselves are incomplete and point beyond them-
selves. They are, as it were, fragments torn from
their contexts; but, even so conceived, they carry
with them, as a rule, evidence of their connection
with the contexts from which they have been torn.
Unless this were so, single judgments would always
remain ambiguous. But if this were the case, if,
that is, there existed even a considerable number
of judgments from which we are unable to remove
their ambiguity, because they do not point with
sufficient definiteness to an interpreting context, the
fact that, apart from such contexts, they remain
ambiguous is in itself evidence that they lack some-
thing which is characteristic of significant asser-
tions. The meaning, therefore, of any judgment is

the meaning that it comes to have by virtue of its
pointing relevantly to something which is not iden-
tical with the relational content asserted by it. In
so far then as a judgment has to be supplemented
by what its context supplies, so far is it incomplete;
and if this incompleteness is to be overcome, it must
be by what the judgment enables us to add through
its presuppositions.

If, in view of this discussion, we now define the
judgment, more fully than we have done hitherto,
as an assertion of, or of something about, the reality
presupposed by the judgment, we are immediately
confronted with a question concerning the kinds of
reality presupposed by our various judgments. In
respect to this question, it has been maintained, for
example by Bradley, that the real subject of which
the thought-contents asserted by all our judgments
are predicated is the totality of really existing things
which we call the universe. Whatever any judg-
ment asserts, just that, so it is maintained, is as-
serted of reality in the sense of the system of inter-
related existences known as the universe. Reality,
according to this view, is always that about which
we judge, and our particular judgments assign to
it, as its subject, the concrete details which such
judgments assert. On this view, no question as to
what is the universe presupposed by any judgment

could arise, or if it did, it would be answered before
it was asked.

Now, in considering this view, we do not need
to inquire whether in the end we should be obliged

to take some such position as has just been stated,
although there seem to be difficulties in the way
of its adoption; what rather is more to our present
purpose is to remark that such a statement does not
represent the actual circumstances in which many
of our concrete acts of judgment are made. For
instance, the series of judgments in which the
ancient mythologies state the relations of the gods
and goddesses to one another, and to natural events
and human history, cannot be said to be made of
the universe of really existing objects in the sense
that the series of judgments which constitute the
body of one of the natural sciences can be said to
be made of that universe. If, further, we consider
the judgments in which we express social, ethical,
and aesthetical facts and relations, judgments, as
we have seen, which are not descriptive in the sense
that scientific judgments are descriptive, but which
refer human behaviour and natural phenomena to
a norm or standard, it is difficult to maintain that
these are made with immediate reference to the
universe which sums up in itself all that may be
called real. Whether the facts and relations that
constitute the subject-matter of mythology, of soci-
ology, ethics, and aesthetics can be asserted of the
universe of which the facts and relations of the
natural sciences are asserted, is not the question
that confronts us; the question rather is whether,
in the acts of judgment which give definite form
to our knowledge of these subjects, they are so
asserted, or whether they are asserted of other

universes than the one which is existentially real.
If we admit, as we must, the latter alternative, if,
that is, we admit the existence of a number of uni-
verses, other than the real, within which judgments
may fall, the question whether the real universe
includes all these, as is sometimes maintained, is
still left open, and we do not need to close it, for
the reason, if for no other, that the problem involved
belongs to metaphysics rather than to logic. Logic
is interested in the question only for the purpose of
emphasising the importance of ascertaining the
universe in relation to which, as a matter of fact,
particular judgments are asserted as the condition
of correctly interpreting such judgments. Thus if
we were confined to the view we are criticising, the
assertion that 'Fishes are animals which get their
oxygen from the water in which they live through
gill slits/ and The Royal dragon of China has five

claws' would have to be taken as qualifying a single
universe ; but surely no one not blinded by a theory
could fail to observe that in the former case we are
asserting in the world of zoological fact, and in the
latter in the world of Chinese heraldic design. The
view, therefore, that seems most serviceable, and
the one which keeps closest to the facts of our ordi-
nary experience, is the view that emphasises the
importance of bringing particular judgments into
relation with their immediate contexts whatever
these may be, and warns us against resolving the
distinctions by which these contexts are character-
ised into a single context about which the only

intelligible thing that can be said is that, in some
sense, it is real or exists. In this connection it may
be remarked that for logic the important question is
in what sense the reality or truth of an assertion
is to be understood.

Truth, Probability and Error. Truth, probability
and error, as employed in logic, are terms which
describe characteristics that belong to assertions,
they are never employed, as they sometimes are in
popular speech, to designate qualities of the objects
about which the assertions are made. From the
standpoint of logic, objects exist, and they are only
the assertions which are made about particular
existing things that are said to be true, probable,
or erroneous. Truth, probability, and error, then,
can never be predicated of things, but only of our
judgments of, or about, things.

Now, since all judgments claim to be true, we
have to inquire what we mean by truth, and how
there can be such things as probability and error.
With regard to the meaning of truth, it is pretty
generally agreed that the notion is so nearly ulti-
mate that we find it difficult, if not impossible, to
offer a definition which does not involve the notion
itself as one of the terms. But if truth cannot be
defined, we can describe, in a more or less satis-
factory manner, what we mean when we use the
word. We may say, then, that an assertion is
true when it assigns a character to the elements
and relations of a subject-matter which are found
to be verified when this subject-matter is investi-

gated by appropriate methods. Thus the judgment,
'The fire is hot/ is true, if, when I put myself into
sufficiently close proximity to the fire referred to,
I experience the sensation called heat. Truth, then,
is not a quality of judgments merely as such ; it is
a quality that belongs to judgments ad hoc, that is,
as assertions of definitely specified contents. When,
in other words, the ideas conveyed by a judgment

are such that, in the universe presupposed by the
judgment, there are facts which exist in the manner
it asserts, the judgment is said to be true. Truth,
that is to say, is always a claim that is set up on
behalf of a judgment's object, in behalf, that is, of
what Meinong called the judgment's 'objective.'

In view of this general statement, it may be
asked whether any judgment is true, or whether
judgments are at best only probable. The answer
to this question obviously depends upon whether we
ever need to go beyond a judgment's assertion to
ascertain whether the facts and relations asserted
by it are as they are asserted. When, for example,
we assert that The sun is the source of the world's
heat,' it is obvious that the verification of the asser-
tion must be sought in astronomical physics, that,
in other words, the judgment is true conditionally
upon our being able to verify, in the appropriate
universe, the facts and relations asserted in the
judgment. But not all our judgments are, in this
sense, assertions about a given subject; judgments
are also assertions of a given subject. If, for ex-
ample, we say, 'The subject about which we are

thinking is the sun as the source of the world's
heat/ it is obvious that, whatever physics may have
to say about this particular subject, it can have
nothing to say that throws doubt upon the fact that,
at the time the assertion is made, we are actually
thinking about this particular subject. We select
an illustrative example from the world of physical
objects because arguments for the absolute contin-
gency of truth have sometimes been framed on the
supposition that contingency can be removed only
when all the factors of the judgment are merely
states of one's own mind. It is often said, for instance,
that the certainty that belongs to mathematics
is rendered possible by the fact that the fundamental
notions of mathematics are concepts and not really
existing things. Whether this view of mathematics
is correct or not, it is certain that the judgments
which assert these fundamental notions are no more
indubitable than are those judgments which assert
some object in the physical world as the object of
thought's activity. It would seem to follow, there-
fore, that all judgments which are assertions of
particular objects as the objects of thought are true
in the sense that it is not possible for those who
entertain them to be in any doubt that those are
the objects with which thought is engaged.

Judgments which make assertions about, and
are not merely assertions of, their subject-matter
are in a different position from those just considered.
The chief difference is that in their case we have
to go outside the judgment's assertion for the veri-

fication of the truth of what such judgments assert.
The grounds, that is to say, on which the truth of
these judgments rest are to be found in the universe
to which what the judgment asserts is known to
belong. The fact to which attention is in this way
being directed is that the assertions we make about
the objects of our experience do not derive their
truth from the fact that they are asserted, but from
the fact that there can be shown to exist in a given
universe facts and relations of the kind that our
judgments assert. This interpretation of the truth
of our judgments should not come as a surprise to
those who have followed the discussions of this and
the preceding chapters, for the demand for a test
of truth is after all merely a challenge to refer one's
judgments back to the conditions which, in the first
place, made them possible. In this way we are
enabled to show that, when all the motives that,
in the first place, conditioned the judgment are
operative, the assertion contained in it is just the
assertion that that situation compels us to make.
Thus when the chemist's assertion that the liquid
contained in a particular bottle is sulphuric acid is
called in question, he does not attempt to prove the
truth of his judgment by an emphatic restatement
of it, nor by any form or number of reiterations;
what he does, if he wishes to remove the doubt that
the question has raised, is to apply the tests for
this substance which, in the first place, convinced
him that it was sulphuric acid and not something
else. We may conclude, therefore, with reference

to the class of judgments under consideration that
their truth is conditional upon our ability to apply
tests of a kind suitable to the character of the
subject-matter about which the assertions are made,
for it is only when tested that we are able to com-
pare what is asserted with what happens in situu-
ations similar to those in which the judgments in
question originated. In the absence of such tests,
judgments of this class can only be said to have more
or less probability.

There are situations, however, in which we are
either unable or unwilling to verify our judgments,
and are thus precluded from determining the par-
ticular degree of credibility that properly belongs
to them. In these cases, the claim to truth which
all judgments maintain on their own behalf can be
acquiesced in as little as it can be dissented from.
There belongs, consequently, to the judgments in
question the probability that attaches to any unver-
ified assertion from whatever cause it may arise.

It is because so large a number of our social
judgments are incapable of the strict proof that
can be insisted upon when the subject of the judg-
ment is some part of the material universe that,

as a class, they have generally been regarded as
possessing a lower degree of certainty than that
which seems to belong to some of the established
conclusions of the natural sciences. We cannot
revive in the form of actually existing situations,
for example, the circumstances which determined
our actions of a week ago, and we cannot, therefore,

verify the judgments of which these actions are
the practical expression. That at the time indicated
and in relation to the situation then existing we did
judge so and so, is as certain as any judgment can
be; but that the judgment at which we then arrived
was true is, in the nature of the case, beyond the
possibility of strict proof. It would certainly be a
very gratuitous form of scepticism to repose no
confidence whatever in any social judgment, because
all such judgments labour under this disadvantage;
and to suggest its possibility is sufficient to expose
the absurdity of such a course. For it may be
affirmed that the disadvantage in question is not
confined to the social judgments we are now con-
sidering. It may be urged that some of the judg-
ments that are made about the material universe
are incapable of the experimental proof to which
our exposition has pointed as the test of truth. Our
belief that the sum total of physical things is a
universe, is, that is, a sphere of material existences
whose changes are all subject to law, is not beyond
question; and when the belief is challenged, as it
has been recently, we cannot put the material uni-
verse itself in evidence on either side of the ques-
tion. Such a belief, and the judgment in which the
belief is asserted, can have no other kind of cer-
tainty than that which belongs to the social judg-
ments of which we have in particular been speaking.
Current belief undoubtedly regards the moon as a
sphere, but, on account of the particular configura-
tion of the solar system, it can never be a practically

demonstrated fact that the side which is always
turned away from our earth is not flat. Ether,
ions, centres of force, and atoms themselves are all
subject to the same kind of doubt, whenever any
one, for what seems to him sufficient reasons, is
inclined to call them in question. In view of these
instances, it is only fair to conclude that judgments
about any sort of material must be regarded merely
as probable whenever we are unable to show that
facts and relations of the kind asserted do exist in
the universe that is presupposed by these judgments.
Again, judgments must be classed as probable
whenever we are unwilling, for a reason that seems
sufficient to us, to apply the test of truth. When,
for example, one refuses a cup of coffee of one's
hostess with, 'No, thank you; coffee always means

a sleepless night/ the judgment by which we excuse
or explain our refusal has no doubt a certain prob-
ability derived from past experience, but it is one
that, for prudential reasons, we are unwilling to
verify in the particular circumstances which are
the occasion of its assertion. Sleepless nights, we
may admit, have followed the drinking of coffee in
the past, and it is anticipated that a similar result
will follow on the present occasion. In a case like
this, which is typical of many others that involve
future consequences rather than past acts, we should
be going beyond the bounds of necessity if we ac-
ceded without reservation the certainty that the
judgment claims on its own behalf. We feel, per-
haps, that the judgment in question has a high

degree of probability, but whether it deserves the
confidence, say, that is commonly reposed in the
prediction of a solar eclipse, is a matter upon which
it is not necessary to dogmatise. It is more to the
point to observe that the class of judgments that
we are discussing is conditional, and, consequently,
that it is only if we suppose the present situation
is in all essential respects similar to those in which
the consequence has followed in the past, that we
have sufficient reason for believing that a like con-
sequence will follow on the present occasion. But
it is exactly this supposition of which the judgment
itself is unable to give assurance, and which there-
fore renders the judgment less, than certain until
it is submitted to the process of proof.

We may now pass to the meaning of error.
And, in the first place, error must be distinguished
from mere irrelevance. Irrelevance may exist in
either of two forms. It may exist, first, as an in-
compatibility in the content of what a judgment
asserts. If, for example, Shylock's bond had been
drawn for a pound of justice, and not for a pound
of flesh, there would have been an irrelevance of the
kind in question, because the avoirdupois scale can-
not in any sense be made the measure of justice.
The universe suggested by the assertion, *I will
have a pound of justice/ is one in which the content,
on account of its internal contradiction, cannot pos-
sibly get realised. Irrelevance in this form, then,
arises whenever we predicate of a subject qualities
5

and relations which cannot be realised in the uni-
verse to which the subject is thought to belong.
Instances of this occur whenever we attribute to
purely natural events moral or aesthetic significance,
or when we explain any of our ideals in terms of
mechanical causation. Secondly, irrelevance may
exist as an incompatibility between what is asserted

and the purpose by which the assertion is controlled.
What in these instances is asserted may be true, as,
for example, 'Mont Blanc is snow-capped all the
year round,' but no one would think of making or
entertaining the assertion in a discussion on the
value of Rotterdam as a Dutch port of entry to the
German Rhine. Failure to understand the limita-
tions that a guiding purpose or interest imposes on
what may and what may not be significantly asserted
about a given subject-matter is one of the most
fruitful sources of confusion in discussions of all
sorts, and it is to this form of irrelevancy that we
look for the origin of those half-truths which do
more mischief in the world than frank and un-
blushing error. The comment is worth while in
this connection because it is to the avoidance of
such irrelevance that the student may look as one
of the means of hastening his academic and prac-
tical efficiency. In either of the two forms which
we have now distinguished, then, irrelevance is not
to be identified with error.

Error, in contrast with the second of the two
forms of irrelevance just distinguished, is an asser-
tion which is relevant to a purpose, and, in contrast

to the first, is an assertion whose contents are com-
patible. Unless it possessed both these marks of a
true judgment, error could not possibly exist. To
emphasise the former contrast, we may say that
error is ascribed to any judgment which, if true,
would satisfy the purpose for which the judgment
is made. There follows from this statement a con-
sideration which is important for all our judgments,
namely, that the range of assertion about any
subject-matter is determined at the outset by the
character of the purpose which stimulates and
directs the judging process. In other words, to
expect our judgments to be true is a perfectly rea-
sonable expectation, but to expect that they will
assert the whole truth is to convict our expectation
of being either unmeaning or false. The latter
expectation is indefensible for the same reason that
the former is maintained, namely, that we do not
as a rule, nor can any reason be advanced why we
should, encumber our judgments by asserting non-
significant features of the subject-matter to which
these judgments refer. And if it is asked, 'What is
and what is not significant?' we can only reply that
that all depends upon what the judgment* is wanted
for. The truth of this statement can be readily
seen in what occurs when all interest in a question
vanishes. In such a situation nothing whatever
can get asserted. But when an assertion is made,
it must be made, not merely of something, but for
some purpose, and it is the character of the purpose
that determines what feature of that 'something'

is selected for assertion. There is, for example, no
doubt that the grass is green and, let us say, that
it is long, but it is only the latter assertion that is
pertinent when one has to decide what instructions
to give the gardener about the day's work. What
one thinks about any object, say a house, depends
upon whether we are considering it architecturally,
domestically, or as an investment. These interests,
no doubt, overlap, but they are sufficiently distinct
to make quite irrelevant certain assertions that
might be made from one of these points of view
when, as a matter of fact, we are considering it
from one of the other points of view. But we do
not call judgments false which bear no relation to
the interest by which the judging process is initiated.
Error as well as truth exist only in those judgments
which claim to fulfill the purpose of the individual
by whom they are asserted.

The second contrast stated above calls attention
to the fact that the contents of erroneous judgments
are, as we said, compatible. That is to say the
judgment must assign its content to a sphere in
which it is possible for that content to be realised.
The absence of incongruity between the elements
of what is asserted is a characteristic of error as it
is of truth. When, for example, we judge that an
object is elliptical when in reality it is round, we
are in error, but the error does not consist in
assigning it a shape, but in attributing to it the
wrong shape. The wrong shape, however, is an
antecedently possible shape, and it is upon this ante-

cedent possibility that the erroneous character of
the judgment rests. If instead of asserting that the
object was elliptical we had asserted that it was
blue, we should not regard that as an error; we
should regard it either as a misunderstanding of
the motive of the judgment or as nonsense.

We are now in a position to state what error is.
The problem of error is greatly simplified when it is
observed that no judgment which fails to assert
those features of its subject-matter which are perti-
nent to the purpose in hand could by any possibility
be regarded as true or erroneous. They are, as we
saw, merely irrelevant. It is only when judgments
offer themselves as the means of satisfying a pur-
pose that they are ever entertained. There is, there-
fore, from the standpoint of the interest involved,
little chance for error. All that we can say about
a judgment, from this point of view, is that it does
more or less completely fulfil a present purpose. It
is, therefore, to the character of what is asserted
that we must look finally for the detection of error.
And here, as in the coresponding case of truth, we
are confronted with a simple question of fact. Is
it a fact, we must enquire, that there exist in the

universe presupposed by the judgment qualities and
relations of the kind asserted in the judgment? If
there are, we call the judgment true; if there are
not, we call the judgment erroneous. Error, then,
may be defined as some discrepancy between asser-
tion and fact.

We have been speaking in this section of error
as a failure of the judgment to assert the significant
qualities and relations of the object upon which
thought is directed. The term is also used to denote
those mistakes of judgment which depend, for ex-
ample, upon inference. In this sense it is preferable
to speak of fallacies. A discussion of this subject
will be found in the concluding chapters of this
book.

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QUESTIONS

1. What general meaning may be given to the term object?

2. In what several ways may we be acquainted with
objects?

3. Is the character of an object affected by the way in
which it is apprehended?

4. What do you understand by objects being implicated
in all mental processes?

5. Distinguish three senses in which the term 'thought' has been used, and state how they are related to each other.

6. To which of the meanings already distinguished is thought, from the logical point of view, most closely related?

7. What particular aspect of thought does logic emphasise in its use of the term judgment?

8. What is meant by saying that the subject-matter of judgment is the content of a thought process? Illustrate.

9. Explain: 'Judgment is an assertion of the qualities and relations of the objects of thought.'

10. Is language necessary to give thought the character of assertion? Explain.

11. State clearly what you understand by assertion. Illustrate.

12. Show in what ways judgments are implied, but not expressed, in interrogatives, imperatives, optatives, and exclamations.

13. Describe what is meant by groundless statements, and in what respect do they differ from judgments?

14. Define and illustrate the practical and theoretical aspects of thought processes.

15. 'Judgments may be defined as relevant assertions.' How does this view of the judgment agree with and differ from that stated in Question 9?

16. In what two respects may all judgments be said to be relevant?

17. Explain what is meant by saying that judgment is based in and grows out of our practical needs. Illustrate.

18. Define what you understand by 'practical,' and show how unsatisfied needs of the sort here in question condition the formation of judgments.

19. How is your answer to the preceding question affected by the fact that judgments are assertions about a subject-matter of some sort?

20. To what two kinds of error is one exposed in trying to show the relation of thought to its object?

21. Explain and illustrate what is meant by saying that the interest that conditions a judgment may be extrinsic.

22. What do you understand by a value judgment?

23. Describe the nature of scientific interest, and explain why it may be called, in contrast to other kinds of interest, intrinsic.

24. Is judgment to be distinguished from awareness of an object? Explain.

25. What difference, if any, do you recognise between the subject and the object of judgment, and illustrate by referring to Bradley's distinction between the 'that' and the 'what.'

26. Explain what Meinong means by the 'object' and the 'objective' of logical judgments.

27. How may Meinong's distinction be correlated with the view taken in the text?

28. 'Judgment may be defined as an assertion of, or of something about, the objects of our experience.' Explain this statement, and correlate it with the definitions of judgment in Questions 9 and 15.

29. "Why is the definition of judgment given in the preceding

question not completely satisfactory?

30. What do you understand by a universe of discourse? Illustrate.

31. Why must any universe of discourse have a more or less indeterminate character?

32. Why must single judgments be regarded as incomplete, and, therefore, as being to some extent ambiguous?

33. How may this ambiguity be overcome?

34. 'Judgment may be defined as an assertion of, or of something about, the reality presupposed by the judgment/ Explain and compare with other definitions given in Questions 9, 15, 28.

35. What, according to Bradley, is the universe presupposed by all our judgments?

36. What objections can you urge against Bradley's view?

37. Is there a plurality of universes? Justify your answer and illustrate.

38. Of what are truth, probability and error predicated in logic?

39. In what respect does the logical differ from the popular use of these terms? Illustrate.

40. What is the logical meaning of truth? Illustrate.

41. Of what class of logical judgments can you say that they are certainly true? Illustrate.

42. Can the truth of any of our judgments about a given subject-matter be maintained? State reasons for your answer, and illustrate.

43. What two conditions compel us to regard certain of our judgments as probable, not true?

44. Why do we generally regard judgments about social material merely as probable?

45. Do similar reasons apply to any of our judgments about the material world? Explain and illustrate.

46. How does unwillingness to verify an assertion affect its claim to be true?

47. In what two forms may irrelevance exist? Explain and illustrate each.

48. How do you distinguish irrelevance from error?

49. Why do we not call those judgments which fail to fulfil a purpose erroneous? Illustrate.

50. What is meant by saying that in order to be erroneous judgments must assert contents that are compatible? Illustrate.

51. Wherein consists the nature of error?

52. Can you frame a definition of error?

53. In what respect does error differ from fallacy?

EXERCISES

1. In what sense is the word, thinking, used in the following statements:

(1) All human beings are thinking beings.

(2) There is no truth or error but thinking makes it so.

2. State at least two judgments about each of the following subjects:

(1) Mathematics as a required subject for college graduation.

(2) Inter-collegiate football as a desirable form of student activity.

3. What are the grammatical forms of the following, and show in what sense they may be said to involve judgments :

(1) O wad some power the giftie gie us
To see ourselves as others see us.

(2) How oft the sight of means to do ill deeds
Makes deeds ill done.

(3) Can one desire too much of a good thing?

(4) Are things what they seem?
Or is visions about?

(5) Give me that man
That is not passion's slave, and I will wear him
in my heart's core, ay, in my heart of hearts,
As I do thee.

4. Give six illustrations of what are called groundless
statements.

5. State six judgments on subjects of your own choosing
that show the influence of purpose on the judging
activity.

6. Give six illustrations of the way that judgments are
controlled by the nature of the subject-matter about
which one thinks.

7. Take three instances of judgment from your answer to
Question 5, and the same number from your answer to
Question 6, and show in each case the relation of interest
to subject-matter.

8. Take the remaining instances from your answers to
Questions 5 and 6, and state what is the subject and
the object in each case.

9. What can you say about 'water' in each of the following
universes of discourse: domestic life; chemistry; phys-
ics; art; physiology.

10. Examine the following judgments, and state whether,
and under what conditions, you regard them as true,
irrelevant, probable, or erroneous:

(1) Everything comes if a man will only wait.

(2) For a man's house is his castle.

(3) The many still must labour for the one.

(4) Thought is free.

(5) Virtue is its own reward.

CHAPTER III
THE PROPOSITION

Judgment and the Proposition. In text-books of

logic, it is usual to discuss the judgment and the proposition in the same chapter, and to emphasise the points of similarity between them. In the present chapter, we are to consider the proposition by itself, because in this way we shall be able not only to distinguish between it and the judgment, but to group together certain problems that arise out of the nature of the proposition which are more or less distinct from those of the judgment which were discussed in the previous chapter.

In its most general meaning, a proposition may be defined as the verbal expression of a judgment. As we proceed, this statement will be made more explicit; but it will suffice for our present purpose if it enables us to understand the importance of putting into verbal form the truths that are asserted in our judgments. The necessity of finding a suitable medium for expressing our judgments is forced upon us when it is realised that explicit statements of our meanings are, sometimes, if not frequently, important factors in our search for truth. We often find, for example, that ideas with which we had supposed ourselves perfectly familiar suddenly take on a penumbral haze when we are required to use these ideas in working out new problems, for instance,

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in solving an 'original' in geometry or in finding an 'unknown' in chemistry ; or when we try to communicate these ideas to other people, for instance, in a class recitation. In both these cases, we have before us the task of setting the ideas in question in a different context, and it is the new context into which they are to be fitted that reveals to us defects in the ideas themselves of which we were hitherto unaware. In order to succeed in the problem that is thus presented, it often becomes necessary to give verbal expression to our ideas, and our search for the suitable form is not infrequently found to react upon the ideas themselves to make them more exact. It may also be noticed that when we have once expressed our ideas in accurate verbal forms, we are able to analyse these ideas, and thus to adjust them to other ideas with which they have various relations. For it must be admitted that our interest in ideas is not merely to know that they are true, but, concurrently with this, to use them in enlarging the boundaries and directions of our knowledge. And it contributes to both these objects to secure for our ideas an adequate verbal expression. The statement of our judgments in the form of propositions both clarifies the meaning and renders the application of our ideas possible.

We may bring out the difference between the judgment and the proposition if we refer to the way that each originates in our ordinary experience. In the foregoing chapter, we have had occasion to indi-

cate in a general way the conditions under which our

judgments arise. Judgments were there described
as completed solutions of problems set by the situ-
ations in which one finds himself from time to time.
That is to say, judgments arise out of whatever is
problematical, undetermined, baffling, whether this
falls in the sphere of perception, or in the sphere
of the social, scientific, ethical, sesthetical, or relig-
ious life. Whatever sets a barrier to the satisfac-
tion of wishes, whatever hinders, arrests, or makes
impossible the carrying out of cherished plans, chal-
lenges and stimulates the life of thought, and forces
us into a judgment. Judgments arise out of our
needs for knowledge, and this need is stimulated
when the situation which instigates the need is of
such a character that our way to the successful con-
duct of the theoretical or practical life is blocked.
When we have unravelled the tangle, and see the
total situation in its bearing upon our arrested pur-
suits so that we either modify or change our aims, or
they are given an open field, we may be said to have
judged. It is another story when we ask what are
the conditions that determine the rise of proposi-
tions. In the proposition we are not seeking to
extricate ourselves from an embarrassment, because
no embarrassment is present, and we are not seeking
knowledge, because that already exists. A proposi-
tion, as we have already said, is the verbal statement
of what we already know ; it is a statement in which
something is either affirmed or denied of something
else. It is, consequently, not an instrument of the
search for knowledge, but of its communication.

When we put our judgments into propositional form,
we are making them socially available, and present-
ing them for acceptance or rejection.

The Import of Propositions. A proposition may
be interpreted from either or both of two points of
view : from the point of view of the person speaking,
and from the point of view of the person spoken to.
In each of these cases, the proposition has a different
import or meaning. In the former, where the person
speaking is expressing a judgment concerning a sub-
ject about which he has reached a conclusion, the
proposition means what the judgment which it ex-
presses means, and must be interpreted as a judg-
ment. That is to say, the truth of the proposition
is also the truth of its corresponding judgment, and
vice versa. The meaning of the proposition, inter-
preted from the point of view of the speaker, is
designated in logic as the truth-import of the propo-
sition. In the other case, when we consider the
proposition from the standpoint of the hearer of it,
the proposition and the judgment which it expresses

are not the same, and the truth they express may not be identical. The reason why the proposition may mean one thing to the hearer and another to the speaker must be looked for in the differences of the relations that the hearer and speaker have to the knowledge that the proposition embodies. Or, to put the matter more definitely, the speaker's relations are with the knowledge which the proposition expresses, while the hearer's are with the terms of the proposition itself. When we interpret a propo-

sition from the standpoint of the person spoken to, we have what is called in logic the statement-import of the proposition. The statement-import is, conse-quently, a structural interpretation of the proposi-tion ; it is the meaning that a proposition has when it is considered from the standpoint of its factors or terms.

We may look at this distinction between the statement-import and the truth-import of proposi-tions a little more in detail. It is obvious that the question before the speaker is one of selecting the words that will adequately convey his meaning. When one wishes to make a judgment socially avail-able, one has to express the judgment in words, or in some other recognised means of communication. When, on the other hand, we listen to what is said, or read what is written, the question before us is to ascertain the meaning that the words were originally intended to convey. This is not always as simple as it may sometimes seem. Because, for example, the words in which we are addressed are familiar, it does not follow that the idea that the words express is at all understood. The common misunderstandings of ordinary life, and the more serious difficulties that we meet with in the course of our studies, are due very often to our failure to interpret aright the meaning, not to our inability to understand the words, of the propositions that are laid before us. In such a case, the proposition means for us some-thing that it does not mean for the speaker; it has

for us, that is to say, a statement-import but no truth-import.

It will help our understanding of this statement if we throw the essential factors of our problem into the form of a diagram :

Speaker Hearer

f \ f >

Idea Proposition * Idea

V J V, J

^Y" ~~Y~~"

Truth-import Statement-import

If, reading the above diagram, our interpretation of
the proposition is made from the standpoint of the
speaker, we start with the idea or judgment that has
to be expressed in the proposition; the proposition
is then the verbal expression of the judgment or
idea from which we set out. For the speaker, the
proposition does express his judgment, and so inter-
preted it embodies the truth of his judgment. If,
on the other hand, our interpretation is made from
the standpoint of the hearer, we start with the prop-
osition, the verbal expression of the speaker's judg-
ment, and the words of the proposition have to be
interpreted so as to render an idea or judgment pos-
sible. But what is the guarantee in such a case that
the meaning derived from the proposition will be
the meaning expressed by it? The idea in the
hearer's mind may be different from the idea in the
speaker's mind. It is this idea, the idea or meaning
that the hearer of a statement gets from what is said

to him, that we designate the statement-import of
the proposition. The truth-import and the state-
ment-import of a proposition, therefore, may not be
the same.

But, it may be asked, does not our interpretation
of a proposition, even when it is taken from the
standpoint of the hearer, aim at an identity of mean-
ing between its truth-import and the statement-
import? This is doubtless true. But we should
miss a great deal in our understanding of the life of
thought if we did not see the possibility of the same
statement meaning different things for speaker and
hearer. It is this fact that we have been emphasis-
ing. And it is as desirable to ascertain how this
difference may arise as to see how it may be over-
come. For if we understand the origin of such dif-
ferences, we shall know how to avoid or overcome
them. In either case, we are concerned with the
context of the idea or judgment that we are trying
to understand ; and it is obvious that when the con-
text is different for speaker and hearer, the idea
the proposition conveys must, in some measure, be
different for both. For, as we have seen, the con-
texts in which our ideas occur give part of the mean-
ing that ideas may have. If, therefore, you change
the contexts you change also in part the ideas them-
selves. Thus, whenever we fail to get the meaning
of what is said to us by reason of our failure to
understand the universe of discourse within which
the thought of the speaker is moving, we do not
naturally ask for a repetition of the sentence or

proposition, but require, for its comprehension, a
larger section of the context, and, in some cases, the
revival of the whole universe within which the truth
of the judgment is, by the speaker, presumed to
exist. In other words, it is the fragmentariness of
all our judgments, to which reference has been made,
that is the ground of the difference between the
truth-import and the statement-import of proposi-
tions ; a fragmentariness that can be overcome only
if it is supplemented by a larger portion of the inter-
preting context than is frequently implied by the
single proposition.

We may further elucidate the important distinc-
tion just made between the truth-import and the
statement-import of propositions if we consider it
as a special instance of the difference, first drawn
by the English historian, Grote, and made current
by the American psychologist, James, between
"knowledge of acquaintance" and "knowledge
about." An illustration sometimes used to indicate
the contrast between these two kinds of knowledge
is the difference between the normal child's expe-
rience of light, and the experience of light that a
child, blind from birth, has through the reports of
seeing adults. The knowledge of the two children,
without doubt, is at different removes from the real
character of light. That is to say, the contrast be-
tween "knowledge of acquaintance" and "knowledge
about" calls attention to the fact that the knowledge
that any one has is sometimes immediate and direct,
and sometimes mediate and indirect. Now, the dis-

tinction between the truth-import and the statement-
import of propositions seems to be contingent upon
whether propositions express either the one or the
other of the above-mentioned kinds of knowledge.
We are all aware that much that we ordinarily call
knowledge is based upon nothing more certain than
our ability to understand the words in which this
knowledge has been communicated, while a much
smaller fraction of our knowledge rests on direct
acquaintance with the facts, and a study of the rea-
sons by which such knowledge is supported. In the
one case, propositions embody judgments, and are
to be interpreted as judgments; in the other case,
propositions are statements to be understood,
whether they introduce us or not to the facts out of
which the judgments which they express have come.
To understand what is told us is a first step in knowl-
edge; but it is only a first step, and should lead us
beyond itself to a more intimate and personal ac-
quaintance with the truths and facts that are the
material of advancing knowledge. In other words,
we must proceed from the statement-import to the

truth-import of the propositions which convey to us
so large a proportion of the material upon which the
educative processes as a whole depend.

Formal Analysis of the Proposition. The propo-
sition was defined above as the verbal expression of
a judgment; it is the logical instrument by which
what is true for judgment gets a simple and un-
equivocal expression. But not every verbal expres-
sion of a judgment is a proposition; it may be, for

example, a sentence. A sentence may be a proposi-
tion, as, for example, 'The book is on the table ;' but
this is not necessarily the case, as, for example, 'A
friend of mine has gone abroad/ From the formal
side, the essential difference between the sentence
and the proposition lies in the number of the factors
present in each. A sentence always requires the
presence of a subject and a predicate; the proposi-
tion cannot exist without a subject and predicate,
which are called terms, and also a copula. If we
compare the sentence and the proposition in these
respects, we shall see that the predicate of the sen-
tence is, by logic, broken up into two parts, the
copula and the predicate of the proposition, and that
the subject remains the same. The following dia-
gram represents these relations to the eye :

Sentence: Subject Predicate

A

Proposition: Subject Copula Predicate

The doctrine of formal logic depends upon the struc-
tural difference between the proposition and the sen-
tence as thus outlined. In the following sections,
therefore, we shall dwell on the meaning that logic
assigns to the several parts of the proposition.

Terms. The subjects and predicates of proposi-
tions are called terms. Now, since the proposition
is a statement in which, as we have seen, something
is predicated affirmed or denied of something
else, we may define the predicate term as that which
is predicated, and the subject term as that of which

the predication is made. If, as is usual, we use the
symbol S for the subject term, and the symbol P
for the predicate term, the structural proposition
may be written S P. In such a proposition, P is
said to be predicated of S. We may observe that
the subject term of a proposition is always written
first, and the predicate term last. The reason for

this seems to be that since the proposition is deter-
mined by the interests of communication, it is im-
portant, at first, to call attention to that about which
we wish to speak. If the student remembers this
he will avoid the difficulty that is sometimes expe-
rienced in distinguishing between S and P. For
example, if we wished to express in prepositional
form the statement, 'Uneasy lies the head that wears
a crown,' it would not be accurate to say that 'Un-
easy' is the subject. The rule that may be followed,
whenever we are in doubt as to what our terms are,
is to ask: What am I speaking about? The answer
to this question will give us the subject term. The
predicate term may be found by asking, What am
I saying of this? If we apply these tests to the
example just cited, we shall find that we are speak-
ing about 'The head that wears a crown/ and this,
consequently, is the subject term of the proposition ;
and that what we are saying of this is that it is
'uneasy,' and this, consequently, is the predicate of
the same proposition.

It should be remarked that we are frequently
at a loss to know which is the subject, and which
the predicate, term of given statements. The reason

for this seems to be that in order to know what any
statement means we require sometimes to have be-
fore us a larger section of the whole context of
thought than the particular statement itself pro-
vides. This takes us back to what we said above
about 'the universe of discourse/ and the function
it serves in giving to our particular judgments the
meaning they are intended to have. Propositions
express judgments which are torn loose from their
contexts, and they sometimes do, and sometimes do
not, retain sufficient of the original context to make
our interpretation of them certain. The example
that was quoted above illustrates the former case;
we were doubtless talking about 'crowned heads.'
A more difficult case, taken from Jevons, is the fol-
lowing: 'Life is held dear by every man.' In this
statement, are we talking about 'life,' or about
'things that are held dear,' or about 'every man'?
Grammatically, 'life' is the object of the verb 'holds
dear,' and cannot, therefore, be the subject. The
meaning of the statement, consequently, is : 'Every
man holds life dear.' We are speaking in the uni-
verse of values ; and, in the statement, we are nam-
ing one of the objects of value. If, however, to take
an illustration from Sidgwick, we say that 'Newman
wrote the Grammar of Assent,' we have no means
of determining whether 'Newman' or The Gram-
mar of Assent' is the subject, because, as Sidgwick
says, "the statement is regarded in isolation from
all context. Regarded in this abstract way, it may
equally well be called a statement about Newman,

or about the book, or again about both the man and the book." It would seem, then, that back of all particular statements there lies a universe of fact or idea which flows over into these statements to give them the determinate meaning they may properly have.

Names and Words. Another question, closely connected with the foregoing, arises when we ask whether terms can exist outside the propositions in which they are found. We may ask, for example, whether The head that wears a crown/ which, as we saw, was the subject term of the proposition which was studied above, is always a term, and in whatever connection we may meet the phrase. Or, we may inquire, is it a term only when it occurs in a proposition? To this question we reply that terms are terms only in relation to the proposition in which they occur. For example, we may write down the following :

Silver Conductor of electricity Comets

Plants Without weight Roses

But neither this, nor any similar list, is a list of terms. In logical terminology, this is a list of Names. By a name, therefore, we understand a word, or a collection of words, which has a complete meaning, and which may be used as the subject or predicate of a proposition. In the following, 'Silver/ 'Without weight/ 'Plants/ etc., names from the above list, are terms :

Silver is a conductor of electricity.
Comets are without weight.
Roses are plants.

Now it may seem that the distinction between terms and names is over-drawn, and that it does not correspond to any real difference. This is not the case. For observe that although the words in the list of names, and the words that appear in the propositions are the same, the meaning in the latter case is much more precise than in the former; it has changed from being vague, general, and loose, to being specific, particular, and fixed. In so far as our propositions express judgments, this is the result that we should expect to find. For the sake of emphasis, the difference between a name and a term may be stated in the following way:

A Name is a word, or a collection of words, with a complete meaning, which may be thought of as the S or P of a proposition.

A Term is a word, or collection of words, with a complete meaning, which is thought of as the S

or P of a proposition.

Both terms and names are ordinarily expressed
in words, but it is not because they are words, but
because they have meaning that they are so called.
Terms and names are significant words. We are
not confined, however, to the study of words from
the standpoint of their significance or meaning.
Grammar, for example, studies words with respect
to the uses they have in sentences. Substantitives,

verbs, prepositions, adjectives, adverbs, etc., are the
names of various classes of words that are recog-
nised by grammar when their use is made the basis
of classification. Logic also finds it convenient to
classify words with respect to their uses as terms
in the proposition, disregarding, as does grammar,
the meaning that particular words may have. But
the logical classification is simpler than the gram-
matical, because the logical requirements are nar-
rower and more precise than the grammatical.
Words, for logic, are arranged in two main groups,
according as they are or are not able to stand by
themselves as S or P in a proposition. Words which
by themselves are capable of being thought of as S
or P of a proposition are called Categorematic
words. Words, on the other hand, which require the
assistance of other words before they can be
thought of as the S or P of a proposition are called
Syncategorematic words. 'Metal/ 'laws/ 'elements/
'custom/ are categorematic words, since they may
stand by themselves as terms in a proposition. For
example :

All metals are elements.
Some laws arise from custom.

The words 'of/ 'the/ 'always/ 'a/ in the following
statements, are syncategorematic words, because by
themselves they cannot be thought as S or P in a
proposition.

Mistakes are not always a proof of ignorance.
Bismarck is the man of iron.
A burnt child dreads the fire.

The only apparent exception to the statement of
what should be understood by a syncategorematic
word is illustrated by such instances as the follow-
ing: 'Good is an adjective,' 'Of is a preposition/
But it should be observed that it is not the use of
the word in a logical proposition, but the word as
an example of a group of words in grammar that
is the subject term of such propositions. They are
for logic categorematic words.

If we examine the logical classification of words, we shall see that the terms of propositions in which categorematic words occur are single-worded terms, while the terms of propositions in which syncatego-rematic words occur must necessarily be many-worded terms. On the basis, therefore, of the kinds of words that enter into them, we may classify terms as either single-worded or many-worded terms.

The Copula. The most distinctive element of the proposition is the copula. It is always expressed by 'is' or 'is not,' 'are' or 'are not,' depending on whether the subject term of the proposition is sin-gular or plural, and whether the judgment is affirm-ative or negative. From the standpoint of the hearer, the proposition tends to fall apart into its terms; and it is the function of the copula to hold them together in the concrete unity of a single idea,

and thus .to preserve in the proposition a quality that is characteristic of the judgment itself. The copula must not be looked upon as a coupler be-tween the subject and predicate terms, nor is there any separate and distinct element in the judgment corresponding to it, and coming between the idea of the subject and that of the predicate. Its function is to express the act of judgment by which the S and P are really held together in the way that the proposition expresses.

The copula has been a much debated subject of logic. It will help us to a better understanding of it if we consider some of the views that have been advanced concerning it. We may distinguish two such views, the relational and the existential, and these we shall touch upon briefly in order.

The Relational View. This view is based upon the assumption that each term of the proposition has a distinct meaning, and it holds that the copula brings these terms together in the unity of a single statement. If we -adopt this view, we are required to admit that our concepts or terms are independent of our judgments, and .that is -to deny that judgment is the starting-point of knowledge. The discussions of the logicians of the Middle Ages over Univer-sals were concerned with this subject, and they were divided in their opinion as to whether concepts ex-isted apart from our knowledge of them. The views developed by the Schoolmen, as the great thinkers of the Middle Ages were called, are three, and these wei may enumerate and describe briefly. The real-

istic view, held by Anselm and Aquinas r was that universals or concepts have an existence before and

independently of the particular objects through
which we become aware of them. Briefly expressed,
this position was summarised in the Latin state-
ment: Universalia ante rem. The view of the
Nominalists was that universals or concepts owe
their existence to the prior existence of the par-
ticular objects of our experience, or, as they said,
Universalia post rem. This view was held, among
others, by Roscellinus. A conceptualist view,
which aimed to embody the truth of each of the for-
mer views, was developed by Abelard. This view
called attention to the fact that universals or con-
cepts have no meaning apart from the particular
objects in which they are embodied, and that par-
ticular objects have no meaning apart from the uni-
versal or concept which gives them their significance.
These ideas are expressed in the Latin statement:
Universalia in re. Outside the official teaching of
the Roman Church, which is realistic, some form of
conceptualism quite generally prevails at the present
day. At any rate, it would be agreed by most logi-
cians that concepts are elements of our knowledge,
and that it is our ability to judge, to assert like-
nesses and differences of the objects of our expe-
rience, that gives existence and life to the things
we call concepts. Psychology and logic both teach
that the objects of our experience are inextricably
connected, and that our knowledge grows by dis-
tinguishing now one aspect and now another of the

inter-related world of men and things around us.
If this is true, there is no object that is merely
itself, or that exists in isolation from everything
else. Every object with which we are in any way
concerned is always becoming for us something else,
showing some new quality or entering into some
new relation. This state of affairs is expressed in
logic by saying that there are no S's that are not P's,
that the P predicated of any S is not a foreign thing
that is added to it by the copula, but some quality
that it already possesses, or some relation that it
actually sustains. In other words, we never start
with a bare S, with an S that is an unrelated unit,
but with an SP that is a relational unity, and it is
this fact that becomes explicit in the judgment, S
is P. Unless S were already P, judgment would be
impossible, and the proposition could not exist. The
proposition makes explicit what is already present
in knowledge, and since knowledge, whatever its
form, is a qualification of an S by a P, there does
not seem to be any separate meaning for the copula
when knowledge is expressed in a proposition. That
is to say, we do not need the copula for the estab-
lishment of the knowledge relation; but it is used
in the proposition, as Mill asserts, as "a sign of
predication." In other words, the copula must be
understood as serving notice upon the person who
undertakes to interpret the proposition that S and
P are not separate and distinct things, but, for the
purposes for which the proposition is expressed,

one and inseparable. The proposition, that is, does

not tell us about any S, but only about the S that
is P.

The Existential View. This view arises out of
the fact that 'is,' besides serving as "a sign of pred-
ication," has also a meaning of its own, namely,
existence. Thus, if we say that, 'Aristotle is the
father of formal logic,' it may seem that we are not
merely stating the relation of Aristotle to the science
of logic, but are also asserting the existence of Aris-
totle. For if we do not believe in the reality of Aris-
totle, what significance, it may be asked, can belong
to the statement that he is the founder of formal
logic? To preserve the proposition, therefore, from
evaporating into mere nonsense, we seem forced to
admit that the reality of the subject term must be
secured by the structural character of the proposi-
tion itself. Thus, if we consider the structural for-
mula, 'S is P,' we must, from this point of view,
interpret it as meaning, 'S is, and it is P.' That is
to say, the significance of the predication, 'S is P,'
depends upon our right to take the copula twice
over, and in each case with a different meaning. In
the first case, 'S is' is equivalent to 'S exists ;' in the
second, 'S is P/ 'is' is "a sign of predication," in
the sense already explained. This, in brief, is the
existential view of the copula.

It is evident that we can accept this view only
if we take the copula in the same double way in all
propositions. But this we can not do. There are
some propositions whose terms forbid this interpre-
tation of their copula. When, to take Mill's example,

we say that 'A centaur is a fiction of the poets,'
existence is explicitly denied, but it is no less ex-
cluded when, explaining a name, we say, 'A couch
is an article of furniture used for reclining/ Fur-
ther, if we say that 'Shakespeare's Henry V is nobly
drawn/ we are obviously moving in the sphere of
fiction, as we are moving in the realm of mythology
when we say that 'Zeus is king of all the gods.' In
cases like the foregoing, the existential interpreta-
tion of the copula seems to be without meaning;
but this is so not because 'is' has lost the meaning
of existence, but because the terms of the proposi-
tion will not support such an interpretation. Thus
we see that the effort to give the copula a distinctive
sense, over and above what it has as "a sign of
predication," breaks down before the controlling
influence of the terms which constitute our proposi-
tions. As we have seen, propositions are statements
of the relationship of terms, and the relations are
determined not by any special meaning carried by

the copula, but by the character of the terms that
enter into propositional statements.

To meet these difficulties, it is sometimes pointed
out that, for speaker and hearer alike, all motive
for judgment is taken away unless we presuppose
the reality of the subject-matter of our judgments.
We do not express judgments, it is said, about sub-
jects which we believe do not exist. This may be
readily granted ; but we should remark, at the same
time, that it is one thing to admit that existence
is presupposed by our judgments, and quite another

to affirm that reality is asserted by the copula of
the propositions in which our judgments are ex-
pressed. Judgments may imply reality without as-
serting reality. Belief in the reality of Columbus,
for example, is implied in the statement that 'Co-
lumbus is the discoverer of America ;' but what the
statement asserts is that he discovered America.
And what is true of this case, is substantially true
of every case of the judgment.

If, then, we must hold that belief in reality is
presupposed by every judgment, it is obvious that
we cannot mean the same thing by existence in
every case of judgment. In the examples, 'Utopia
is the ideal commonwealth as depicted by More/ and
The sun is the centre of our solar system,' we can
not be supposed to imply that 'The sun' and 'Utopia'
belong to the same sphere of existence or reality.
In other words, we must recognise different spheres
of reality, and it is existence within one or other
of these spheres that is implied in every judgment
that we make. Thus, 'Utopia' belongs to the world
of the imagination ; 'The sun' to the world of phys-
ical objects. This is a doctrine of logical importance,
for we may remark that ambiguity, misunder-
standing, and error arise when what a judgment
asserts as true within one sphere of reality is taken
as true within another with respect to which the
judgment has not been determined. If, for example,
I say that 'I believe in the reality of Santa Claus,'
I am, of course, asserting a belief which falls within

the world of ideas; but if you understand me to
imply the corporeal and individual existence of
Santa Glaus, you only emphasise your misunder-
standing 1 of what I asserted if you challenge me to
produce him, or to have him as my guest on Christ-
mas Day..

We may, then, sum up this discussion in the fol-
lowing statements : (1) the copula does not express
existence, but is only 'a sign of predication;' (2)
reality of their subject-matter is presupposed not

expressed by all our judgments; (3) there are
different spheres of reality within which the mean-
ing of our several judgments is to be determined;
and (4) a failure to refer any judgment to its proper
or intended sphere of reality leads to ambiguity,
misunderstanding, and error.

Kinds of Propositions. There are three main
types of propositions; the categorical, the dis-
junctive, and the hypothetical. In this section we
shall limit ourselves to the task of characterising
each kind of proposition, reserving for other chap-
ters the discussion of the logical problems which
are connected with these forms of statement. In
the first place, however, it should be remembered
that we are considering propositions in general, and
that, however the categorical, the disjunctive, and
the hypothetical propositions differ from each other,
they all share the common characteristics of propo-
sitions. It is, we have seen, the business of propo-
sitions to express the affirmative or negative rela-
tions between the objects of our experience when

these relations have become explicit in judgment.
This function of the proposition is called in logic
'predication.' In every proposition P is predicated
of S, and as we have seen, the copula is the sign
of such predication. With respect, therefore, to the
three types of proposition we may say that they
differ, if they differ at all, by reason of the differ-
ence in the forms of their predication. And this is
the usual way of distinguishing them. Thus, in the
categorical proposition we have simple predication ;
in the disjunctive proposition, alternative predica-
tion; and in the hypothetical proposition, condi-
tional predication. The structural formulae for
these three kinds of proposition respectively are:
'S is P ;' 'S is either P or Q or M ;' 'If S is P, it is
M.' We may also illustrate each kind by the fol-
lowing examples : 'The way of the transgressor is
hard ;' 'Today is either Monday or Tuesday or Wed-
nesday or etc.;' 'If Caesar was ambitious, he de-
served to die.'

Relations of the Main Types of Propositions. Prop-
ositions have been distinguished as either categor-
ical, disjunctive, or hypothetical. These different
forms of proposition correspond to the different de-
grees of certainty or explicitness of the judgments
they express. Now, since we know more about
same subjects than we do about others, and our
knowledge of some parts of some subjects is more
exact than it is about other parts, we should expect
that this fact would be reflected in the propositions
in which we express our several judgments. In

other words, the difference in the forms of preposi-
tional statements corresponds to a difference in the
explicitness of the knowledge asserted by our judg-
ments. There is pretty general agreement among
logicians as to the foregoing statement. There is
not, however, the same harmony among them on the
question of the precise order in which the several
types of propositions should be arranged. We
would suggest that they may be taken, in the order
of their increasing exactness, in the following way :
the disjunctive, the hypothetical, and the categor-
ical. That is to say, the disjunctive and the cate-
gorical propositions, respectively, express the least
and the most explicit forms of knowledge, and the
hypothetical, to which class most of our judgments
belong, will appear as a form of statement that ex-
presses, in the majority of cases, the maximum at-
tainable certainty in our quest for knowledge.

To consider each case separately, we may say of
the disjunctive proposition that it expresses uncer-
tainty as to the details of a subject-matter which is
explicitly under consideration. For instance, we
may not be in doubt that there will be students
whose task it will be to read this paragraph, but
we may not be certain how far they will understand
it. If, in such a case, we tried to make the details
of judgment as precise as possible, our proposition
would then assume this form: 'The student who
reads this paragraph will either understand it, or
not understand it, or misunderstand it.' Such a
statement, or the judgment presupposed by such a

statement, does not carry us far on the way to
knowledge. It leaves us in doubt at the point where,
if we are to have probable knowledge, uncertainty
can not exist, namely, in respect to the details of the
judgment's content. In other words, the disjunctive
proposition starts with a belief in the reality of an
S, but is uncertain as to what S is, that is, whether
it is one or other of a number of alternatives which
are possible of realisation in the sphere of existence
or reality covered by S. All that, in such a case,
we can say is that 'S is either A, or B, or C, or D.'
If now we consider the hypothetical proposition,
we find that the defect of the disjunctive propo-
sition has been overcome, and we are no longer in
doubt as to what we are asked to believe. But we
also notice that the greater explicitness of the rela-
tions expressed by the proposition has been secured
by a corresponding loss. To consider the latter
point first, we may observe that the hypothetical
proposition does not imply, as does the disjunctive
proposition, a definite belief in the existence of the
sphere of reality within which the relations ex-
pressed by the proposition are understood to fall.
In the case cited, for instance, the disjunctive prop-
osition started with belief in the existence of The
student who reads this paragraph/ In the hypo-
thetical proposition the relations involved in this

belief are used as a condition of the ensuing judg-
ment. Thus, The student who reads this paragraph'
becomes, in the hypothetical proposition, 'If a stu-
dent reads this paragraph/ a form of statement

which, of course, leaves us uncommitted as to
whether there is any such student or not. So far,
therefore, as the hypothetical proposition is con-
cerned, belief is never definitely implied in the exist-
ence of the sphere of reality within which the rela-
tions asserted by the judgment find their possible
realisation. This, however, is not an uncompen-
sated limitation. For, to consider the other point
mentioned above, the meaning expressed by the
hypothetical proposition is specific; the details with
which the judgment is concerned have become de-
fined in such a way that the conditions on which
belief rests form part of what the judgment asserts.
Thus, fully expressed, the hypothetical proposition
reads, 'If a student reads this paragraph, he will
understand it.' In this case the internal structure,
the organic relations, of the elements of thought are
more highly specialised than they are in the disjunc-
tive proposition, and what we are told is that an
understanding of 'this paragraph' is definitely
grounded in the sphere of belief implied, although
indefinitely, by the proposition itself. If we may
hold that knowledge grows by the definition of de-
tails, we shall have to say that the hypothetical
proposition expresses a higher type of knowledge
than the disjunctive proposition.

The categorical proposition, if it exists, carries
us outside the boundaries of probability into the
field of certainty. The categorical proposition com-
bines certainty as to the existence of the sphere of
reality which is characteristic of the disjunctive

proposition, and certainty as to the detailed rela-
tions of the matter of the judgment which is charac-
teristic of the hypothetical judgment. Hence our
proposition reads, 'The student who reads this par-
agraph, will understand it.' But in order to under-
stand the categorical proposition, we should observe
that our knowledge of any subject-matter is so
rarely, if ever, complete, and that, in those cases
where it is, the material of judgment is likely to be
so insignificant, that, from the logical point of view,
the categorical proposition must be held to express
either an ideal limit of knowledge, the goal toward
which knowledge is constantly advancing but never
quite reaches; or that it is the least serviceable,
because least significant, form for the expression
of truth. We may, perhaps, roughly indicate the
meaning of this remark by the commonplace obser-
vation that an examination of the forms of state-

ment of the poorly educated reveals a predominance
of categorical propositions; and, that, as we rise in
the scale of educated intelligence, the other forms,
and especially the hypothetical form, predominate.
Dogmatic statements, in other words, are character-
istic of the man who does not know, or of the man
who knows things about which no one particularly
cares. In either case, we should have to say that
such statements, from the logical point of view, are
pseudo-categoricals, that they express a belief which
either goes beyond or falls below the range of our
knowledge of significant reality. But this perver-
sion of the categorical proposition by the ignorant,

need not obscure for us its proper logical position.
It does express the form into which knowledge,
when it is perfect, would naturally fall. The cate-
gorical proposition implies belief in the existence
of a sphere of reality within which certain ex-
pressed relations are fulfilled. It, however, remains
an ideal because, our knowledge being finite, we
can never get beyond the possibility of doubt as to
whether one or other of the conditions of the judg-
ment has been completely satisfied.

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QUESTIONS

1. In what respect does the proposition differ from the
judgment?

2. What is meant by the import of a proposition?

3. Distinguish between the truth-import and the gtatement-import of propositions.

4. What light does this distinction throw upon the interpretation of propositions?

5. Why do we always write the subject term of a proposition first?

6. How may we distinguish between the subject and predicate terms, and is it always possible to make this distinction? Explain.

7. What is the logical difference between terms, names, and words?

8. Give a logical classification of words.

9. What is meant by single-worded and many-worded terms?

10. What is meant by saying that the copula is the most distinctive element of the proposition?

11. State and criticise the relational view of the copula.

12. What are the realistic, nominalistic, and conceptualistic views of the concept?

13. What is the existential view of the copula, and what objections can be brought against it?

12. What do you understand by predication? Characterise the various kinds of predication, and show how these give rise to the several types of logical proposition.

15. What are the conditions under which we give a disjunctive expression to our judgments?

16. Discuss the nature of hypothetical propositions, and show their relation to disjunctive propositions.

17. Discuss the nature and limits of categorical propositions.

EXERCISES

1. Illustrate, from your own observation preferably, the possibility of confusing the truth-import with the statement-import of a proposition.

2. Write the following sentences in the form of propositions, indicating the subject and predicate terms in each:

(1) Over the mountains poured the barbarian horde.

(2) The moonlighh plays fitfully upon yonder rippling stream.

(3) Happy is the man that findeth wisdom.

(4) All is not misfortune that seems at the moment un-endurable.

3. Write six sentences in which you think it difficult or im-possible to distinguish the subject and predicate terms.

4. Make a list of twelve categorematic words.

5. Write six statements which show the error of an exist-ential interpretation of the copula, and explain the rea-son in each instance.

6. Write disjunctive propositions about the following sub-jects:

(1) Your presence at a concert to be given, say, next week.

(2) The result of a particular political election.

7. Write hypothetical propositions about the following sub-jects:

(1) Tomorrow's weather.

(2) The study of the biological sciences.

CHAPTER IV

TERMS

Proposition and Terms. In the last chapter, we defined a proposition as the verbal expression of a judgment in which something (P) is predicated of something else (S). We also analysed the propo-sition into its constituent factors terms and the copula and saw that the relation which these ele-ments sustain to one another is determined by the meaning of the proposition taken as a whole. The proposition, that is to say, was considered as deter-mining the existence and character of its terms, and not the existence and character of terms as deter-mining the existence and character of the proposi-tion. Terms are different aspects of the meaning of the proposition in which they occur. Expressed otherwise, they are functions of their propositions. The further discussion of terms which we begin in this chapter must be carried on in light of these general positions, and it must be considered as a more detailed consideration of certain important features of the proposition. The separate chapter headings are employed merely for pedagogic con-venience.

Connotative and Denotative use of Terms. We are to consider at the outset a distinction in the use of

terms upon which hinge many of the problems that
will come before us in the succeeding pages. It is,

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therefore, important to give special attention to the
precise logical significance that the distinction has,
and to get clearly before ourselves the scope of its
application. The latter point will be discussed in
the next section; we shall, therefore, confine our-
selves here to a statement and illustration of the
uses connotative and denotative to which terms,
whatever their character, may logically be put.

It is part of our common knowledge that words
are frequently used as labels by means of which we
identify things, and distinguish these things from
other things. Many illustrations will come to mind :
'the Rocky Mountains,' 'the Amazon River/ 'my old
bay horse,' etc. There is hardly any end to the
number of words which have this use of pointing
to objects, and which put us in contact with par-
ticular things, or groups of things. Now it is this
fact of our common speech that logic describes when
it talks about the denotative use of terms. Terms
are used to point out, refer to, or indicate objects.
For instance, in the statement, 'When it comes to
packing, books are a nuisance,' the term 'books' re-
fers to the individuals of a class of objects, and it
is, therefore, said to be used denotatively. In the
same way, the term 'lion' in the proposition, 'Lions
are carnivorous animals,' is used to point out this,
that or the other particular lion, and the proposition
means that any individual lion will be found to
possess the specified characteristics. Since the term
'lion* points out the individual objects one has in

mind when the term is used it is said to be used
denotatively.

We may also go to our ordinary employment of
language to ascertain what logic understands by the
connotative use of terms. Words, as we know, not
only point out objects, but they also have meanings.
When, for example, we hear a strange word spoken,
or meet with it in our reading, we ask what the
word means. If no one can tell us, we go to the
dictionary for the information. Now we do this,
because we have been trained to expect that the
words we meet will arouse some sort of mental
image, and because experience has taught us that,
when they do not, we fail to understand what is
said to us. That words should have a meaning is
just as important as that they should indicate indi-
vidual objects. Unless such words as Violin,' 'art/
'mathematics/ 'landscape/ 'ocean' aroused within us

quite different images or ideas, we should be at a
loss how to use them, or to understand them. Now
logic indicates this aspect of words, their meaning
aspect, when it speaks of the connotative use of
terms. Terms, from this point of view, are used to
call up the qualities or attributes of objects. When
we use a term connotatively, it must be understood,
consequently, that we are speaking about its dic-
tionary meaning. But, it should also be observed,
the particular dictionary meaning of any term can
be determined only from the standpoint of the par-
ticular proposition in which the term occurs. For
example, in Shakespeare's Coriolanus we read, 'She

will but disease our better mirth/ a passage in
which the term 'disease' means 'disturb.' When
Locke writes, 'Although great light be insufferable
to our eyes, yet the highest degree of darkness does
not disease them,' he is using the same word in the
sense of 'cause suffering to.' When, further, in
Thomson's Summer we read,

Then wasteful forth
Walks the dire power of pestilent disease,

'disease' is used in the more usual sense of 'a phys-
ical or physiological disorder.' This dependence of
the meaning of terms on their propositions is of
capital importance, and should be kept constantly
in mind.

Relation of the Connotative and Denotative use
of Terms. The difficulty that is usually experienced
in understanding the doctrine of connotation and
denotation is due to the fact that we do not have
one group of words whose use is always connota-
tive, and another group of words whose use is
always denotative. Most, if not all, terms are capa-
ble of being used in either the one or other of these
ways. But this is not all. The most important
fact to remark is that in whichever of the ways
mentioned a given term is employed, it is so em-
ployed with the other use more or less distinctly
in mind. It would be quite a fair statement of the
case to say that there is always a reference of the
one to the other, and that in any particular instance
the one implies the other. It is not difficult to see,

for example, that the identification of the individ-
uals which are denoted by any term depends upon
their possession of the qualities that are connoted
by the same term. It is also clear that the qualities
that a term connotes are the qualities of the individ-
uals which the term denotes. Let us, for example,
examine the subject term of the proposition, 'Man
is a rational animal.' If the term 'man' is used

denotatively, that is, to point out 'Tom, Dick,
Harry, etc.,' the proposition must mean that 'Tom,
Dick, Harry, etc.,' are the individuals in whom are
found realised the qualities expressed by the pred-
icate term. If the term 'man' is used connotatively,
the proposition must mean that the qualities, 'ra-
tional animal,' will be found present in each indi-
vidual, that is, in 'Tom, Dick, Harry, etc.' Let us
take, as another case, 'Man is a being who volun-
tarily sets himself tasks.' If, in this proposition,
the term 'man' is used to denote individual men,
then our identification of the individuals who set
themselves tasks depends upon our knowing what
the qualities are which the term 'man' connotes ; and
if it is used to connote certain qualities, our under-
standing of the proposition depends upon the sup-
position that these qualities can be found in a num-
ber of discoverable individuals. These illustrations
serve to emphasise the general rule that the con-
notative use of a term does not break away entirely
from its denotative use, or vice versa; and the sole
logical distinction between them is that, in the one;,
we lay the primary emphasis on the

which possess the qualities, and, in the other, on the
qualities possessed by the individuals.

Another inquiry which conies before us here is
whether this relation between the connotative and
the denotative use of terms is realised in all terms
whatsoever. We can give an answer to this ques-
tion only by anticipating certain features of the dis-
cussion of terms contained in the following pages.
We may, however, at this point call attention to the
generally accepted position that no term is ever so
exclusively denotative as to lose all connotation
whatsoever, and that no term can be said to have
developed on the side of meaning, i. e., connotatively,
so one-sidedly as to have lost all reference to objects.
The discussion of this question has been brought to
the study of proper names as to a test case; and it
is thought that if the position can be maintained
with respect to these terms, it will be possible to
maintain it with respect to other kinds of terms.
The question is not a theoretical one, and we shall
gain nothing by considering it as such. It is a
question of fact, and can be determined only by a
study of each kind of terms as it comes before us
in this and the following chapter. We may express
the opinion, however, that it is quite possible that,
in the course of time, the employment of particular
terms may shift from a predominantly connotative
to a predominantly denotative use, and there is no
reason, except one of convenience, why all meaning
should not drop away from some terms, and that
they should stand in our vocabulary merely as sym-

bols of the existence of things. Whether there are
any such terms cannot be decided now; it is more
important to see that the possibility of this being
the case does not obscure for us the more general
relation which was expounded in the preceding para-
graph.

A subject that is usually discussed in this con-
nection relates to the changes that take place in the
connotation and denotation of terms when either
of these is increased or decreased. Under these
conditions, the changes in the connotation and deno-
tation of terms are said to vary inversely. More
fully stated, when the connotation of a term is in-
creased, its denotation is decreased, and vice versa.
For example, the denotation of the term 'man' is 'the
total population of the earth/ and its connotation,
we may say, is 'rationality and the upright position.'
If we increase the connotation by specifying 'white
man,' the connotation of which term is 'white, ra-
tionality and upright position,' we decrease the de-
notation which then refers to 'the white population
of the earth.' If a further increase in connotation
is made by specifying 'European white man,' the
denotation is decreased still more, and indicates 'the
white population of Europe.' The process thus
begun can be carried as far as interest or ingenuity
allows. The general truth to which such illustra-
tions point is that the denotation of a term is dimin-
ished as its connotation is made more definite by the
addition of new attributes ; and, conversely, that

when the connotation is decreased by dropping at-
tributes the number of individuals to which the
term applies is increased. This statement holds
good as a general rule, but there is no numerical
ratio between the increase or decrease of connota-
tion and the accompanying decrease or increase of
the denotation. Indeed, the denotation of a term
may be increased greatly without any change in its
connotation, as actually happened, for example,
when the British government annexed some mil-
lions of Africans at the close of the Boer war with-
out making thereby any change at all in the conno-
tation of the term, 'British subject.'

Distribution of Terms. If we carry our study of
the denotative use of terms a step further, we shall
find that the purposes which prompt our statements
sometimes require us to refer to a determinate num-
ber of the individuals denoted by the term, and that
sometimes our purpose is satisfied if we indicate
an indeterminate number of the individuals included
under the term. Let us suppose, for example, that
we are discussing the theory of kingship, and that
I express the belief, after Hobbes, that the king can
do no wrong. If this belief were thrown into a
propositional form, it would become clear that I am
thinking of all the individuals who have exercised,

or at some time may exercise, the functions of king-
ship. What I mean is that 'No king can do any
wrong/ that is, wrong doing cannot be predicated
of any king, of this, that, or of any other indi-
vidual who is or may be a king. If such a state-

ment does not recommend itself to your judgment,
and you express dissent from it, you are not re-
quired, by the conditions of the situation which
determine your judgment, to concern yourself with
each and every king; it will be sufficient, if wrong
doing by kings has ever occurred, for you to limit
your statement to any of the cases which contradict
the theory you oppose. Expressed in a proposition,
your judgment will be 'Some kings can do wrong,'
or more definitely, 'Some kings have done wrong.'
You are obviously speaking of a number of indi-
viduals, not definitely specified, who belong to the
group denoted by the term 'king.' The distinction,
thus indicated, in the denotation, width, or extent of
terms, is known in logic as the 'distribution' of
terms. By the distribution of terms we mean the
consideration of terms from the standpoint of their
quantity. Now, in respect of quantity, we are lim-
ited in logic by the contrast between a definite and
an indefinite number, and the terms which denote
these quantities are said to be distributed and un-
distributed respectively. A term is 'distributed'
when, from the form of the proposition in which it
occurs, it is known to refer to a determined number
of individuals of the class denoted by the term; it
is said to be 'undistributed' when, from the form
of the proposition in which it occurs, it is known
to refer to an undetermined number of the individ-
uals of the class denoted by the term. The tech-
nical sign of a distributed term, in an affirmative
proposition, is 'All,' and, in a negative proposition,

'No.' The technical sign of an undistributed term,
in both affirmative and negative propositions, is
'Some.'

We have just said that the difference between
distributed and undistributed terms is that in
undistributed terms the exact number of in-
dividuals referred to is left indefinite, as, for
example, 'Some birds are blue;' while in distributed
terms the number is made definite, as for example,
'No man is free from the defects of his qualities,'
and 'Half my goods I give to feed the poor.' We
shall have occasion to discuss this distinction again
when we study the interpretation of propositions;
but for the present, it is enough to remark that
neither in the case of a distributed, nor in that of
an undistributed, term can we say, from the form
of the proposition, what the arithmetical number

of the individuals denoted by the term is. It may,
perhaps, help to make the matter clear if we recall
that in the study of algebra we are taught to use
the first letters of the alphabet, a, b, c, to represent
the known quantities of a problem, and the last let-
ters of the alphabet, x, y, z, to represent the un-
known quantities. The mathematical difference be-
tween these two classes of quantity, the known and
the unknown, is the difference between the dis-
tributed and the undistributed use of terms in logic.
In the former case, the known objects are deter-
minate; in the latter, the unknown objects are inde-
terminate.

Some other Characteristics of Terms. In the fore-
going paragraphs, we have considered mainly those
features of terms which are important from the
point of view of their denotation. There are cer-
tain questions which arise from the standpoint of
the connotation of terms to which we shall direct
attention in the remainder of this and in the fol-
lowing chapter. The questions to which we refer
must not be confused with those that will engage
us in a later chapter, and which relate particularly
to the problem of definition, that is, to the problem
of how the meaning of terms receives logical formu-
lation. What, rather, we have to consider at pres-
ent is the fact that there are certain general charac-
teristics of terms which do not depend upon the par-
ticular meaning that terms have, but upon the
nature of the interest which stimulates our judging
activity. The interests under which we are led to
judge any subject-matter may require us to express
what we wish to say either concretely, abstractly,
absolutely, relatively, positively, or negatively.
That is to say, our meaning may be either concrete,
abstract, absolute, relative, positive, or negative.
These distinctions are not coordinate, and they are
not at all of equal importance; but the particular
relations which they sustain to one another become
apparent only when it is clear what each signifies.
We shall, therefore, confine ourselves, in the main,
to stating how each of these distinctions is to be
understood, and we shall begin with the broadest

among them, the distinction between concrete and
abstract meaning.

Concrete Meaning. One of the most familiar
facts of our every day life is that we distinguish
from one another the various objects that come
under our observation. When, for example, we go
into the city, we perceive the houses, the shops, the

traffic on the streets, and the people on the side-
walks as quite different things. We also carry over
into our academic studies the endeavor to make dis-
tinctions, and to regard different things as different.
Thus, the student of zoology learns to discriminate
between the blood vessels, the supporting tissue, and
the characteristic cells of the specimens he observes
under the microscope. Indeed, so general and im-
portant is this ability on our part that there is no
interest that is not served by it, and no limit to
which it may not be carried. For instance, we may
mark off in this way not only the objects of the
material world, but the qualities and relations of
these objects, and set them before us as distinct ob-
jects of our thought. Thus, 'green/ 'heavy,' 'but/
'cause/ may become for us objects as distinct as are
the chairs and tables of our domestic life. Now
whatever we set off as a distinct object of percep-
tion or thought is in logic considered as a concrete
object, and the term that denotes such an object is
called a concrete term.

It may be observed that the significance for logic
of the term concrete depends upon the significance
of the word 'thing' in the body of our common

knowledge. By a thing we ordinarily mean some
part of the physical world which is perceived as dis-
tinct from other parts with which it coexists. Thus,
the pictures on the walls of our room, the articles
on display in the shop widows, the mountains and
streams of the landscape, the cattle on a thousand
hill, are all called 'things' whenever we think of them
as distinct from other objects with which they are
associated in the same common environment. But
the word 'thing' is not confined to objects of the
material world. We also designate as things what-
ever can be thought of as having a distinct exist-
ence of any kind. Thus, if I am trying to recall
something in particular that has been told me, I may
express my impatience at not being able to do so by
saying, 'Why can't I remember the thing?' What I
refer to here as a thing is an idea. A similar usage
is found in the commandment against idolatry
among the Hebrews when it is forbidden them to
make a graven image "in the likeness of any thing
in the heavens above," where the word 'heavens'
has a quasi-spiritual meaning. Instances might be
multiplied of the very wide and varied use to which
we put the word thing in popular speech, but those
given are enough to emphasise the connection be-
tween it and the logical meaning of the term con-
crete.

While, however, there is this general connection
between the two words, the meaning of the term
concrete is more precise than is the meaning of the
word thing. It is true, for instance, that we do not

ordinarily refer to persons as things, but logic
would have no hesitation in calling the terms, by
which they were denoted, concrete terms. On the
other hand, we should describe as a thing any object
of which we could say only that it was in our con-
sciousness, but unless we knew some of its attri-
butes or relations, we should not be warranted log-
ically in calling it a concrete object, or the word
used to denote it a concrete term. These cases are
suggestive of the truth that it is not mere existence,
but significant existence that logic, in the main, de-
notes by the term concrete. Whenever an object is
thought of as having a definite kind of existence,
that is, as possessing certain qualities or standing
in such and such relations, it is called a concrete
object, and the words we use to denote such objects
are concrete terms because they are used to connote
these qualities and relations. There are, as we shall
see, varying degrees of definiteness in the ways in
which significant existence is asserted, and there
are, consequently, several degrees of explicitness in
the meaning of the terms used for denoting such
existence. This matter we shall discuss in the fol-
lowing sections; it will be sufficient, meanwhile, if
the broad meaning of the term concrete has been
made clear.

Individual Meanings: Proper Names and Desig-
nations. The first class of concrete terms that we
shall consider is that which denotes particular indi-
vidual objects. To be able to point out individual
objects, we must have in mind, as a general rule,

some attribute, or group of attributes, which is
thought of as belonging to the one object we desire
to single out, and to make the subject of further
consideration. The names of such objects, when
they are used as terms in a proposition, are definitely
denotative and explicitly connotative; they point to
their objects by means of the attribute or attributes
which the term connotes. Such terms are called
individual, or singular, terms.

Individual concrete terms are of two kinds:
proper names and designations. A proper name, to
consider that first, is the name given to an object -
person, place, or thing as a special means of dis-
tinguishing this object from all other objects. We
give names to the members of our families, Tom,
Dick, Mary, Sue, etc., to continents, mountains,
rivers, towns etc. We also give names to the horses
in our stables and the cattle in our barns. There
is no limit, except its usefulness, to the process of
naming the objects of our acquaintance in order to
distinguish them from others with which we do not
wish them confused. In all such instances the
names are proper names, and they serve to individ-

ualise the particular objects to which they belong.
When such names are made the subject of pred-
ication they are singular or individual terms.

Now, about proper names, as thus defined, we
may ask whether their designation of particular
objects is made possible because they imply an attri-
bute or attributes, that is, because proper names
are connotative. In answer to this question, Mill,

for example, replied that proper names are non-
connotative, they can be used only, he said, to sig-
nify an subject. This is, in many quarters, consid-
ered an extreme position, and it may be due to the
failure to see that significance may belong to a sub-
ject not only because of the qualities that it pos-
sesses, but also because of the relations in which it
stands. "The very fact," as Creighton points out,
"that a proper name is given to an object implies
that is possesses a certain marked individuality,"
and the intelligent use of the name surely implies a
reference to the qualities or relations by which that
individuality is defined. However, be that as it may,
we may admit that the connotation of proper names
is ordinarily quite general and often vague, without
thereby refusing to grant them any significance
whatever. If the application of such terms is un-
ambiguous, it is quite natural that their meaning
should drop into the background of consciousness;
but if its application should become uncertain or be
misunderstood, we should then feel the need of mak-
ing the connotation of the term more definite.

Individual concrete meaning may be expressed,
in the second place, by a designation. Logic regards
as a designation any phrase that describes an object
by its qualities or relations, when such phrase is
used for the purpose of definitely pointing out this
object. The assassin of Franz Ferdinand of Aus-
tria/ 'my winter overcoat/ 'the centre of the mate-
rial universe/ 'my partner/ all these are designa-
tions in the sense defined. It is clear that a desig-

nation depends upon the appropriateness of the de-
scription it embodies for the accurate identification
of the object to which it points. That is to say, a
designation must be explicitly connotative as well as
definitely denotative.

The wide usefulness of this method of express-
ing our individual concrete meanings is very evi-
dent. It is true that, in ordinary life and in scien-
tific pursuits, we need a number of terms which

shall have the specialised function of designating
particular individual objects, that is, terms that are
definitely proper names. But neither in science nor
in daily life is it necessary to assign proper names
to all the objects that engage attention, and yet
some method of referring to these objects is neces-
sary if we are to develop the interests that prompt
us to take note of them. It is under such circum-
stances, as a general thing, that the designation
becomes of use. We should be on our guard, how-
ever, against supposing that the objects to which
proper names are assigned are necessarily of more
importance than those to which we refer by means
of designations. While it is true that some of the
objects which we denote by designations are rela-
tively insignificant, this is not always the case. In
science, for instance, we speak of 'the law of grav-
itation,' 'the law of diminishing returns/ 'cen-
trifugal force,' etc.; and in daiy life we use such
phrases as 'the President of the United States,' 'the
Secretary of State,' etc. These phrases are, accord-
ing to the definition, designations; they point out

definite objects by means of a brief description of
the objects' characteristics. They have, moreover,
a higher importance than some of the objects to
which proper names are given.

General Meaning. The second class of concrete
terms, which we have now to consider, is character-
ised by the fact that the meaning conveyed by such
terms is applicable to more than one object. Now,
it is true that, if we were to list all the attributes
of all the objects of our acquaintance, it would be
found that no one object possessed in every respect
precisely the same qualities as any other. Every
object, in this sense, is a unique object; and, if there
were no other interest in things than that which
leads to the observation of their uniqueness, we
should have to use, when speaking of such objects,
either proper names or designations. It frequently
happens, however, that our practical or theoretical
interests require us to distinguish among the attri-
butes of individual objects those that belong to
only one individual, and those that are possessed in
common by a number of individuals. On the basis
of this distinction, we are able to group together
the objects which possess a common set of attri-
butes, and, conversely, to make the common attri-
butes the basis of our inclusion of other individuals
within particular groups. For example, we classify
certain animals as quadrupeds, and certain others
as bipeds, on the ground that, amid an indefinite
number of differences, certain animals are alike in
the fact that they walk on four feet, and that cer-

tain others are alike in the fact that they walk on
two feet. Stated otherwise, in constructing such
classes of objects, each of the individuals belonging
to any one class is thought of as possessing exactly
the same characteristics as any other individual of
that class.

Now the names which embody a meaning that
can be applied to any one of an indefinite number of
individuals are known in logic as 'general' or 'com-
mon' terms. Of such terms we may say, in view of
the foregoing discussion, that they are explicitly
connotative, but indefinitely denotative. In other
words, the attributes that a general term connotes
belong equally to each and every individual of a
group; but we cannot tell which one or more of
these individuals is denoted, merely by knowing the
connotation of the term. The characteristic fact
about a general term is, then, that while its conno-
tation or meaning is concrete, its application is
always general; the meaning, that is to say, can be
applied to an indefinite number of individuals. It
should be observed, however, that the meaning of
any such term does not exist apart from some or
all of the individuals in which this meaning is con-
cretely embodied. That is to say, it is the existence
of the individuals which form the group that deter-
mines the meaning that any general term may have.
Apart from these individuals, indefinitely denoted
though they are, the general term would lose all its
meaning. One reason for remarking this fact is
that the interest, which leads us to observe the com-

mon characteristics of numbers of objects, is an
interest that still recognizes the differences that
exist among the objects which it groups together.
When, therefore, these common characteristics are
expressed in general terms, it is not to be supposed
that the differences that distinguish one object from
another are thereby denied. What our general
terms imply is that the presence of individual dif-
ferences is not inconsistent with the possession, by
a number of objects, of certain characteristics in
common.

Collective Meaning: Individual and General. We
have traced the development of meaning from the
singular concrete to the general concrete, and we
have seen that, in this development, we have been
concerned with some feature or features of the indi-
vidual or individuals which our interests prompt us
to study. For instance, our interest in the differ-
ences that exist between one object and another is
embodied in the meaning that singular terms have ;
our interest in the likenesses which exist along with
these individual differences is expressed in the mean-
ing that general terms have. That is to say, the de-
velopment of meaning which leads from the individ-
ual to the general term has been guided by the con-
sideration that we must not do violence to the differ-

ences that exist between one individual and another
while seeking for the common ground of their like-
ness. We have now to consider whether, neglecting
the differences between individuals, we may start
with their common likeness, and carry the develop-

ment a step further. Or, to state the inquiry more
definitely, we may ask what alteration in our mean-
ing is made if and when, in our study of individuals,
we ignore their differences, and take note only of
their likenesses. We have seen that we may take
account of both likenesses and differences, and still
be able to define a meaning which applies to each of
a number of otherwise dissimilar individuals. What
we have now to see is that if we pay attention only
to likenesses, or, what amounts to the same thing,
consider only similar individuals, we are able to de-
fine a meaning which applies to no one of the indi-
viduals, but can be intelligently used of all these in-
dividuals taken together as a whole. To illustrate,
let us suppose that we bring together in one place
a number of animals lions, tigers, elephants,
jaguars, ibexes, zebras, etc. Such a collec-
tion we should call a menagerie. If, again,
we were to bring together a number of children
for the purpose of educating them we should
call such a collection a school. There are many
such collective groups of individuals; and we
can say that the meaning of the word by which each
is indicated applies to none of the individuals which
constitute the group, but only to the group which is
constituted by the individuals. Thus, 'a menagerie'
is the name for a particular group of animals, 'a
school' is the name for a particular group of chil-
dren under instruction ; 'the United States of Amer-
ica' is the name for a particular group of political
organisations, etc.

Now a name which embodies a meaning that
can be applied to a number of similar individals,
taken together and thought of as a whole, is called
in logic a collective term. It is obvious, from what
has been said, that the connotation or meaning of
collective terms is determined for us by the points
of observed similarity between the individuals which
constitute the groups which these terms denote.
Thus, we call a particular group of individuals a
nation when we think of all the individuals belong-
ing to the group as citizens, citizenship is the one
attribute that all have in common. We call another
particular group of individuals a legislature when
we think of all the individuals belonging to the
group as makers of laws, making laws is the one
common task in which all its members are engaged.
The same thing, mutatis mutandis, will be found
true of all collective terms whatever: the connota-

tion of such terms embodies certain observed sim-
ilarities between the individuals which belong to the
groups which the terms denote.

When, on the other hand, we consider the deno-
tation of collective terms, it is evident that the
groups which such terms point out constitute a new
kind of individual, and must be distinguished from
the individuals which are denoted by the general
term. The individuals which general terms, as a
rule, denote are objects of our ordinary perception
and thought; they are the things which, in the
course of our daily life, we are accustomed to take
as distinct objects; such things, we may say, as

each of us has been trained to observe in the course
of the education that the community provides. On
the other hand, the individuals which collective
terms denote are individuals of a higher order, so
to speak; they result from a definitely conscious
effort on our part to bring together under a single
view a number of diverse things, and to regard these
things as one object. The objects which collective
terms denote are more complex than those denoted
by the general term, and should be carefully dis-
tinguished from the latter.

Collective concrete terms may be either individ-
ual or general. The individual collective term is
used to point out a particular group of objects which
we wish to distinguish from all other objects what-
ever. The Rough Riders/ 'the Gordon Highlanders,'
'the Allies,' (in the present war in Europe) are
examples of collective terms used in this way. It
may be observed that the individual collective term
always contains the definite article, 'the,' as part of
its verbal form. Thus, 'the committee,' 'the library,'
'the family' are collective terms used to point out
particular distinctive groups. The denotation of
these terms is definite. The general collective term
is used to indicate a particular kind or class of
grouped objects, and, therefore, may be applied to
any particular group of objects which has the char-
acteristics of the class which the term denotes. For
example, when the military and naval forces of two
or more nations act together for the purpose of de-
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feating a common enemey, these nations are called
allies. 'Allies' is a collective term, and, in this case,
is general, since we apply the same name to each of
the many combinations of this character which his-
tory records. Other illustrations of collective terms
which have a general application are, 'family,' 'li-
brary,' 'committee.'

It is sometimes said that the individual collective
can be changed into a general collective term by
substituting the indefinite article, 'a,' for the definite
article, 'the ;' or by omitting the article without sub-
stitution. Thus, 'the allies,' which is an individual
collective term, becomes a general collective term
by omitting 'the;' 'the committee,' 'the family,' 'the
library' become general by substituting 'a' for 'the'
in each instance, 'a committee,' 'a family,' 'a li-
brary.' Sometimes, however, the connotation of a
collective term has become so highly specialised that
it is capable of being applied to only a single object,
and in that case it cannot be used, by any change
whatever, as a general term. Examples of this are :
'the Congressional Library at Washington,' 'the
family of King George IV,' 'the Committee on For-
eign Relations in the Sixty-third Congress.'

Abstract Meaning. In the foregoing sections, we
have studied how concrete meaning develops, and
have seen that such meaning may assume one of
three forms, or, as we may say, indicate one of
three kinds of objects : individual, general, or
collective. We have said that, in these instances,
the meaning is concrete because, in each of them,

the connection between attribute and object is
particularly direct and intimate, although the con-
nection is in differing degrees of intimacy. Any
meaning is considered concrete which conveys the
idea that 'these are the attributes which such or
such an object has/ or that 'this is the object which
has such or such attributes/ It has been shown
that the object, in some instances, is a material ob-
ject; in others, it is mental. But so long as the
meaning we wish to express is concrete, we always
suppose that we can pass from object to attribute,
or from attribute to object, without a break, or that
the connection between attribute and object is un-
equivocal. In other words, whenever we take an
object in connection with its attributes, or think of
attributes only in connection with their objects, our
meaning is concrete. If, however, we were to con-
sider attributes apart from objects, we should con-
front a new situation, and one which would involve
a new set of problems, the consideration of which,
in the end, would lead us to define a new kind of
meaning which, in contrast to concrete, might ap-
propriately be called 'abstract.' For by abstract
meaning we commonly understand the idea of an
attribute quality or relation thought of inde-
pendently of the particular object or objects of
which it is the attribute.

Now, when we look at the possibility of the ex-
istence of such meanings as this, we are confronted
with the danger of meaning less than we actually
say. For instance, some logicians have defined the

terms in which jstract meanings are expressed

'abstract te ,, as they are called as those
which apply to objects thought of apart from the
whole to which they belong, or to attributes which
are thought of apart from the objects of which they
are the attributes. Thus, a 'leaf thought of apart
from the tree on which it grows is, according to this
definition, an abstract term, and 'green/ if it is not
thought of as the color of this particular leaf, or of
any other particular green object, is likewise an
abstract term. In our view, this is a very mislead-
ing statement of what abstract meanings and terms
are. For instance, in the cases just mentioned, both
'leaf* and 'green' are concrete general terms. The
one is the name of an object, the other of an attri-
bute, and although these terms are not thought of
as belonging to any one particular object, still they
are thought of as belonging to any one of an in-
definite number of particular objects; unless we
think of them in this way we cannot think of them
at all. But if this is what we are to understand by
an abstract term, then abstract are not distinct
from general terms, and have to be classed as such.
Although the view we have just criticised is apt
to be misleading if it is taken as providing a defin-
ition of what abstract meaning is, it may neverthe-
less serve a useful purpose if it indicates how such
a meaning is developed. It is true that in order to
make our meanings abstract, we have to take attri-
butes and objects apart from their mutual impli-
cation of each other; but merely to take objects or

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attributes in isolation is not, , if, sufficient to

secure a new logical product. Tht Difficulty of such
a view as we are criticising can be seen if we
observe what would follow from its acceptance.
For if, according to this view, only a meaning
were retained, the thing meant by it being ig-
nored, we may ask about this meaning whether
it is a detached meaning, a meaning that is not
the meaning of any object. If we answer this ques-
tion in the affirmative, as we are required to do, we
have opened the door to all the absurdities that be-
long, in the popular understanding of the word, to
'abstract' thought, to thought, that is, that has
nothing to do with any definable reality. To illus-
trate, if from a student who comes for the first time
to the study of philosophy, we were to elicit by care-
ful questioning what his uninstructed understand-
ing of philosophy is, we should probably find that
for him philosophy is a set of ideas more or less
connected with one another, but having little or no
connection with anything else; and if, by further

questioning, we were to get him to state why he had
undertaken its study, we should probably find that
he looked upon it either as a good mental gymnastic,
or as a field in which, since no one can ever be
right, he at least can never be wrong, whatever
opinions he may hold. Such views are held merely
because it is supposed, by those who entertain them,
that philosophy is a set of ideas dissociated from all
objects whatever, that it is, in the popular under-
standing of the word, an 'abstract' subject. But

ideas which do not make some object more intelli-
gible cannot be saved from the fate of oblivion by
giving them a name ; and we may neglect, as falling
below the minimum of what knowledge requires,
this understanding of the term abstract.

Having rejected the popular interpretation of
the expression 'abstract idea/ we have to ask
whether, in fact, such ideas exist, and if they do,
under what conditions their meaning is developed.
In answering these questions, we may remark that
the situation with respect to abstract ideas is some-
what as follows : If, concerning these ideas, we say
that they are true of the objects in connection with
which they have been formulated already in our
experience, then they are not abstract ideas at all ;
they are, as we have seen, general ideas ; and if we
say that they are ideas which mean nothing, we
are talking nonsense. To illustrate, let us suppose
that in the spring of the year, we are looking out
upon the landscape, and that you remark, 'How
green everything is!' Here 'green/ as you use it,
is a general idea. If, however, in the midst of a
conversation on monometallism, or of an unbroken
silence, I were to say 'green/ you would naturally
ask, 'Green what?' And if I replied, 'Green nothing,
just green/ you would have a right to suspect my
sanity. I can only rehabilitate myself in your re-
gard by pointing out that 'green' is as possible an
object of thought as 'trees' or 'grass;' and this is,
without doubt, the course that, under such circum-
stances, one would take. Now, in this illustration

we have a clue to what happens when a concrete
general idea has broken away from its moorings in
the world of concrete fact: the meaning conveyed
by the general idea becomes at once a new object
of thought, which is capable of further considera-
tion and characterisation. In brief, it is only when
a general idea has, in this way, been dealt with as
a subject of predication that we arrive at a true
abstract idea. For instance, if we take our former
illustration we may observe that although the grass,
the oak, maple, sycamore, and elm trees, the wind-
ing river, etc., are all 'green,' they are not the same

greens; they vary, as the psychologist tells us, in
tint and saturation. Now if we ask, with respect
to this fact, what we mean by calling things admit-
tedly different by the same name, we shall have to
say that there is something, whether we can state
definitely what it is or not, which is common to all
these objects, something which we express by the
word 'greenness/ 'Greenness' is the abstract qual-
ity by virtue of which any object is called green, it
is that which belongs as an attribute to all greens
whatsoever. If, to take another illustration, we
sort out the skeins of yarn for testing colour blind-
ness, and ask what it is that leads us to consider
objects which give so many different sensory im-
pressions as belonging to a single group, we should
doubtless, answer colour. 'Colour' (=colouredness)
is the abstract quality by virtue of which objects
are classified with regard to the common visual im-
pressions that they make. Again, 'triangle' is an

abstract idea, because it implies the quality (tri-
angularity) by virtue of which three-sided plane
figures are grouped together. These illustrations
indicate with sufficient clearness the answer that
must be given to the question we are considering.
Any idea which denotes certain attributes common
to a group of concrete objects is abstract if, at the
same time, it connotes the underlying ground of the
similarity which exists between these attributes.

REFERENCES

SEE THE END OF THE NEXT CHAPTER

QUESTIONS

1. What is the relation of terms to propositions?

2. What is meant by the connotative and denotative use of
terms? Illustrate.

3. Are terms ever used exclusively in a connotative or ex-
clusively in a denotative sense? Explain your answer.

4. In case a term is both connotative and denotative, are
the connotation and denotation always equally promi-
nent? Explain.

5. How does any increase in the connotation of a term
affect its denotation, and vice versa?

6. What is the relation of the distribution of terms to the
connotative and denotative use of terms?

7. Explain what is meant by the distribution of terms,
being careful to distinguish between distributed and
undistributed terms.

8. What is the relation of the meaning of terms to the
connotative and denotative use of terms?

9. What general characteristics of terms may be mentioned
from the standpoint of connotation?

10. Upon what do these characterictics particularly depend?

11. How is the problem of definition distinguished?

12. Upon what fact of our common experience does concrete
meaning depend?

13. In what respects does the term concrete differ from the
word thing?

14. What do you understand by an individual or singular
term?

15. Name the kinds of individual terms.

16. Define and illustrate proper names.

17. Are proper names used connotatively? Explain and
illustrate your answer.

18. Define and illustrate designations.

19. Are designations used connotatively and denotatively?
Explain.

20. What is the importance of designations?

21. Explain how meaning becomes general, and show that
in doing so it remains concrete.

22. What is a general, or common, term? Illustrate.

23. Discuss the connotative and denotative use of general
terms.

24. Explain how meaning becomes collective, and yet re-
mains concrete.

25. What is a collective term? Illustrate.

26. Discuss the connotative and denotative use of collective
terms.

27. What is an individual collective term? Illustrate.

28. What is a general collective term? Illustrate.

29. What is the relation between individual and general
collective terms?

30. Does this relation always hold? Explain.

31. How does abstract, differ from concrete, meaning?

32. Distinguish carefully between abstract and general
terms.

33. Discuss the connotative and denotative use of abstract terms.

EXERCISES

1. What are the connotation and denotation of the follow-ing terms:

Gentlemen my typewriter logic

George Washington gratitude the University

2. Show by an illustration that the denotation of a term may decrease if its connotation is increased.

3. Classify in a table all the terms discussed in this chap-ter, showing which are coordinate and which are sub-ordinate.

4. Write a list of twelve concrete individual terms, and indicate which are proper names, and which, if any, are designations.

5. What kind of term is 'goodness' in each of the following statements?

(1) Goodness knows what we shall do.

(2) He did it out of sheer goodness.

6. Write a list of six general terms.

7. Derive, if possible, abstract terms from each of those that occur in your answer to the previous question.

CHAPTER V
TERMS (CONTINUED)

The Purpose of the Chapter. In the previous chapter we have traced the development of meaning from its concrete to its abstract form, and in doing so we have touched upon the main principles that control the logical use of terms. There are, how-ever, a number of other interests that lead us to consider objects and their qualities in ways slightly different from those already described, and thus to give our doctrine of meaning, in each case, a slightly different emphasis. In this chapter we shall define and illustrate some of these more common interests, and point out the varying emphasis that our mean-ings come to have under their guidance.

The Basis of the Distinctions to be Studied. The distinctions in meaning that we are to study in this chapter, like those studied in the last, have a basis

in common linguistic usage. The basis of the dis-
tinction of concrete and abstract meaning is the
fact that we distinguish between an object and its
qualities, between the object that is the possessor
of qualities, and the qualities possessed by the ob-
ject. The distinctions studied in the present chap-
ter are based on this broad contrast between objects
and their qualities, but are not identical with it.
When, for example, we have distinguished between
an object and its qualities, so that we can think of
the object merely as having existence, and can think
of qualities as possible characteristics of objects
without at the same time identifying the objects

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of which they are the qualities, we can take a fur-
ther step in regard to objects, and consider whether
they do or do not stand in relation to other objects,
and, in regard to qualities, whether they do or do
not belong to certain objects. In the former case,
we ask whether the relation that objects sustain to
other objects affects the meaning that such objects
have; and, in the latter, we ask whether the pos-
session or non-possession of certain qualities by ob-
jects in any way modifies the significance that such
objects have for us. In the first question, we are
concerned with what are known, in logic, as abso-
lute and relative terms; and in the second, with
what are known as positive and negative terms.

Absolute and Relative Meaning. This distinction
is one that concerns the existential character of
objects, that is, objects considered with respect to
whether they do or do not depend for the meaning
they have upon the relations in which they stand to
other objects. Stated otherwise, we are asking
whether it is possible and useful to study objects
independently of the connections they may have
with other objects, and whether the terms we use
to denote objects do or do not get part of their
meaning from the relations which these objects sus-
tain to other objects that fall outside the denotation
of these terms themselves. The answer to this
inquiry is quite obvious. Objects whose connection
with other things is for the time being neglected
may certainly be held before the mind as subjects
of investigation. These objects may be quite simple,

as a chair, or they may be quite complex, as the solar
system. But whenever a simple or complex object
derives its importance for consciousness from the
fact that we ignore the connections it may have with
other existential things, it is said to be an inde-
pendent object. Now when the names of such objects
are used as terms in a proposition, they are called

absolute terms. Thus, all individual terms, whether
they denote single individuals, or single groups of
objects, are, in the sense explained, absolute terms.

What we should understand by a relative term
is more difficult to state. We shall first consider
the most general aspect of this question. It is quite
clear, in the first place, that since the whole prob-
lem of meaning rests, as we have seen, upon the
connection between the connotative and denotative
use of terms, that there can be no object entirely
devoid of qualities, and no quality which is not the
quality of some object. There is always a relation
between these two aspects of a term's meaning.
Further, it is clear that all our meanings, whether
concrete or abstract, singular or general, are also
relative in the sense that the objects denoted by
such terms stand in relation to objects denoted by
other terms. Used in the broad way, indicated by
these illustrations, the word 'relative' does not point
out a particular logical distinction, but describes a
common characteristic of all human knowledge
whatsoever.

The term relative is used in logic, in contrast
to absolute, to indicate the fact that part of the
meaning that a term has is derived from the exist-

ence of an object that the term itself does not denote.
Stated another way, a relative term is one that
implies the existence of some other object than
the one that the term itself denotes. It is obvious
that no concrete individual term can be relative in
this sense. But some concrete general terms are.
For example, the term 'father' is a concrete general
term since it is a name which applies to an indefinite
number of individuals in whom the relations implied
by the name are present; it is also relative because
these relations are such that they depend for their
application not only upon the existence of the indi-
vidual to whom the name is given, but also upon
the existence of either a son or a daughter. A sim-
ilar double relationship exists in all family connec-
tions: uncle, grandfather, niece, etc. We may ob-
serve the same thing in other than the family type
of social organisation: political, king-subject;
economic, debtor-creditor; juridical, -- plaintiff-
defendant; commercial, employer-employee; do-
mestic, master-servant, etc. Whether this type
of relationship is ever found outside of social organ-
isations, or if found, whether they are common, has
been questioned. We may point out that some logi-
cians have been inclined to find the meaning of such
a word as 'mountain' in the reference that it is said
to contain to the plain from which it rises. There
may be other words whose meanings are of this
relative sort, such as, right-left, heavy-light, up-
down, etc. In deciding whether any term is rela-
tive, it should be borne in mind that the only clue

that is of logical value, is the sense in which it is
actually used in carefully guarded and intelligent
speech. And by this test it appears that the words
whose meanings are determined by the existence of
other objects than those which such words denote
are chiefly those that indicate the relations that we,
as human beings, have with one another in some
type of social organisation.

One other point remains to be mentioned. It is
sometimes found that when one object derives part
of its meaning from the existence of another, the
latter also derives part of its meaning from the
first. Not only, for example, does uncle or aunt
imply nephew or niece, but nephew or niece implies
uncle or aunt. That is to say, each term of the
relation implies, and is implied by, the other. Re-
lationships of this kind are called reciprocal. The
terms between which such relationship holds are
also called correlatives. Thus, when we regard the
creditor-debtor relation from the standpoint of
creditor, we say that 'debtor' is a correlative term,
and when we regard it from the standpoint of debtor,
we say that 'creditor' is a correlative term. By a
correlative term, therefore, is meant that one of a
pair of relative terms which is implied by the other.

Positive and Negative Meaning. The distinction
between positive and negative meaning rests upon
the answer we give to the question whether a given
object has or has not a certain attribute or set of
attributes. In a general way, it is true that every
object has or has not the attributes which the word

we use to point it out implies; otherwise, it may
be asked, how can we identify any subject of dis-
course? It may, however, be said that it is some-
times necessary to state emphatically that the ob-
jects we are speaking about have or have not cer-
tain attributes, and that when this is the case, the
meaning of what we express is either positive or
negative. A positive meaning, to consider that first,
calls special attention to the fact that an object has
the attributes which are implied by the term which
is used to point it out; and it is necessary some-
times to emphasise this fact, because the meaning
of what we affirm, without such emphasis, is liable
to be misunderstood. Whenever the denotation of
a term is unambiguous, or when its popular mean-
ing does not render it equivocal, we do not need to
call special attention to its precise connotation. For
example, the term 'rent' is popularly understood as
a fixed sum of money that is paid or received for the
occupancy of a house or of land. It is primarily a
denotative term, and many judgments may be ex-
pressed which are perfectly intelligible about the

object, the fixed sum of money which this term
denotes. We may say, for example, that 'Rent is a
constant drain upon a poor man's wages/ To pay
rent all one's life is an indication of improvidence,'
etc. In all such instances, the sense of our asser-
tions is carried easily by the denotative use of the
term 'rent.' However, when what we assert is
dependent, not upon the object's existence, but upon
its meaning, we are in a different position. In that

case, the meaning of the term by which the object
is denoted must be made precise if we are to have
an intelligent understanding of what a proposition
affirms. Thus, for the economist, the term rent is
'the remuneration that is derived from the concrete
things that have the value of capital,' and this mean-
ing of the word must be kept in mind in any discus-
sion which involves the idea for which the term
stands. In this instance 'rent' is used connotatively,
and, so used, it limits whatever can be said intelli-
gently on any subject that implies the idea. It is a
positive term because it is used to indicate the fact
that any object to which it is applied must have the
qualities which the term connotes.

The Conditions of Negative Meaning. In discuss-
ing negative meanings, we shall inquire, in the first
place, into the conditions under which such mean-
ings arise. We call attention to three situations
in which knowledge is forced to assume a negative
form. First, whenever, for any reason, we fail to
reach a positive conclusion on any subject of inquiry,
we may map out the progress of the inquiry by a
series of negations. For example, let us suppose
that a physician is called to see a patient who has
a serious illness. As the examination of the patient
proceeds, a number of prominent and secondary
symptoms are noted and the possibility of typhoid,
tuberculosis, scarlet fever, etc., suggest themselves
in turn, only to be rejected one after the other;
and the physician concludes his visit with a confes-
sion, to himself if not to the family of the patient,
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that he has reached no positive knowledge of the
disease, or complication of diseases, from which the
patient is suffering. The physician's knowledge, in
such a case, is made up of a series of negative judg-
ments ; not typhoid, not scarlet fever, etc. Through
what has been denied, that is, through what the
physician calls his differential diagnosis, he has
come nearer to, but has not succeded in making, a
positive diagnosis. Negations thus mark out the
limits within which the positive characteristics of an
object are to be found. No doubt, in new and com-
plicated situations, business and professional men

are often in the position where the only thing that
is clear to them is what not to do or think. In such
cases, we have negative but not positive meanings ;
but the former exist, not as something opposed to
the latter, but as stages in our progress toward it.
Our subject-matter refuses, one after the other, a
number of suggested qualifications, and often we
have to stop our investigation of the matter in
hand before we have found the particular qualifi-
cation which fits.

Secondly, negative meaning arises when we safe-
guard a positive meaning from misunderstanding
or falsification. Let us take, as an example, the
case where a new truth is presented for the first
time for our understanding. We are more often in
this relation to truth, as students, than in any other.
The teacher, let us say, is expounding the psycho-
logical doctrine of perception. We follow him atten-
tively as step by step he enumerates and explains

the various factors in the problem, and their relation
to each other. Now the important question for us
as students is whether we have really understood
what the teacher has said. Class-room experience
shows that a student's reaction to the subjects of
his study comes most often in the form of a ques-
tion, or a statement, which, from the teacher's stand-
point, is the suggestion of a predicate or series of
predicates, for the topic of discourse, in the ex-
ample, the psychological doctrine of perception ; and
the teacher's problem is to determine whether the
proposed predicates are compatible with those by
means of which his own exposition has been carried
on. Now, since our first apprehensions of any new
truth are liable to be uncertain, vague, or partial,
our proposed predicates not infrequently endanger
our grasp of the new truth, and have to be eliminated
from the list of those attributes which, when taken
together, constitute the positive meaning of the sub-
ject under consideration. Now, this elimination of
incompatible predicates is performed by the teacher
whenever he refuses to accept our statements or
questions as elucidations of the subject-matter in
hand. And his refusal is given in the form of a
negation which means, from his point of view, that
he is defending a positive meaning from misunder-
standing or falsification.

Thirdly, negative meaning arises whenever, in
carrying forward a special line of work, our prob-
lem is to see how far, and in what directions, our
subject is capable of development. The starting

point, in a case like this, is the body of knowledge
we have already acquired about our subject. We do

not become possessed of the truth that lies beyond
our grasp by a method that implies disloyalty to
the truth that lies within it. The working criterion
of the truth of any thing new must be the truth
that we already possess. And this means that
nothing becomes true which contradicts what is
already true. Truth is a system, systematic and
coherent, one part of which supports and supple-
ments every other. However, this position should
not be held in such a way that the limitations of
the truth in hand are allowed to make us inhospit-
able to the constantly increasing and enlarging body
of truth. Truth, it should be borne in mind, grows
from less to more; and, in the process, not only do
we come into possession of new truths, but the old
truths are transformed, and sometimes the entire
system of truth changes its character. A familiar
instance of this is the change from the Ptolemaic
to the Copernican astronomy. The particular use
of the statement and illustration in this place is to
call attention to the fact that such changes in the
character and system of truth is effected by nega-
tion working within the field of established truth.
For what is the recognition of truth's limitations
but the admission that negation not only erects a
barrier against outside error, but also against that
hardening process in the heart of truth itself which,
unchecked, steels it against the recognition of out-
side truth? When, therefore, we are endeavouring

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to extend the boundaries of a particular subject, or
when we have to consider the truth of any subject
in its relations to other fields of knowledge with
which it may be correlated, we are often forced into
the position of either denying all outlying truths,
or modifying, in the interest of the systematisation
of truth, the knowledge that we already possess.
Development of knowledge takes place only when
we follow the latter course. But, we should remark,
the modification of established truths, which is
necessary if what is new is to find a place in the
developing field of knowledge, is made possible by
the elimination of what is erroneous in it ; or, stated
otherwise, the limitations of existent truth are
brought to light by negation working within the
area of our established beliefs.

The Logic of Negation. That there is such a
thing as negative meaning is not open to serious
question, and what the conditions are under which
it arises we have already seen. The inquiry that
confronts us now is, How are negative meanings to
be interpreted? We may approach this question by
remarking that negative meanings are developed out
of the interests that lead us, in our inquiry into the
nature of things, to affirmative conclusions. By
this statement we mean that negation must be inter-
preted as a form of knowledge, and not merely as

an assertion of the absence of knowledge, and that,
as such, it satisfies, in the particular instances in
which negative meanings arise, the motives that
sustain all our cognitive endeavours. Stated other-

wise, we may say that since in all knowledge thought
is, as we have seen, in some particular relation to
its object, we must hold either that this is true of
negative as well as of positive meanings, or that
negative meanings fall outside of the field of logical
inquiry. The only alternative to this position would
be to deny the existence of negation altogether. But
this we cannot do. And we cannot do it for the
simple reason that if we did succeed in getting rid
of negation in one form, it would break out in an-
other, a fact that is significant of the distinctive
function of negation in our search after the truth
of things. An illustration of the fact just referred
to may be found in the endeavour to get rid of neg-
ative meanings by reducing all propositions to a
common affirmative type. Thus, it is contended, the
meaning of the statement, 'Some men are not Cau-
casians/ is not, 'Some men are-not Caucasians,'
a negative proposition, but, 'Some men are
not-Caucasians,' an affirmative propostion. But, if
this is true, it is obvious that, in the latter case, the
predicate term has been burdened with the negative
that belonged, in the former case, to the copula.
And, what is more important, this way of escape
from the difficulties of negative statements seems to
have rendered affirmative ones equivocal. For, it
will be remembered, in all affirmation we are sup-
posed to predicate a positive characteristic, quality,
attribute or relation of a subject; but when we
affirm by means of negative terms, we seem to be
saying that the subject does not possess the attri-

butes connoted by the predicate of the proposi-
tion which expresses our meaning. So far then
from escaping the problem of negation, this attempt
to reduce all statements to an affirmative type forces
upon us the question of how we are to interpret
negative terms. To this question we shall now give
attention.

Let us be perfectly clear what our problem is.
When we say 'not-Caucasian/ 'not-typhoid,' etc., it
is quite possible, as we have said, that we mean
nothing more than that our knowledge is falling
short of what knowledge, strictly regarded, requires.
This, however, is a different thing from saying that
we have attained the full measure of knowledge
when all that we can affirm is that a subject has
some quality or relation vaguely expressed by neg-
ative terms. When, for example, we say of an in-
dividual that he is not-Caucasian, or of a disease

that it is not-typhoid, what, we should like to know,
are the positive attributes, which these terms con-
note? And we can ask such a question just because
we are dealing with an affirmative statement.
Now one way of answering this question has been
to say that, by the exclusion of a particular group
of attributes, expressed by the negative term, we
include within the meaning that the negative term
must have all other attributes whatsoever. In other
words, the negative term, or, as it is sometimes
called, the indefinite, indesignate, or infinite term,
is one which divides all existing things into two
groups, in one of which there is placed definitely

the excluded meaning, and in the other all other ex-
istences and meanings. According to this view, it
is the function of the negative term to denote the
latter group ; it is the name of a miscellaneous num-
ber of things, such as "accidence and adjectives and
names of Jewish kings." Thus, as Bosanquet says,
"not-Christian literally interpreted includes not only
heathen humanity, but the fixed stars, the sea, and
indeed, in Aristotle's words, 'every thing whether
existent or non-existent' except Christian. It refers
to no one sphere in preference to another, and thus
says nothing definite enough to be intelligible." It
is an example of what we may call bare negation,
that is, of negation unlimited by any reference to a
positive sphere of reality; and, because it includes
so much, succeeds, in the end, in denoting nothing
in particular. Now it may be doubted whether, out-
side the field of a purely formal logic, there are any
such infinite terms as this; that is, whether bare
negation, a negation which is not a stage or step in
our acquisition or development of positive knowl-
edge, is ever rooted in the purposes or motives
which, in our relation to things, give birth to rele-
vant assertion. But if these infinite terms do not
'express meanings that are the outgrowth of the
motives that control our knowledge processes, if,
that is, they have no relation to the purposes that
guide and determine the life of judgment, they lose
all interest for logic ; they may have a psychological,
but can have no logical, significance.

Another way of meeting the question we are
considering is to point out that the meaning of any
proposition must be sought within the universe of
discourse which the proposition implies, and that,
consequently, this places a limitation upon the
meaning that the proposition's terms can have. If
from this point of view we consider the statement,
'Some men are not-Caucasian/ it is obvious that we
are speaking of men from the standpoint of their
racial characteristics, and that the group of men
which now interests us, the 'Some men' of the

proposition do not have the characteristics of the
Caucasian. But if we are making the statement at
all intelligently, we mean more than this; we mean
that they have the characteristics of either one or
other of the remaining divisions of the human fam-
ily looked at from the racial point of view. That is
to say, the positive meaning of the negative term
'not-Caucasian' can be expressed by 'either Negro
or Mongolian or American Indian.' Thus, the whole
meaning of our statement is, 'Some men are not-
Caucasian, but are either Negro or Mongolian or
Indian.' Likewise the other statement, 'This dis-
ease is not-typhoid,' means that a pathological con-
dition is present, but it is not typhoid and it is either
scarlet fever or tuberculosis or diphtheria or one
or other of an indefinite number of the ills to which
the human body is subject.

Privative Meaning. Closely connected with nega-
tive terms are those called privative, terms which
indicate the absence of an attribute naturally or

usually belonging to the object which such terms de-
note. 'Blind/ 'maimed/ 'orphaned/ 'deaf/ are ex-
amples. Because they are so closely connected, it
may help us to understand both negative and priva-
tive terms if we indicate wherein they seem to differ
from each other. The negative term, as we have
seen, indicates a number of positive alternatives by
means of a negative characterisation of the object
which such term is made to qualify. It is, there-
fore, not a term that is negative in meaning at all ;
it is only its form that has this characteristic. The
reverse seems to be true of privative terms, their
meaning is negative, and what is negated is defi-
nitely the attribute or attributes which such terms
connote. Thus, 'The boy is an orphan/ must be
understood to mean that he has no parents, 'the
absence of parents' being what the term 'orphan'
connotes. A further difference between these terms
may be indicated. In the case of negative terms,
we are able, through what is denied, to affirm cer-
tain alternative qualities, that is, to go beyond what
is definitely stated by such terms. In the case of
privative terms, this is not true. Of the boy who is
an orphan, all that we can positively affirm is that
he has no parents; we cannot say whether he has
either a brother, or sister, or uncle or aunt. If of
any one we can say, 'He is deaf/ we do not find in
this statement any ground of assertion with respect
to the presence, absence, or degree of acuteness of
any of his other faculties. In view of these charac-
teristics, privation must be interpreted as an ex-

treme case of negation ; that is, of a negation which
arises under conditions that make defect of quality

a differentia of the meaning we intend to convey.

Disparate and Contrary Meaning. We may touch
upon two other related distinctions which have neg-
ative significance. Whenever we can divide a class
of objects into a number of mutually exclusive
classes, as, for example, the class animal into lions,
tigers, etc., these subordinate classes are said to be
disparate. If, further, we can arrange the exclusive
classes of a group of objects with respect to their
possessing more or less of some quality, for ex-
ample, organisms in a series from amoeba to man,
and if we can say of two of these classes that, with
respect to the common quality, they differ from
each other in a greater degree than either does
from any other, the relationship between these two
most differing classes is said in logic to be that of
contrariety. A contrary relation is one form of
negative meaning, and indicates the greatest degree
of exclusion, actual or possible, within a single
genus. In other words, contraries are the extreme
limits of the universe of discourse within which the
meaning of any proposition falls.

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QUESTIONS.

1. How are the logical distinctions of absolute and rela-
tive, positive and negative terms, related to those dis-
cussed in the previous chapter?

2. Upon the answer to what question does the distinction
of absolute and relative depend?

3. State and illustrate the meaning that belongs to abso-
lute terms.

4. What senses of the term relative are excluded from our
discussion of relative terms?

5. What is meant in logic by a relative term?

6. What class of experience provides most of our illustra-
tions of relative terms?

7. What are correlative terms?

8. Upon the answer to what question does the distinction
of positive and negative depend?

9. What is a positive term?

10. Under what conditions do we express our meaning pos-
itively?

11. State and explain the conditions under which our knowl-
edge has to be expressed negatively.

12. Are the motives that lead to negative statements differ-
ent from those that lead to affirmative ones? Explain.

13. How have some logicians tried to get rid of negative
meaning?

14. Criticise this effort.

15. State and illustrate two views of the logical significance
of negative terms.

16. What do you understand by privative meaning?

17. How are privative related to negative terms?

18. What do you understand by disparate and contrary
meaning?

EXERCISES

1. Write three propositions to illustrate the absolute mean-
ing of terms.

2. Discuss each absolute term in your answer to the pre-

vious question to show whether it is concrete or abstract.
Write new propositions to illustrate your results.

3. Write new propositions to illustrate concrete and ab-
stract terms.

4. Write three propositions to illustrate the relative mean-
ing of terms.

5. Discuss each relative term in your answer to the pre-
vious question to show whether it is concrete, abstract,
absolute. Illustrate.

6. Write three propositions to illustrate the positive mean-
ing of terms.

7. Discuss each positive term in your answer to the pre-
vious question to show whether it is concrete, abstract,
absolute, relative. Illustrate.

8. Write three propositions to illustrate the negative mean-
ing of terms.

9. Discuss each negative term in your answer to the pre-
vious question to show whether it is concrete, abstract,
absolute, relative, positive. Illustrate,

CHAPTER VI

DEFINITION AND THE PREDICABLES

The Questions of this Chapter. In our study of
terms, in the two preceding chapters, we saw first,
that a term may be used either to point out par-
ticular existing things or to convey some meaning.
When a term is employed to point out particular
existing things it is said to be used denotatively;
when it is employed to convey some meaning, it is
said to be used connotatively. Arising out of this
distinction of the denotative and connotative use of
terms, certain problems were forced upon us for
consideration. For instance, our study of the deno-
tative use of terms brought before us the problem
of the distribution of terms, and our study of the
connotative use of terms brought to our attention
certain general characteristics of terms the study
of which, as we may now say, involved the problem
of the classification of terms. In our statement of
this latter problem, we were led to recognize another
problem, the (problem of definition, and this
problem was said to be concerned with the way in
which the particular meaning of terms receives
logical formulation. The facts and relations em-
bodied in this statement of the logic of terms may
be expressed in a tabular form as follows :

(158)

Standpoint Problem

Denotation Distribution of terms

Terms

f Classification of terms
Connotation

^Definition of terms

This table may be read as follows: Terms studied
from the standpoint of their denotation give rise
to the problem of the distribution of terms ; studied
from the standpoint of their connotation, they give
rise either to the problem of the classification of
terms or to the problem of the definition of terms.

Of the two problems connected with the conno-
tative use of terms, the problem of the classification
and of the definition of terms, the former may be
said to be concerned with the question, What are
the various kinds of terms that form the S and P
of logical propositions ? And the latter is concerned
with the question, What, irrespective of the kinds
that terms may be, are the meanings that terms may
have? We have considered the first of these ques-
tions in the two previous chapters. The second
question we shall study in the first part of the pres-
ent chapter. In this part, we shall try to show how
to make the particular meanings of the terms we
employ definite, how to formulate them in such a
way that no doubt remains as to the sense in which
they are used. We hope, as the result of our study,
to learn how to proceed when we are required to
make the meaning of any of our terms explicit.

After we have concluded this study, we shall be in
a position to ask and answer the question, What
kinds of things can be predicated of a subject?
The convenience of discussing this question here
is that doubt has been cast upon the possibility of
predicating of any subject its own definition. But
it is more than a question of convenience; for, as
we shall see, our whole view of the nature of defini-
tion is involved in the position we take with respect
to the predicables. There are, then, two problems
to be discussed in this chapter, the problem of defi-
nition and the problem of the predicables, and of
these the first to be considered is the problem of
definition.

Non-Ambiguity. We may approach the study of
this question by calling attention to the fact that in
the fields of science, more than anywhere else, our
ideas must be accurate, and the language in which
these ideas are expressed must definitely convey the
meaning intended. That is to say, the natural fluid-
ity of language must not be allowed to go in the
sciences to the point of ambiguity. Whenever,

that is, we wish to express our ideas in words, there
is a limit to the indefiniteness that can be allowed
to the forms of our speech, and if we really convey
the sense of what we mean our words must be
definite in what they connote.

This demand for precision in the use of words
may be easily misunderstood, and it may lead to an
effort after the impossible or undesirable. The aver-
age man's impatience with over-primness of speech

is a healthy protest against pedantry ; but the same
man's laxness in the use of words bears witness
quite often to the vagueness of his ideas. These are
the extremes against which it is desirable to guard :
the extreme, on the one hand, of an accuracy of
speech out of all proportion to the character and
importance of the subject-matter of our thought;
and the extreme, on the other hand, of being tyran-
nised over by words and of using them as substi-
tutes for ideas. There is always an appropriate
exactness that we should strive to realise in our use
of language, and nothing more than this can be
demanded of us by the strictest logic. We must aim
to make our speech non-ambiguous, but non-ambi-
guity is relative to the purpose of the speaker and
to the subject of his thought. Non-ambiguity
changes with the change of purpose and subject,
and the degree of exactness that is requisite on
some occasions and with respect to some subjects
might be altogether inadequate if these were differ-
ent. There is no one standard of explicitness that
we are required to attain ; the most that can be de-
manded is that on all occasions, and with respect
to all subjects, our language be made a fitting ve-
hicle for the expression of the ideas we wish to
convey.

We have called attention to these somewhat
obviaus considerations, because, through their neg-
lect, the importance of the problems with which we
are here concerned has frequently been obscured.
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This, we think, is unfortunate; for whatever can
help us to avoid misunderstanding, whatever can
strengthen our reputation for saying what we mean
and meaning what we say, cannot be of indifference
to any one of us, in a world where intellectual integ-
rity is coming to play an increasingly important
part.

These considerations may also enable us to see
that whenever we are in danger of being misunder-
stood, whether in science or literature or business,
on account of the indefinite meanings of the words

we employ, there is required some method by which
the misunderstanding can be avoided, some method
by which words can be moulded to the uses of ideas.
Life is one, and the occasions when it is necessary
to state explicitly the meaning of the words we use
arise all along its way, and are not confined to, even
if they are more frequent and more urgent in, the
various departments into which our human knowl-
edge has been organised. In other words, ambiguity
may be as undesirable in the drawing-room or
counting-house as in the laboratory, and whenever
and wherever it is a hindrance, we naturally try
to get rid of it. But before we consider how this
may be done, a word may be added on ambiguity
itself.

Ambiguity. The traditional doctrine of ambi-
guity may be briefly stated. Any term is ambig-
uous if it is given a meaning in a proposition which
it does not have in the judgment which the prop-
osition expresses. For example, 'He was a man who

always chose a mean line of action.' Terms that
have more than one meaning, and which, therefore,
lead to ambiguity of statement, are called ambig-
uous or equivocal; and, in contrast to these, those
that have only one meaning are called unambig-
uous or univocal.

There are two respects in which this view of
ambiguity does not seem to be satisfactory. First,
it implies too formal or mechanical a view of logic.
It leaves the impression that words are like counters
in a game to be pushed here and there as the exi-
gencies of the game demand, that no difference is
made to the words themselves by their change of
relation in different propositions. Second, it sup-
poses that there are certain words which have a
fixed meaning, and that the statements in which
they occur are, therefore, free from ambiguity.
This is difficult to maintain for any class of words,
and if it were true of particular words there is no
guarantee that it must remain so. The principle
that should guide us in a discussion like this is that
it is not words that make a language, but language
that moulds words and fits them to the uses for
which the language exists. For example, the word
'Democrat' has a definite historical meaning, as also
has the word 'Republican' ; but as names of political
parties they no longer mean what they meant origin-
ally, and have become vague and indefinite through
the growth within each party of sub-classes or
varieties of democracy and republicanism, each of
which would deny to the other the right to the name.

This process of splitting off from a perfectly clear

centre of meaning is going on all the time in the
living languages of the world, and is giving rise to
conflicting meanings in the uses of words.

The problem of ambiguity may be viewed in a
broader way still. Instead of considering it as hav-
ing to do with the indefiniteness that arises from the
vague or shifting meaning of words, we may view
it as in some sort the central or fundamental prob-
lem of the science of logic itself. For logic, as we
have seen, is a study of the methods by which mean-
ings can get asserted, and how asserted meanings
can get expressed in propositions. It is because
meaning tends to elude us, and because words are
not always, if they are ever, faithful representatives
of ideas, because, that is to say, ideas and words
are both equivocal, that we are compelled, if the
aims of thinking are to be attained, to study the
sources of this uncertainty, and to derive guidance
from the knowledge that we thus obtain. Ambi-
guity, therefore, is a term that describes a natural
condition of human thinking, as well as a natural
indefiniteness of human speech. But, as we all
know, vagueness in an idea and indefiniteness in
speech, have many sources ; and it will not be until
we have reached the end of our studies that we
shall have reviewed even the more important ones.
Ambiguity in the meaning and application of words,
therefore, is part of a much larger problem ; but in
this chapter we shall consider only the ambiguity
that arises in connection with our use of words.

Translation. One of the most common means for
the removal of ambiguity is translation. Thus, if
what we say is not understood, or is in danger of
being misunderstood, we often translate the same
idea into another set of words in the hope that the
ambiguity may be removed. This is a common prac-
tice both in literature and in ordinary conversation.
When, for example, Shakespeare makes Hamlet say,

O, that this too too solid flesh would melt,
Thaw, and resolve itself into a dew;
Or that the Everlasting had not fixed
His canon 'gainst self-slaughter!

he is putting into Hamlet's mouth words that ex-
press a single idea twice over, namely, the longing
for death as a means of escape from his troubles.
If, again, a teacher should ask his class a question
which fails to elicit the correct answer, he would
probably restate the question in the light of the
difficulties that the answers had thrown upon the
class's understanding of the question as first stated.
If further, to take an illustration already used, we
were to say of a given individual, 'He was a man
who always chose a mean line action,' and we were
misunderstood to say that he was a man 'devoid of
a generous disposition', we should probably substi-
tute for the word 'mean,' the word 'moderate' in a

re-statement of what we had intended, in the first
place, to say. There is no doubt that this habit of
translating into a variety of forms the ideas we wish
to express is so inveterate that most of us talk more

than is necessary for understanding, and many of
the books we ordinarily read are much longer than
they need be. But the care we exercise in making
our meaning clear is grounded in a healthy instinct ;
it is the respect we pay to the demand for unambig-
uous statements.

When Translation may be Employed. If we look
at the class of cases illustrated in the preceding
paragraph, we shall discover that the source of their
ambiguity does not lie in the fact that our words
have a vague fringe of meaning, but that the centre
or core of meaning has been misunderstood. When-
ever ambiguity arises from our unfamiliarity with
the meaning of the words in which ideas are ex-
pressed, what is needed is that the same idea be
translated into a set of words with the meaning of
which we are familiar.

In translation, then, ambiguity arises from the
fact that the central meaning of a word is not pre-
cisely determined, either because the word carries
no meaning at all, or because it carries a meaning
that renders the whole sentence indefinite. If, for
example, you do not know what the word 'com-
mandeer' means, you are not likely to understand
any statement in which the word occurs, for
example, 'My motor has been commandeered.' To
meet such a situation it is obvious that some other
word or explanatory statement would have to be sub-
stituted for the meaningless 'commandeered.' If,
to take another case, a class in logic were given the
task of stating the meaning of the assertion 'Non

omnis moriar (I shall not all die),' and it proved
difficult or impossible, the reason would be that am-
biguity spreads over the whole sentence from the
indefiniteness of the word 'all/ an indefiniteness
that is not due, as in the former illustration, to the
absence of meaning, but to the conflict of two mean-
ings that are not clearly distinguished. In this ex-
ample, the Latin word omnis has a distributed mean-
ing, and if the Roman had wished to express the
collective meaning of 'all/ he would have written
cunctis. We have only, therefore, to point out the
distributed use of the word 'all' to enable the student
to see that the meaning of the statement is 'some
part of me is immortal/

When Definition is Required. The conditions un-
der which definition is required are different from

those under which translation is most effective.
Definition is called for when the work-a-day mean-
ing of the word that requires defining is already
known, but is becoming obscured by the fact that,
through the similarity of its meaning to other
words, its distinctive characteristics are in danger
of being overlooked. For instance, the most obvious
common characteristic of the violin, viola, 'cello,
and bass viol is their shape, and it is this that
leads one to regard all of them, on first ac-
quaintance, as, let us say, violins. Our knowledge,
that is to say, emphasises the common likeness that
exists between the several instruments named, and
there is confusion of one thing with another because
the differences which give to these objects a distinct
place in the universe of musical instruments have

been overlooked. The confusion does not arise from
what is included, but from what is omitted, and
what is omitted, in this case, lies, outside the centre,
at the boundaries of the words' meanings. To state
it generally, the meanings of closely related words
encroach upon one another when the boundaries
that keep their meanings distinct are overlooked or
broken down. Now it often happens that the sense
of what we say depends to a large extent upon a
word's ability to suggest just such differences as,
in the illustration used, we persistently ignored.
When this happens ambiguity is sure to result, an
ambiguity, let it be observed, that is due to the con-
fusion of closely related things. In such a case, the
practically important problem is to find some
method by which ambiguity of the kind here in
question can be overcome when it exists, or be
avoided when it does not.

The Method of Definition. In any case of ambi-
guity that can be overcome by definition, the indefi-
niteness of the word's meaning which occasions the
ambiguity is due to our failure to mark off the
boundaries of this meaning from those of other re-
lated meanings. Indefiniteness of this sort in the
meanings of words may be illustrated if we ask our-
selves, for example, what we understand by a bal-
loon and an air-ship. The conspicuous central mean-
ing of the two words is doubtless the fact that they
are machines that travel in the air ; but if they mean
no more than this, we shall very soon be calling each
by the name of the other, or we shall be calling all

machines that travel in the air by the name of the
one or the other. It is in cases like this, as we have
seen, that the definition of words is necessary.
How, then, shall we go about the task of defining?
Obviously, by the way of comparison, by the com-
parison of the things which our words denote. Thus,

if we wish to make our meanings of the words bal-
loon and air-ship precise, we compare an air-ship
with a balloon, and this comparison will lead to the
discovery that they differ from one another in the
method of their locomotion: the air-ship is driven
by an engine and the balloon is not. We shall, then,
call anything an air-ship which travels in the air
and is driven by an engine, and the word balloon
will be reserved for any air-traveling machine which
depends for its locomotion upon the air-currents.
This method of definition is for all ordinary purposes
the most practical, and it lends itself to the require-
ments of the specific occasions which make defini-
tion imperative. We get, that is to say, the mean-
ing that suits the purpose of the statement. Con-
stant practice in the comparison of what words
denote will not only render our meanings more pre-
cise, but free us from that indefiniteness which
comes from an exclusive familiarity with the dic-
tionary meanings of words; for what a dictionary
cannot do, and what comparison does, is to render
the meanings of words appropriate to the particular
contexts in which they occur. By the method of
comparison we find the relevant meaning, the mean-
ing that is required by the universe of discourse

within which our thought is moving, and by the
purpose which controls our particular assertions.

Definition per genus et differentiam. By defini-
tion, as we have seen, we aim to substitute definite-
ness for indefiniteness in the meaning of our words,
and thus to avoid ambiguities of statement. We
have seen, also, that not all cases of ambiguity are
overcome best by definition, but only, or particularly,
those cases in which the vagueness of the boundaries
of a word's meaning obscures the sense of what
we wish to say. In definition, therefore, we seek
to limit the range of a word's meaning, by giving
an appropriate degree of definiteness to its fringe
or outlying area.

Now it is quite obvious that we cannot limit
the meaning of our words in the way required by
definition if these words are used or understood by
us with no meaning at all. We cannot talk about
limiting the extent of our words' meanings unless
these words are used, and are understood, in some,
however vague, sense. Hence, as we said above,
the central meaning of words is not in question in
these cases of ambiguity ; it is only the range of the
word's meaning that is in doubt. It would seem,
therefore, that the limitations that we put upon
our meanings in defining them must have some rela-
tion to these meanings themselves, but the particular
direction in which the limitation is made depends
upon the purpose for which we are seeking the defi-
nition. To take a simpler illustration, if the purpose
for which we need a definition of 'water' is domes-

tic, we may say that it is a liquid which is useful
for cleansing; but if our interests are chemical, we
must say that the liquid is composed of two mole-
cules of hydrogen and one of oxygen. In both in-
stances, we start with the central idea of water as
a liquid, and in both we limit the range of this
meaning in a direction which is determined by the
purpose or interest that the definition is to serve.
It would seem, consequently, that every definition
has two parts, a central and a peripheral, and that
these are different, though related, aspects of a
word's explicit meaning.

Now the two parts of which, as we have seen,
the meaning of words is comprised are called in
logic the genus and the differentia respectively. By
the genus we mean the clear centre, and by the
differentia the vague periphery of a word's conno-
tation. The connection between the two is obvious
if we remember that both are specifications of a
single meaning. Since, therefore, in defining a
word's meaning we start with the recognition of
its genus, the differentia cannot add to that meaning
anything inconsistent with what the genus already
connotes. That is to say, we must look within the
range of meaning broadly marked out already by
its genus for the marks that make the meaning of
a word distinct. The differentia must lie within the
genus, and not outside it, if we are to mark off from
encroaching meanings the one that, by definition,
we are trying to make distinct. For what lies out-
side any genus belongs to another genus, or is that

genus itself, and is not likely to threaten us with
ambiguity; but the distinctions that lie within a
genus are likely to be overlooked because of the com-
mon meaning that pervades all that belongs to the
genus. For example, no one is in any danger of
confusing a typewriter with the table on which it
stands because each belongs, in our common ac-
quaintance with it, to a different genus, the one to
the genus 'objects for writing with,' and the other to
the genus 'objects for placing things upon/ But if,
to take another illustration, the poet or philosopher
or scientist were to mistake the world of his imagi-
nation for the world of his actual experience, this
would be because he had failed to observe the marks
that keep the two worlds distinct. If, again, the
student were to use the words 'university* and 'col-
lege' synonymously, this would be because he had
failed to notice, within the meaning that both have
in common, the specific difference by which the one
is distinguished from the other in the same genus.
From these statements and illustrations it is obvious
not only how genus and differentia are related to
each other in a logical definition, but also what the

terms themselves signify. Thus, by a genus is meant
a group of qualities belonging to a number of par-
ticular objects in common. The word is also used to
denote any group of objects when these objects are
thought of as possessing common qualities. By a
differentia, on the other hand, is meant the specific
difference by which a distinct place is given to an
object within a genus by reason of its possessing a

quality, or group of qualities, that does not belong
to any other member of its genus. Hence, in looking
for the differentia of an object we must look for some
quality, or group of qualities, that does not belong to
any other object of the group to which this object
belongs. When this quality or group of qualities
is not clearly apprehended we are liable to confuse
one thing with another.

Verbal and Real Definition. The distinction be-
tween real and verbal definition, or, as it is some-
times stated, between scientific and nominal defini-
tion, is as old as Aristotle, although in the case of
verbal definition modern writers do not seem agreed
as to how it should be understood. By a real or
scientific definition is meant a definition that is based
upon and gives a description of the essential nature
of the object which the word to be defined denotes.
Far example, a 'liquid' is defined as that form of
matter in which the molecules move with perfect
freedom without changing their size. Verbal or
nominal definitions, on the other hand, have received
at least two different interpretations. The first, or
Aristotelian, interpretation bids us regard as ver-
bal definitions the current or popular meanings of
words. For example, the definition of a house as 'a
building in which people live' would be, on this in-
terpretation, a verbal definition. The second inter-
pretation would make any definition verbal when
the word in question is used to indicate what any-
thing is called. For example, the definition of the
word 'dog' is verbal when it fails to convey any

information about the essential qualities of the ob-
ject that the word denotes, and connotes only those
qualities which make the use of the word appro-
priate.

Now the distinction of real and verbal definition,
and the variations of the sense in which verbal defi-
nitions are understood, are interesting, from a log-
ical point of view, because they raise the question
whether in definition we are dealing with thoughts
or things, with the nature of objects, or with our
interests and purposes in their relation to objects.
According to the view of logic which we are ex-
pounding, no answer can be given to this question

which ignores the intimate connection of thoughts
and things. In the pursuit of knowledge, we are not
interested exclusively in either thoughts or things;
knowledge, as we have shown, exists in the form
of thoughts-about-things. If this is borne in mind,
it will be evident that in all our efforts to avoid
ambiguity we strive to bring our thoughts into rela-
tion with things, and things into relation with
thoughts; and in definition it is sometimes the one
and sometimes the other of these factors of knowl-
edge that requires to be made explicit. In the light
of this statement, the distinction of verbal and real
definition is not an absolute but a relative one, and
were it not for the fact that our words need to be
wedded to fixed meanings, and meanings to be fixed
and made definite by the use of words, the distinc-
tion would have no particular logical interest, and
might vanish entirely. The distinction, however,

persists and is likely to persist, because our knowl-
edge is always in different stages of development,
and because with the improvement of knowledge
old words receive more precise meanings, and new
terms are constantly taking their place in the vocab-
ulary of the people. But while this is true, it is
quite clear that the goal toward which we move in
definition is a truer insight into reality, and the
preservation of this insight in terms that adequately
express it.

The Relation of Purpose to Definition. We have
said that the aim of every definition is to make our
knowledge of things more precise, and to fix this
knowledge in words. So far as this is true, we are
emphasising the relation of definition to the objects
of our knowledge. But what objects and what fea-
tures of objects are of importance for knowledge,
depends upon the purpose for which the definition
of these objects is sought. A change in purpose is
liable to produce a corresponding change in the defi-
nition. For example, if my purpose is to ascertain
the structural character of a circle, my definition
will call attention to the fact that a circle is a plane
figure bounded in such a way that all straight lines
drawn from a fixed point, called the centre, to this
bounding line are of equal length. If, on the other
hand, my purpose is to enable one to draw a circle,
it will then be defined as the plane figure described
by a point moving at a given distance around an-
other fixed point. This is called, in contrast to the
structural, a genetic definition. It should be ob-

served that the distinction between structural and
genetic definition is not confined to mathematics;
the distinction, that is, does not depend on the sub-
ject matter, but upon the purpose for which the

definition is sought. But every case of definition
whether structural or genetic is per genus et differ-
entiam, a form of definition which we must take as
typical of all definition whatsoever.

Tests of a Definition. In text-books of logic, it
is customary to enumerate a number of other rules
of definition than the one to which our attention has
been exclusively directed. There results from this
mode of presenting the subject an impression of
complexity and difficulty that is really foreign to it,
and the student is deprived of the incentive that
comes from a simple and unencumbered statement
to make a practical use of that rule. We, therefore,
emphasise again the fact that all definition is to be
sought per genus et differentiam, and that this rule,
when properly applied, relieves of ambiguity any
statement that is caused by indefiniteness in the
meaning of words, and that it is the only one where-
by this result can be accomplished.

The only question remaining on our hands is,
then, how we are to know whether the rule has been
properly applied. It is as an answer to this ques-
tion that the other so-called rules have their value;
and because they provide us with an answer to this
question they are not rules of definition at all, but
tests of the accuracy of definitions reached in some
other way. We shall consider them in this light in

the following paragraphs, and thereby make the
one rule of definition itself more definite.

In the first place, let us recall the fact that the
object of definition is to limit the extent of a word's
meaning, and in limiting it to make it more exact.
Omnis determinatio limitatio est: we make our
knowledge of objects definite by limiting the range
of the object's nature of which our knowledge, at
any time, takes account. Nowhere more than in the
intellectual life does the proverb 'grasp all lose all'
have a more pertinent application. Only if we are
willing to let some things go, can we gain anything
at all. But in order to gain something, we must
systematically eliminate what does not have a bear-
ing upon the purpose for which knowledge is being
sought. And, as we have shown, definition is a
means of systematically eliminating encroaching
meanings which are threatening the definiteness of
our assertions. It would seem, therefore, that one
of the dangers to which our definitions may be ex-
posed is to be found in their particular range: our
definitions may be either too broad or too narrow.
We shall examine each of these cases separately.

If the genius of a definition is not proximate our
definition is likely to be too broad. For example, if
we define a square as a quadrilateral figure (genus)
whose angles are right-angles (differentia), it is
obvious that we are in danger of confusing a square

with an oblong which is also a quadrilateral rec-
tangular figure. The definition is too wide. To

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rectify the definition we shall have to compare the
square with an oblong, and then we shall observe
that while both are quadrilateral, this is not their
nearest genus, that is, it does not contain all the
qualities that they have in common. Besides being
quadrilateral they are both rectangular. The class,
therefore, to which they both belong is quadrilateral
rectangle. Now, within this class, the differentia
of the square will be equilateral, having all its sides
equal. Our finished definition of a square will,
therefore, be 'a quadrilateral rectangle having all its
sides equal/

If the differentia of a definition is not exact our
definition is likely to be too narrow. By the differ-
entia being exact we mean that it must be such that
only the objects denoted by the term we are defining
possess the attribute in question. Suppose we were
to define man as a civilised animal, the differentia
'civilised' would not be exact, and the definition too
narrow, because it excluded from the class, man,
all individuals who had not reached a certain stage
of culture. To test the accuracy of our differentia
we may ask ourselves the question : Do all and only
the objects denoted by the term we are defining
possess the quality connoted by the differentia by
means of which we are seeking to mark off the
meaning of the term from that of other closely
related terms? If not, the definition will be too
narrow.

After we have done the best we can to secure
the accuracy of our definition in the ways mentioned,

we may then examine the definition as a whole. We
can do this if we remember that a true definition
can always be simply converted. If it is true, for
example, that 'a house-dog is a domestic animal that
barks/ then, if our definition is accurate, it must be
true that 'a domestic animal that barks is a house-
dog/ That is to say, the object defined (the defini-
endum) and the definition must be commensurate.
Or, to state the same fact another way, whatever
can be relevantly predicated of the object defined
must be predicable of the definition, and vice-versa.
This rule guards against anything superfluous in
definition.

Further, the terms of the definition must be of
the same order as the term defined. If, for example,
we defined the body as 'the visible garment of the

soul/ it is obvious that the word soul belongs to the
order of spiritual facts, and is transferred to the
physical order, the order of the term defined. The
uselessness of definitions of this kind may be over-
come if we take our clue to the order of the terms
in which our definition must be stated from the
order of the term to be defined. Hence, to satisfy
this requirement, we may ask ourselves the ques-
tion : Are all the terms of the definition homo-
geneous with the term defined? In this way we
avoid the indefiniteness that arises from the use of
figurative language.

Another requirement of a good definition is that
the terms of the definition should be more ele-
mentary than the term defined. The elementariness

of a term is determined with reference to the uni-
verse within which the term to be defined belongs.
For example, the terms 'rational' and 'animal' are
more elementary than the term 'man' of which they
are predicated as the definition; and in the same
way the terms 'mammal' and 'living in the ocean'
are more elementary than the term 'whale.' By ele-
mentary, that is, is meant elementary in the field
of knowledge to which the term to be defined re-
fers, and not to the range of information that may
at any time be current. Hence, for one who has no
acquaintance with the field of knowledge with which
the term is connected, we may remove the ambi-
guity that exists in the meaning of the term better
by pointing out a specimen of the class or kind of
thing that the term denotes than we can by a
definition.

Again, a term must not be defined by the use
of the term itself or by one of its synonyms. If
this occurs we have what is called a circular defini-
tion. For example, if we define a power as 'a force
that tends to produce motion,' we are obviously
guilty of a breach of this requirement since the word
force has the same meaning as the word to be de-
fined.

Finally, the form of our definition must be pos-
itive if the term to be defined is positive, and neg-
ative if the term to be defined is negative. For
example, the term 'gentleman' has a positive mean-
ing, and, therefore, it would be a breach of this
requirement if we were to define it as 'a man who

has no definite means of support.' But if we were
to define an alien as 'a man who is not a citizen of
the country with respect to which he is declared an
alien,' we should satisfy the requirement, because
the term alien carries with it a negative meaning.

The Problem and Classification of the Predicables.
Whatever can be predicated of a subject is called
a predicable. Now if we ask ourselves the ques-
tion, What sort of things can be predicables, i. e.,
can be predicated of a subject? we have definitely
placed before ourselves an inquiry that engaged the
attention of Aristotle, and again of Porphyry six
hundred years after Aristotle's time. The answers
that Aristotle and Porphyry gave to this question
may be placed in two separate columns thus :

ARISTOTLE'S LIST OP PORPHYRY'S LIST OF

PREDICABLES PREDICABLES

Definition Genus

Genus Species

Differentia / Differentia

Proprium Proprium

Accident Accident

The various kinds of things that can form the pred-
icates of logical propositions are the kinds of things
indicated by the names in these two lists.

An examination of these lists will show that they
differ in the substitution by Porphyry of 'species'
for Aristotle's 'definition/ the other four predi-
cables being the same. But although apparently
only a slight difference, this change indicates a dif-

ference in the doctrine of definition of sufficient sig-
nificance to demand a word or two of explanation.
The significance of this difference in the two lists
can, perhaps, be seen if we remark that the question,
What sorts of thing can be predicated? is not un-
connected with the question, What kinds of thing
can be defined? We have seen, for example, that
in logical propositions we are concerned with both
subject and predicate terms, and it has been made
clear that our predicate terms must not only be
predicable, but predicable of the objects denoted by
our subject terms. If, for example, there should be
anything indefinable, such a thing would correspond
to what is called an individual ; and of such individ-
ual it is obvious that we cannot affirm a genus and
a differentia. Now, it is the difference between the
views of Aristotle and Porphyry as to the kinds of
thing that are capable of definition that accounts for
the difference in their lists of predicables. Aristotle
held that it is only as a universal or species that
anything could be defined. Porphyry held that the
subject of predication might be not only a species,
but also an individual. It was, therefore, reason-
able to include species in his list of predicables, for,
doubtless, its species can be predicated of an indi-

vidual ; but it would have been a mere tautology to
predicate species of itself as would have happened
if this predicable had been included in Aristotle's
list.

Our exposition of the doctrine of the predicables
will follow in the main the Aristotelian view. We

shall assume that the subject terms of logical prop-
ositions denote objects, or groups of objects, that
are thought of as possessing attributes which ex-
press the common nature of all the objects to which
the subject term can be applied. Now if it is asked
what can be predicated of objects so conceived, the
answer is given in the list of Aristotelian predi-
cables. Before, however, we consider in detail what
each of these predicables means, we may point out
that they are not all related to a subject in exactly
the same way. Some of the predicables are com-
mensurate with their subjects, and some are non-
commensurate. To the former class belong defini-
tion and proprium; to the latter, genus, differentia,
and accident.

The Commensurable Predicables. By a commen-
surate predicable is meant one that is found wher-
ever the subject of which it is predicated is found.
It is an attribute, or group of attributes, that is
always present when the object is present, and ab-
sent when the object is absent. This class of pred-
icables we shall explain briefly in this section.

The definition we have considered already. It is,
as we have seen, an answer to the question, What
is it? and this question may be asked of anything,
of an attribute as well as of a substance. For ex-
ample, if we ask what acceleration is, and the phy-
sicist were to answer, change of velocity per second,
he is offering this as a definition, that is, a state-
ment of what it is that makes anything the kind
of thing called acceleration. Similarly, when an

organism is defined as a material body of which the
parts are reciprocally related as ends and means,
we should refuse to recognize as an organism any
object which did not manifest these particular char-
acteristics. The propositions, therefore, in which
the predicate terms claim to be definitions are those
in which the predicates also claim to be commensu-
rate with their subject terms. This is only another
way of saying, as we said above, that the state-
ments which embody definitions must be capable of
simple conversion. The definition states what is
essential to the existence of the objects denoted by
the term that is defined.

A proprium or property is an attribute peculiar
to or characteristic of an object, and is commen-
surate with its existence, but it is not an essential
part of its definition. We may state the relation
between the proprium and definition by saying that
by means of the proprium we develop the meaning
of a term from the point at which its definition
stopped. From this it will be obvious that whether
we go beyond the meaning that is assigned to a
term in its definition will depend upon a motive
other than that which makes definition necessary.
In other words, the propria of terms are those char-
acteristic features of an object's nature which re-
main after definition has removed any existing am-
biguity; and whether these are predicated as part
of the term's meaning will depend upon whether
special motives operate to make them explicit. For
example, an equilateral triangle may be defined as

a three-sided plane figure having all its sides equal.
This statement is sufficient for the purpose of dis-
tinguishing this kind of triangle from all other
kinds. But if we were interested further in equi-
lateral triangles, we should find that they are also
equiangular, and this fact of being equiangular is
called a property of the kind of triangles in ques-
tion. Likewise, contractility, irritability, assimilat-
ing food, reproduction after its kind, are properties
of an organism as this term was defined above.

The Non-Commensurable Predicables. By a non-
commensurate predicable is meant any quality which
alone does not exhaust the nature of an object, or
which belongs to an object in some only of the ob-
ject's relations. In neither case is the nature of
the objects denoted by the term made entirely ex-
plicit. The following illustrations will make this
clear.

We may, in the first place, predicate of any sub-
ject the genus to which it belongs. That is to say,
we may affirm the area of clear meaning of a term,
and this may be all that is necessary to convey our
meaning. It is obvious that we are here dealing with
the class of cases that were considered above under
the head of translation. But, as we saw there, the
genus alone does not tell us all that is necessary
for a complete understanding of any object's nature.
The genus is, therefore, an incommensurable pred-
icable. We may, in the second place, predicate of
a subject its differentia, that is, that part of the es-
sential nature of the subject which distinguishes it

from other species of the same genus. If, therefore,
we are in danger of ambiguity from a tendency to
confuse species, we may, to make our meaning clear,

resort to the method of calling attention to the
specific differences of the objects that we have hith-
erto failed to distinguish. But the differentia alone,
as we have seen, does not exhaust the nature of any
object, and it is not, therefore, a commensurable
predicable. In the third place, we may predicate
some attribute not included in the definition of a
subject, that is to say, an attribute that may or may
not belong to the subject. For example, there is
nothing in the nature of a pen that it should be
made by a particular firm, or that it should belong
to a particular person. These are accidental rela-
tions, and belong to the pen merely as an individual.
All such attributes, not contained in the definition
or proprium, are called accidents.

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QUESTIONS

1. From what two standpoints may the logical discussion of terms be carried on, and to what new problems does such a discussion give rise?

2. Define each of the problems enumerated in your answer to the previous question.

3. Define the nature and limits of the demand for non-ambiguous statements.

4. What is the practical importance of being able to make non-ambiguous statements?

5. State and criticise the traditional doctrine of ambiguity.

6. In what sense can ambiguity be said to be the fundamental problem of logic?

7. Explain the nature of translation as a method of overcoming .ambiguity.

8. What conditions call for the employment of translation in the removal of ambiguity?

9. What conditions call for the employment of definition in the removal of ambiguity?

10. Explain and illustrate: The method of definition is comparison.

11. What is meant by: Logical definition is per genus et differentiam?

12. What do you understand by real and verbal definition? In what two senses may verbal definition be understood?

13. What is the logical significance of the distinction of real and verbal definition?

14. What is the relation of purpose to logical definition?

15. In what two ways may our definitions fall short of being strictly accurate?

16. Explain and illustrate how a definition may be too broad.

17. Explain and illustrate how a definition may be too narrow.

18. How does the simple conversion of a definition guard against introducing anything superfluous into the definition?

19. How may we guard against figurative language in definitions?

20. Explain: The terms of a definition should be more elementary than the term to be defined.

21. What is meant by a circular definition, and how may circular definitions be avoided?

22. What do you understand by a predicable?

23. How many predicables are there, and what is the difference between Aristotle's and Porphyry's lists of the predicables?

24. What is the relation of the problem of the predicables to that of definition?

25. Explain why Aristotle's and Porphyry's lists of the predicables differ?

26. What is meant by a commensurable predicable?

27. Which of the predicables are commensurable?

28. In what sense is a definition a predicable?

29. What is a proprium?

30. What is meant by a non-commensurable predicable?

31. Explain genus, differentia, and accident as non-commensurable predicables.

EXERCISES

1. Write three ambiguous statements whose ambiguity can be removed by translation.

2. Write three ambiguous statements whose ambiguity can be removed by definition.

3. Define, and state, in each case, the purpose that the definition is intended to serve: anger, river, house, emperor, metal, justice.

4. Criticise the following definitions, and show what rules, if any, are violated by them:

(1) Thunderbolts are the winged messengers of the gods.

(2) Round is a quality that belongs to any rotund object.

(3) Man is a vertebrate animal.

(4) An inflammation is some abnormal condition of one of the body tissues.

(5) An absentee is a person who does not live in his own country, or who does not look after his own property.

(6) Prudence is the ballast of the moral vessel.

5. Construct three definitions for the purpose of showing how definition depends upon comparison.

6. To which of the Predicables does each of the following predicates belong :

(1) The whale is a mammal.

(2) The whale is a vertebrate.

(3) The whale lives in the ocean.

(4) The whale was caught and brought to land.

(5) Logic is a good mental discipline.

(6) The tiger is a predatory animal.

(7) Englishmen are keen sportsmen.

(8) Lord Shaftesbury was a great philanthropist.

7. Give the genus, differentia, proprium, and accidens of (a) peninsula, (b) triangle, (c) affirmative statement,

CHAPTER VII
DIVISION AND CLASSIFICATION

Relation of Definition and Division. Whenever ambiguity threatens any statement on account of the vagueness of the outlying range of a word's meaning, we may remove the ambiguity by defining the word's meaning. The method of definition, as we saw in the last chapter, is comparison. By this method we distinguish a meaning from one or more others with which we are in danger of confusing it, and our result is a division of the genus into two or more species. There is, however, nothing in the nature or conditions of definition that, in principle, assures us that all the distinguishable meanings of a genus have been discovered, and nothing, there- fore, that assures us that we have examined all the species which belong to the genus from which our definition starts. If, therefore, instead of asking how one species differs from another, we wished to know how many species there are in a given genus, we should be confronted with a new problem which it is the business of logical division to consider; for by division we mean, in general, the method that must be employed to develop systematically all the species which belong to a genus. Now, if it is asked why any one should raise such a question as this, we can only say that the demand for non-ambiguous statements may be left unsatisfied after making the

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meaning of our words as clear as possible. Ambi-
guity, in other words, may be occasioned not only
by uncertainty in the connotation of terms, but also
by uncertainty in their denotation; and whenever
there is vagueness in either respect there is likely
to be a corresponding vagueness in the other. From
this point of view, logical definition and division are
closely connected problems, and they differ merely
as one stage differs from another in a single process.
In logical division we carry further the process that
begins in logical definition, and the object is to re-
move any remaining uncertainty in a word's mean-
ing.

What is Meant by Logical Division. The word
'division' is not well chosen to designate the process
that we have now to describe. If it should suggest,
as it ordinarily must, that it is the method by which
we split up a genus into its component parts, in
much the same way that a house-wrecker separates
the doors, windows, joists, etc., of the building he
is dismantling, we should be misled entirely in our
understanding of what the term means or the proc-
ess implies. If this were the sense in which we were
required to understand the word, its application
would not give us a clearer apprehension of a term's
meaning, but would result in the destruction of the
meaning altogether. It will, perhaps, set the mat-
ter in a clearer light if we say that logical division,
like logical definition, starts with species or con-
cepts, and that in both cases we are concerned with
the kinds in which the species is found realised.

This being the case, we cannot say that a genus is
the sum of its species; we can only say that it is
differentiated into its species.

In logical division, we are concerned with the
relation of a genus and its species. But that rela-
tion, as we have just seen, cannot be one of a whole
to its parts; it is rather a relation in which the
species disjunctively enumerate the alternatives
which, when taken as an enumeration, denote the
range of a term's meaning. That is, by division we
analyse the denotation of a term's meaning. For
example, if we should divide the genus 'rectangle'
into two species, one with its adjacent sides equal,
and the other with its adjacent sides unequal, we
cannot mean by rectangle, in such a case, the sum
of these two species. 'Rectangle' does not mean the
square plus the oblong; it means either the square
or the oblong. That is to say, the genus is realised
in each of its species ; the species of any genus ex-
hibit distributively, not collectively, a word's mean-
ing.

If, now, we should seek to derive from these
statements about the nature of logical division a
rule which, when applied to any case, will serve as

a test of the accuracy with which the division has
been carried out, we may perhaps say that we must
be able to predicate the genus, or whole that is di-
vided, of each of the species of a logical division.
Thus, in the previous example, we called the oblong
a rectangle, and also the square a rectangle. Each
js the whole of what a rectangle is. To take another

illustration. The genus 'human being' may be log-
ically divided into 'man,' 'woman,' etc., and the genus
-human being of which they are the species,
may be predicated of each one, thus : 'a man is a
human being,' 'a woman is a human being,' etc.

In this discussion of the nature of logical divi-
sion we have seen (1) that logical division is the
process by which the range of a term's meaning
can be exhaustively determined. It follows from
this that the process of logical division can be ap-
plied only to what is in its nature general, in other
words, to a species or concept. The genus, species,
or concept to which the process of division is applied
is called the totum divisum. We have seen also (2)
that the sub-species of the whole that is divided
enumerate disjunctively the kinds into which the
whole is differentiated, that they are not the parts
which when taken together constitute the whole.
From this it follows (3) that we must be able to
predicate of each kind the qualities connoted by the
genus or whole that is divided. When this is not
possible logical division has not taken place.

Other Kinds of Division. It will help to keep the
meaning of logical division distinct, if we describe
the characteristics of other operations that go by
the same general name of division. Of these, there
are in particular three : metaphysical, physical, and
verbal division. These are, like logical division,
mental operations, but each serves a distinct pur-
pose. The purpose of logical division, as we have

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seen, is to enumerate the kinds or species into
which a genus is differentiated, or, what is the same
thing, the kinds or species in which the qualities of
the genus are realised. The purpose of metaphysical
division is to distinguish the several attributes
which are capable of being predicated of a genus.
This kind of division obviously lies at the founda-
tion of the problem of the predicables which was
considered in the last chapter. For the problem of
the predicables, as we saw, was concerned with the
character of the attributes that could be predicated
of any species. When, therefore, we divide a spe-
cies into its genus, differentia, proprium and acci-

dens, we are not employing what is technically
known as logical division, but a method that is
known as metaphysical division. The difference
between these two methods may be brought out in
the statement that in metaphysical division we
must be able to predicate of the genus the species
which our division has been the means of distin-
guishing; whereas in logical division the converse
statement holds true, that is, it is the genus which
must be predicable of the species. For example, if
we divide 'organism' into 'animals/ 'birds/ 'fishes'
and 'reptiles/ we have a logical division, a divi-
sion which makes it possible to predicate of each
species the genus which has been divided. If, on
the other hand, 'organism' is divided into 'living
creature/ 'capable of locomotion/ 'quadruped/ etc.,
this is called a metaphysical division, a division
which makes it possible to predicate of the genus

each of the attributes which the division distin-
guishes. The purpose of physical division is to anal-
yse a whole or aggregate into the parts of which
it is composed. Thus, we may divide 'horse' into
head, legs, ears, tail, etc. This process is sometimes
called physical partition. It is distinguished from
the other kinds of division by the fact that neither
parts nor wholes can be predicated of each other.
For example, it is obvious that 'horse' is neither
head, nor legs, nor ears, etc.; nor can we say of
any one of these that it is horse. Verbal division is
sometimes mentioned as a separate form of division.
It is used to denote the act of distinguishing the
homonymous meanings of a word. For example, the
word 'hand' may mean either 'a labourer' or 'an
organ of the human body.'

Fundamentum Divisionis. We have seen that the
motive to logical division is found in the interest
we have in determining the whole denotation of a
term's meaning. Logical division is, therefore, the
method by which we systematically develop the de-
notation of terms whose meanings have been fixed
by definition. It follows from this that we cannot
divide a term whose meaning is unknown to us.
This fact is frequently overlooked by the student,
and he is apt to make the effort to put the method
into operation in a case in which his knowledge of
the totum divisum, or term to be divided, makes his
failure a foregone conclusion. Logical division pre-
supposes that the totum divisum has been given a
meaning by logical definition. If, consequently, we

are required to determine the denotation of a term
with whose connotation we are unacquainted, we
must first determine the meaning of that term by
the method of logical definition. While, therefore,

logical division and logical definition are, as we
have seen, closely related processes, each has a dis-
tinctive role to play in the development of meaning.
With this caution in mind, we pass to a statement
of certain features of the method of logical division
which throw light upon the significance of the proc-
ess itself. What, we may ask, is the basis of divi-
sion? On what principle or principles are we to
proceed in any given case? By what are we to be
guided in working out a logical division? The
answer to such questions as these is usually given in
an exposition of what logicians call the fundamen-
tum divisionis. By a fundamentum divisionis is
meant some characteristic of the totum divisum
which, when systematically applied, develops differ-
ences among its members. Or, as it is sometimes
said, it is that aspect of the genus in respect of
which its species are differentiated. If, now, the
purpose of logical division is to develop differences
in respect of which species may be differentiated,
we shall have to seek in our definition of the totum
divisum for some indeterminate attribute which
can serve as the basis of our division. Now that
there should be something indeterminate in a defini-
tion will become perfectly clear if we recollect that
all that a definition aims to give is a meaning relevant
to the situation and purpose which made the defini-

tion necessary. There is no such thing as a complete
definition in any other sense than a relevant defini-
tion. The only other sense in which we can speak
of definitions being complete is that we are ac-
quainted with all the known meanings of a word.
But in that case we should not have a single defini-
tion but a series of definitions; and, of course, all
that we could say about that is that the series is
complete, not that the definition is. If, consequently,
our definition of a term enables us to make unam-
biguous statements, that is all that we can expect
of it; but it does not follow that the definition will
be sufficiently determinate for carrying out a logical
division. For example, 'man* has been defined as
a rational animal, and, as a definition, it serves its
purpose well enough. But if we consider the deno-
tation of the term's meaning thus defined, we shall
find that there is something indeterminate in the
word rational, for rationality, as we all know, ad-
mits of degrees. When, therefore, we assert of any
individual that he is a man, that is, a rational ani-
mal, we cannot be understood to imply a definite
degree of rationality, but only some degree. If,
however, we asked what degrees of rationality exist,
we should have to adopt some standard of ration-
ality, or state more carefully what we mean by
rationality in our definition of man. This standard
or statement would be, for the purpose of logical
division, our fundamentum divisionis. With respect
to this fundamentum divisionis, some individuals
will meet the requirements it lays down, and these

we call normal ; others will fail to meet it, and these
we call abnormal. In the latter class, we find some
who fall below, and some who fall above the stan-
dard : the sub-normal and the super-normal respect-
ively. The sub-normal, again, may be divided into
dements, those in whom mental deficiency appears
subsequently to mental development, and aments,
those who have never attained normal mental devel-
opment. The aments may be divided, according to
the degree in which they depart from the normal,
into feeble-minded, imbecile, idiot. This division
may be shown in tabular form as follows:

Man

A

Nrmal Abnormal

A

Sub-normal Super-normal

Dements Aments Genius

^_ A

f \

Feeble-minded Imbecile Idiots

We may point out in this connection that every
division reacts upon the definition from which it
starts to make it more exact. For example, we
found the definition of man as a rational animal
defective because it neither stated what is meant
by rationality, nor what degrees of rationality were
to be recognised. . Both these deficiencies are made
good in logical division. Thus, to make our funda-
mentum divisionis clear, we may say that by ration-
ality we mean 'a degree of intellectual capacity suffi-

cient to enable its possessor to perform his duties
as a member of society in that position of life to
which he is born/ and the classes of those who ful-
fill these standard requirements or depart from
them either by way of excess or defect are the
normal, dements, feeble-minded, imbecile, idiot,
genius. When, therefore, we look back upon the
original definition from the standpoint of our

completed division, it has taken on a more definite meaning. We now know not only what is specifically meant by calling any man rational, but we also know what are the different degrees in which rationality may in any case be realised. In other words, our division enables us to say that the concept 'man,' when determined with respect to rationality, may be realised in either one or the other of the forms specified in the division.

Questions of Terminology. We shall postpone further discussion of the problems of logical division until we have explained the technical terms in which the discussion must be carried on. For the sake of completeness, we may recall that the term totum divisum was used above to denote the whole that is divided; it is the genus with which any division starts. When viewed in relation to all the species to which logical division gives rise, the totum divisum is called the summum genus. The species with which a division ends are called infirmae species. If, as in the illustration used in the last section, our division is carried through a number of stages, the intermediate species, that

is, those that fall under the summum genus, are spoken of as subaltern genera. When, however, we wish to point out the relation that any one of the subaltern genera has to the next below it in the series, we designate this subaltern genus the proximum genus. It will be observed that the totum dioisum is a proximate genus with respect to the next below it in the series, but a summum genus with respect to all, whether one or more, that lie below it in the series. The constituent or co-ordinate species are those which are differentiated at any single stage in the process of logical division. These distinctions, it should be noted, are purely relative, and the student will have no difficulty in mastering the terminology if he observes that they all hinge upon the meaning assigned to genus and species. A genus is anything considered as a subject of division, and a species is always the end-product of a division. The same thing, therefore, may be both a genus and a species, but whenever that is the case, the same thing is being looked at from different points of view.

Rules of Logical Division. There are other features of logical division than those that have been already considered with which it is important that the student should become acquainted. These we shall state and illustrate in connection with our enumeration and exposition of the rules of logical division.

The first rule is that a logical division must proceed in all its stages upon one fundamentum divi-

sionis. The reason for this, of course, is found in
the nature of the problem that logical division is
set to solve. That problem is to develop the mean-
ing of a term so as to make determinate whatever
may have been left indeterminate in its definition.
If we did not keep within that aspect of a term's
meaning with which our logical division starts,
we should fail to develop this meaning from an in-
determinate to a more determinate form. In the
example used above, we found that a number of de-
grees of rationality exist, and that these must be
included in our definition of 'man' if this concept is
to be completely determined. If we had found, in
our division of the term, species of another kind,
let us say red man, yellow man, it would be evi-
dent that we had gone outside the fundamentum
divisionis, rationality, and that we had consequently
failed to determine that aspect of the term's meaning
with which we were concerned. Whenever this hap-
pens, whenever, that is, we fail to carry the division
through on a single principle, we are said to have a
cross division. All the species to which a logical
division gives rise must be the same in kind; and
this is possible only if we retain the same principle
of division throughout. Again, in carrying out a
principle of division, we aim to make our species
exclusive, to include, that is to say, in any one species
only that which is definitely excluded by the other
co-ordinate species. The constituent species of a
genus must not overlap. This requirement is ob-
viously related to that feature of a logical definition

which emphasises the difference between two or
more conflicting meanings (differentia), as the
former requirement connects logical division with
the other aspect of definition which emphasises the
common likeness of these conflicting meanings
(g enus).

It is not difficult to apply the first rule of divi-
sion when the fundamentum divisionis is completed
in a single step. For example, if 'man' is defined as
'a rational animal possessing a skin-color of some
kind/ the latter part of the definition may become
for us a principle of division. Dividing man then
according to skin-colour we find the denotation of
the term to be as follows :

Man

^ A ^

f >\

White man Black man Yellow man Brown man Red man

When, however, the division is carried through

several stages, as it frequently is, it may not be
apparent how a single principle can control the
whole series of divisions. If, for example, we were
to divide 'human being' into 'male' and 'female,' and
were then to divide 'female' into 'brunette' and
'blonde,' it is obvious that the fundamentum divi-
sionis in the first division is sex difference, and in
the second, complexion colour. In cases like this,
we cannot look upon the division as a series which
develops a single theme; we must regard it rather
as a chain of discontinuous divisions which contains
as many separate divisions as there are distinct
fundamenta. The fact that they can be written

consecutively does not have any logical significance ;
the reason for giving this form to them is econom-
ical; it saves time, when the end product of one
division is the starting-point of a new one, to con-
tinue in the serial order. If, however, our practice
were guided by logical requirements, we should re-
write our term whenever we intend to apply to it a
new principle of division.

Let us now consider the case of a division which
has the characteristics of a continuous series, that
is, a series which develops a single idea through a
number of stages. The significance of this case is
that it emphasises the importance and illustrates
the method of systematically developed knowledge,
of knowledge, that is, which proceeds at each step by
the smallest possible degrees of relevant difference.
Thus, in carrying out a division which develops its
meaning in a continuous series, we are counselled to
make the steps of the series as small as possible. This
is the purport of the Latin injunction, Divisio ne fiat
per saltum: you must not make your division go
by leaps. A division that is not systematically de-
veloped is useless for the purpose that put it in oper-
ation. But since, throughout all the stages that we
carry our division, we need to be guided by a single
principle, it is evident that at each stage of the divi-
sion we must use a fundamentum divisionis that is
some modification of the principle with which we
began the division. That is to say, each subordinate
fundamentum must fall within the meaning of the
original fundamentum. An illustration, borrowed

from Gibson, will make this evident. Let us take
as our fundamentum divisionis, the side-relations of
'quadrilateral figures,' understanding by quadrilat-
eral figure 'a plane rectilinear quadrilateral figure.'
Our purpose is to develop the number of types which
belong to this class. According to their side-rela-
tions, 'quadrilateral figures' are either 'parallelo-
grams/ that is, figures whose opposite sides are
parallel and equal, or 'non-parallelograms.' Divid-

ing these species further according to the inclination
of their sides, a special form of the original funda-
mentum, we get, in the case of the parallelograms,
rectangle and non-rectangle ; and in the case of the
non-parallelograms trapezium, a figure in which
there are no parallel sides, and trapezoid, a figure in
which two of the sides are parallel but not equal.
Another specification of the original fundamentum
would be relative side-length. If we apply this to
rectangle we get square and oblong; and to non-
rectangle, rhombus and rhomboid, oblique figures
which correspond to the square and oblong respect-
ively. All these relations expressed in the form of
a genealogical tree are as follows:

Quadrilateral Figure

Parallelogram Non-parallelogram

Rectangle Non-rectangle Trapezium Trapezoid

Square Oblong Rhombus Rhomboid

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The second rule is that a logical division must
be exhaustive. The reason for this rule is connected
obviously with the purpose that controls such divi-
sion, namely, to denote in orderly relation whatever
belongs to a certain genus. What the rule states
is that a place must be found, when the division has
been made, for everything that belongs to the genus
in one or other of the constituent species. It is only
another way of stating the purport of the rule to
say that the constituent species together must be
coextensive with the whole genus. The rule is in-
tended to guard against too narrow and too broad
division. When the division is too narrow some-
thing is omitted from, and when the division is too
broad something is added to, the genus, and which-
ever fault we may fall into, the division is rendered
useless. Instances of too narrow division are : 'men'
into 'good' and 'bad;' and 'objects' into 'useful' and
'ornamental.' Too broad division is likely to occur
whenever there is an indistinct apprehension of the
connotation of the terms we employ in our divisions.
Unless, therefore, a division is exhaustive, that is,
neither too narrow nor too broad, we have not really
divided at all ; for when the division is too narrow,
the constituent species are equivalent to only part of
the genus, and when it is too broad, they are equiv-
alent to the genus and something else. Whenever a
genus has been properly divided, the denotation of
genus and species must exactly coincide.

Dichotomy. Our discussion of logical division

has emphasised two things: (1) that our ability to

use the method depends upon our knowledge of the
subject to which it is applied, and (2) that to insure
against omitting anything that really belongs to a
genus we must make our division exhaustive, and
that when this requires us to carry the division
through several stages, the steps between one sub-
division and another must be made as small as pos-
sible. Division is not, consequently, an easy method
to apply, although it is not difficult to understand;
but the difficulty is due primarily to the great com-
plexity of the material that nature presents for our
study.

Dichotomy is a traditional method of division
which has been supposed to relieve us of the diffi-
culties to which we have just referred, and to make
it possible, in the absence of any considerable knowl-
edge of the subject under investigation, to deter-
mine the species which may belong to it. If this
were true, we might omit the consideration of it
entirely on the ground that it is a merely formal
process ; if it is not true, we must consider its value
in relation to our effort to make our knowledge of
things systematic. That it is not true is the position
of modern logicians as it was of Aristotle. We must,
therefore, place this method in its relation to our
foregoing discussions.

First, let us inquire how dichotomy differs from
the form of division which we have just considered.
The characteristic of a dichotomous division is, as
the name implies, that it proceeds at each step of
the division by dividing a genus into two alternative

species. Now, if each step of such a division ex-
hausts the genus we are dividing, it is apparent that
one of the terms must be an indefinite or so-called
negative term. Thus, if we divide 'triangle' accord-
ing to the relations of the sides, we shall have at
the first division, if we take equality of all the sides
as the fundamentum, two species, 'equilateral' and
'non-equilateral.' Dividing the 'non-equilateral'
term with reference to the equality of two of the
sides, we shall have once more two species, 'isosceles'
and 'non-isosceles.' If we divide now the 'non-
isosceles' term on the basis of the only remaining
possibility, namely, the equality of one side with
itself, we get also two species, 'scalene' and, if there
are any, 'non-scalene.' The arrangement of these
divisions in a tree will illustrate the typical form
of division by dichotomy. Thus:

Triangle

A

Equilateral Non-equilateral

Isosceles Non-isosceles

"N

Scalene Non-scalene

From the foregoing statements and illustration,
it will be apparent that we cannot begin to divide
a term by dichotomy without having before our
minds some definition of the genus that we wish to
divide. Unless we knew, for example, that a tri-
angle was 'a plane figure bounded by three straight
lines,' we should not be able to divide it to determine

its species. Dichotomy, as much as any form of divi-
sion, presupposes definition. Now, the connection
between dichotomy and definition per genus et differ-
entiam, may be expressed by saying that every such
division suggests a definition of the class we are
dividing, and that every definition implies a division
by dichotomy. Thus, to take the illustration already
used, a 'triangle' may be defined as 'a three-sided
plane figure whose sides have a certain relation to
each other;' and if we wish to make the indeter-
minate part of this definition determinate, we divide
by dichotomy in order to bring out the specific rela-
tionship of the sides to each other.

We may observe, further, that, applied to rela-
tively simple cases, dichotomy is a rather cumber-
some method of doing what can be accomplished
more expeditiously at a single step. There is no
reason, for example, why we should not divide tri-
angle into its constituent species at once ; for, in such
a case, it is not by the method of division, but by
reason of our acquaintance with the subject-matter,
that we know the species that our division is a means
of classifying. We may also observe that it is un-
avoidable in division by dichotomy that the end-
product should be a hypothetical term, 'non-
scalene' in the case above on the existence or non-
existence of which the division itself can throw abso-
lutely no light.

What now, it may be asked, is the value of a
division by dichotomy? It is valuable in the first
place as a test of the accuracy and exhaustiveness

of our analysis of a term's meaning. To take an
illustration from Aristotle, we may classify the
Predicables as follows:

Predicables

Commensurable Non-commensurable

f \ r

Essence Not essence Part of essence Not part of essence
(Definition) (Proprium) (Genus or Differentia) (Accidens)

It will be noticed in this case that the fundamentum
divisionis, or, as we may say, the differentia, is the
relation of the species according to the degrees of
the essential connection that they severally have to
the genus, and that the division is throughout dich-
otomous. But, of course, the Predicables were al-
ready known before they could serve as an illustra-
tion of how dichotomy may verify a classification.

We may also point out that a division by dich-
otomy is also valuable if we wish to ascertain the
position of a particular species in the class to which
it belongs. Thus, to quote Welton, "in the Analytic
Key prefixed to Bentham's British Flora, which is
intended to enable anyone who has a specimen of a
certain plant before him to discover its species and
its technical name, the arrangement is nearly en-
tirely dichotomous, and, for such a purpose, this
form is the most useful. But to adopt dichotomy as
a final arrangement would be absurd. A botanist, for
example, starts at once with three classes of the sum-
mum genus plant, viz., exogens, endogens, and acro-

H

gens, and each of these is sub-divided into varying
numbers of orders, and these again into still further
varying number of genera, and so on, with little or
no regard to dichotomy, the object being to make the
classification agree with the distinctions existing
in the plants themselves."

The Tree of Porphyry. In a typical division by
dichotomy, as we saw in the last section, it is the
negative or indeterminate term that lends itself to
further division. If, now, the division proceeds
through all its stages by the dichotomous division
of the r^oaitiy^L or determinate term, we have a spe-
cies of division which is illustrated by what is tech-

nically known as the 'Tree of Porphyry/ An illus-
tration will show not only the possibility of such a
division, but exhibit the form that is characteristic
of it. Thus:

Substance

Corporeal Incorporeal

f \

Animate Inanimate

Sensible Insensible

Rational Irrational

In any case of division by dichotomy whether of
this type or not, the indeterminate or negative term
and the determinate or positive term, in their rela-
tion to each other, are sometimes referred to as
Contradictory Opposites, Contradictory Relatives,
or Contradictories. This designation is apt to be

misleading unless it is pointed out that contradic-
tion can be logically postulated of terms only when
these have a common or underlying basis. There is
no contradiction, for example, between virtue and
beef-steak, because they do not belong to the same
universe of discourse, that is, because they have no
common basis. Animate and inanimate are contra-
dictories because they are the alternative ways in
which corporeal substance is capable of getting itself
expressed. The alternative species, therefore, to
which a dichotomous division gives rise may be
spoken of as contradictory in the sense that they
are the definite and exclusive forms in which the
genus to which they belong is realised. It would,
perhaps, avoid all ambiguity if we spoke of the rela-
tion between the determinate and indeterminate
terms of a logical division as Complementary* If
we did so, we should have to mean that the indeter-
minate term included within it all of the denotation
of the genus that was not definitely included in the
determinate term. Only on this interpretation can
these terms be regarded as the names of alternate
species.

It will be observed that in a division of the type
illustrated by the Tree of Porphyry the indetermin-
ate term is rejected at each of the subordinate steps.
This fact is technically known as an abscissio in-

finiti.

Classification Defined. One does not need to go
to text-books of logic to become acquainted with the
process that is denoted by the term classification.

Before he has entered the university, nay before he
has entered the common school, the normal child
has learned to arrange the objects with which he is
brought daily into contact into groups, and to do
this on the basis of their observed likenesses and
unlikenesses. Whenever anyone groups objects to-
gether on the ground of their likenesses, and dis-
tinguishes between groups on the ground of their
differences, he is employing the method of classifi-
cation. Classification, therefore, may be defined as
the process of thinking together a number of objects
on the ground of their common attributes, and of
thinking apart groups of objects whose attributes
are different.

Classification and Definition. It will be seen that
classification, as thus defined, is closely related to
definition. Definition completes the process that is
begun in classification. Classification underlies the
defining process. This relationship will become evi-
dent if we recall that definition aims to place the
object whose meaning is not clear in a class with
other objects which share with it a common set of
attributes. When, therefore, we ask how we can
find the genus of any term we wish to define, the
answer will point us to the method of classification
which we are now studying. This is only another
way of saying, with a slightly different emphasis,
what was said in the last chapter, namely, that the
method of definition is based upon the comparison
of the object we are defining with other objects that
are in danger of being confused with it. Compar-

ison is common both to definition and to classifica-
tion. But we compare objects with each other in clas-
sification for the purpose of ascertaining their com-
mon attributes; in definition, we compare the ob-
jects of a class for the purpose of discovering the
differences which keep the sub-classes distinct. This
statement has important practical and philosophical
bearings. It enables us to see, for instance, how
groups of objects can be considered as a single ob-
ject, a fact that gives significance, as we have seen,
to the general concrete term. Whenever we over-
look the differences between the objects of which
a class is composed, and emphasise the points of
likeness by which each object retains its place in
the class, we have constituted of the class a distinct
kind of object. In such a class the individuals are
no longer important, there is no discernible differ-

ence between one and another ; they are, as Leibnitz
would say, identical. But if, for any reason, the
statements we make were dependent for their clear-
ness upon the differences in the class, we should
have to go beyond the method of classification by
which our classes are constituted, and we should be
forced, as we have pointed out, to adopt the method
of definition. In classification, we are interested in
the likenesses, in definition, in the differences of
objects.

Classification and Division. Whenever we are in
danger of overlooking the distinctions that exist
within a genus, whenever, that is, we are in danger
of making ambiguous statements through our fail-

ure to keep in mind the whole denotation of a term,
there exists a situation that may be relieved by the
employment of the method of division. The starting
point of a logical division is the genus, the whole
which is possessed of a number of common qualities ;
and the purpose of division is to mark out within
the genus the species which realise, in different
ways, these common qualities. The movement of
thought is downward from the more general to the
less general. If now we consider the characteristics
of a classification, we shall find that they are the
reverse of this. The situation in which we feel
obliged to classify is one in which we are in danger
of failing to observe the likenesses of objects on
account of the prominence that their individual
attributes have come to assume. Popularly ex-
pressed, we are exposed to the danger of "missing
the wood for the trees." The starting point of all
classification, therefore, is the particular, the objects
which are kept distinct and apart on account of
their differences ; and the purpose that classification
is intended to serve is to detect within these differ-
ences certain relatively permanent groups of qual-
ities. Our most available method for doing this is
comparison; but that in respect of which the com-
parison is made is determined by the interest that
our classification is to promote. For instance, we
may classify objects with respect to their use or
with respect to their sense-attributes. It is the
character of our interest in things that determines
which of these principles of classification we choose ;

but, in any case, the movement of thought in class-
ification is upward from the particular to the gen-
eral. Classification is the beginning of a process
that we shall study more in detail when we come to
the problem of induction.

Kinds of Classification. It has been customary
to distinguish two kinds of classification, the arti-

ficial and the natural. By an artificial classification
is usually meant one in which the grouping of ob-
jects takes place on the ground of their possessing
some attribute or group of attributes which does not
serve as the basis of any further statement about
these objects. We may, for example, classify cer-
tain objects of domestic furniture as chairs; but
having done so, we are not able, on that basis, to
predicate anything further of the objects to which
the name chair is given. By a natural classification
is generally meant one that groups objects on the
ground of their possessing an attribute, or group of
attributes, which serves as the basis of further pred-
ication. For example, if we classify a group of ani-
mals as mammals, we are able to say, by virtue of
the fact that they are mammals, that they are also
vertebrates. This view has received, among modern
writers, a classic expression by Mill. It is based
upon the supposition that there exist in nature
classes of objects which are distinct from each other,
and that if we make the differences of these classes
the basis of our classification, we shall thereby mark
off the 'natural kinds' from others which by way of
contrast may be called artificial kinds.

Since the spread of the doctrine of evolution, it
is no longer possible to maintain, in all fields of
knowledge, the distinction of natural and artificial
kinds. We no longer think of species of animals,
for example, as marking fixed and distinct differ-
ences between groups of objects; we have to think,
according to the doctrine of evolution, of the whole
animal series, from amoeba to man, as having
sprung from a common ancestor. Species are not,
in the meaning of the distinction we are now con-
sidering, separate and distinct kinds.

But while we no longer find it possible to classify
objects in the way just considered, the distinction
between natural and artificial suggests a truth of
which we may take advantage in our discussion of
this topic. The fallacy that underlies the separation
of classes into natural and artificial seems to be,
from the logictl standpoint, that it denies that rele-
vancy to purpose is a factor in all classification. The
classification of objects, for example, as natural is
based on the supposition that the attributes of spe-
cies are determined wholly by the nature of the ob-
jects themselves, and that they are in no way and to
no extent determined by the interest which prompts
us to classify; while the classification of objects as
artificial is predominantly, if not wholly, determined
by the interest that controls the classification. This
can not be maintained. For, as we have seen, knowl-
edge is always the product of both kinds of factors,
of both subjective purpose and objective fact. And
it is this analysis of what we mean by knowledge

that gives us the clue to the distinction of natural
and artificial kinds, and which enables us to under-
stand the two main kinds of classification. Our
classification does not depend upon the presence or
absence of interest, but upon the particular kind of
interest which we seek to satisfy. We may be in-
terested, for example, in grouping objects according
to their essential attributes, that is, according to
the attributes which constitute them members of a
class. We may also be interested in grouping ob-
jects according to their non-essential attributes,
that is, according to the attributes which are either
implied by their essential attributes, or which are
only accidental ones. In view of our discussion of
the Predicables, this statement means that we may
make the qualities which characterise the genus the
principle of classification; or the qualities which
characterise the proprium, or the accidens, the basis
of classification.

Classification according to the essential attri-
butes of the objects compared gives a theoretical
classification; and classification according to the
non-essential attributes, a practical classification.
In the former case, the theoretical interests which
prompt us to study the nature of things are upper-
most ; and in the latter, the practical interests wkich
are concerned with the uses of things are in control.
To take an illustration usually found in text-books
of logic, the Swedish botanist, Karl Linnaeus (1707-
1778), based his classification of plants upon the
comparison of the sexual organs of plants. The

distinct advantage of this method was that it made
possible the indexing of plants in a convenient way
into genera and species so that their relative posi-
tion to each other in a series could be made out.
This must be taken not as a theoretical, but as a
practical classification, and, in principle, is not differ-
ent from the arrangement of words in a dictionary
in their alphabetical order. If, on the other hand,
we make a classification according to the natural
relationships of the species, we shall have an illus-
tration of a theoretical classification. It will be
obvious that many variations are possible within
these two divisions ; but for the details, the student
is referred to the larger books on logic and the
principles of science.

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QUESTIONS

1. In what way is logical division related to logical defini-
tion?

2. Name one way in which logical division may not be in-
terpreted.

3. Explain: By division we analyse the denotation of a
term's meaning.

4. What is meant by saying that the species enumerated
in a logical division are to be read disjunctively?

5. What is the test of a logical division?

6. What is a metaphysical division, and how does it differ
from a logical division?

7. What do you understand by a physical division? Illus-
trate.

8. What is a verbal division?

9. Define a fundamentum divisionis.

10. Explain how one discovers for a particular division an
appropriate fundamentum divisionis.

11. In what respects can a logical definition be improved
from the standpoint of logical division?

12. Explain the following terms: genus, species, totum di-
visum, summum genus, infirmae species, subaltern
genera, proximate genus, constituent species.

13. What is the first rule of logical division?

14. What is a cross division? Explain how it occurs.

15. What is meant by saying that the species to which a logical division gives rise must be exclusive?

16. What are the character and importance of a continuous series?

17. How can we keep within a single fundamentum when our division is carried through a number of stages?

18. State and explain the second rule of logical division.

19. What difficulties in the method of logical division are supposed to be met by dichotomy?

20. What are the characteristics of a dichotomous division?

21. What is the relation of dichotomy to definition?

22. What advantages are sometimes claimed for a dichotomous division?

23. What is the Tree of Porphyry?

24. What do you understand by contradictory opposites?

25. Explain absdssio infiniti.

26. What is classification?

27. How are classification and definition related?

26. What is the relation of classification and division?

29. State Mill's doctrine of classification.

30. Why has the distinction of natural and artificial kinds broken down?

31. What is the relation of purpose to classification, and what effect does this have upon the distinction of natural and artificial classification?

32. What bases of classification may be recognized as implicit in Mill's doctrine of classification?

33. Explain theoretical and practical classification.

EXERCISES

1. Divide logically the following terms, stating in each instance (a) the definition and (b) the fundamentum divisionis.

psychology gun culture

European student government

2. Examine the following divisions, and point out which rule of logical division, if any, is broken by them:

(1) Substances into material and spiritual.

(2) Books into scientific, philosophical, and literary.

(3) Religions into true and false.

(4) Students into those who are diligent, female, and

athletic.

3. What is the metaphysical division of the following terms?

landscape philosophy toy

capital child amusement

4. Divide physically six terms of your own selection.

5. Give six illustrations of verbal division.

6. Illustrate a cross division, and explain how it is brought about.

7. Give two examples of dichotomy.

8. Illustrate by two examples the Tree of Porphyry.

9. Give examples which illustrate the characteristics of (a) a theoretical and (b) a practical classification.

CHAPTER VIII

CATEGORICAL PROPOSITIONS

Types of Propositions. In a former chapter we saw that predication is the act of affirming or deny-ing something (P) of something else (S). Any statement which rests upon predication, that is, which affirms or denies something of something else, is called in logic a proposition. Predication may be of various degrees of directness or explicitness, ac-cording to the degree of our knowledge of the sub-ject of predication. For example, if my knowledge of natural history is only slight, I shall probably be able to say of a given animal merely that it is either a lion or a tiger or a leopard or something else. If a further study of animals makes me acquainted with the characteristics of the species lion, I shall then be able to say that if a given animal has these characteristics, it is a lion. If, again, the examina-tion of a particular animal showed that it does or does not have these distinguishing qualities, I should then be able to say that it is or is not a lion. The forms of predication illustrated in these instances

we have learned already to call alternative, hypo-
thetical, and categorically respectively. The state-
ments in which these forms of predication are ex-
pressed are called disjunctive, hypothetical and cate-
gorical propositions. The classification of proposi-
tons into disjunctive, hypothetical, and categorical

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CATEGORICAL PROPOSITIONS

is said to be made from the standpoint of relation, of
the relations, that is, that obtain between the ele-
ments that enter into the proposition. It is quite
obvious, for instance, that the predicate and subject
of each of the above propositions dealing with what,
under given conditions, can be predicated of a par-
ticular animal, are related in quite distinct ways.
The predicate term is asserted differently in each
case, and it is this difference in our manner of
asserting that lies at the foundation of the distinc-
tion we make between disjunctive, hypothetical, and
categorical propositions. The form of assertion
corresponds to a real element in the knowledge that
an assertion claims. We have shown this in detail
in the chapter on propositions. Our present task
is to study the various kinds of propositions and the
logical problems to which they give rise. In the
present chapter, we shall consider a number of ques-
tions which relate to simple predication and which
throw light upon the nature of categorical state-
ments ; in the next, we shall consider problems con-
nected with the other forms of the proposition.

Classification of Categorical Propositions. The
possibility of a classification of categorical proposi-
tions, that is, propositions which predicate P of S
simply, rests upon the fact that unconditional state-
ments (1) do not always, but sometimes do, apply
to a determinate part of the subject-matter of such
statements; or (2) do not always, but sometimes do,
unite the predicate with the subject of such state-
ments; or (3) do not always express the same de-

gree of certainty. We shall illustrate each of these
cases in the order in which they have been named.
As an illustration of the first case, where the state-
ment applies to an indeterminate part of the subject-
matter of the statement, let us take 'Not all men are
honest who say they are.' This is a proposition in
which honesty is predicated of some only of the men
who declare their honesty. As an illustration of the
second case, where the statement does not unite the
predicate with the subject of the proposition, let us
take the illustration just used and observe that hon-
esty is denied of some of the individuals who assure
us that they are honest. As an illustration of the
third case, where our statements express different

degrees of certainty, let us take the following : 'He may be honest though poor;' 'He is honest but poor;' 'He must be honest.'

The three characteristics of propositions just mentioned and illustrated are so constant, and they occur in such a wide range of our knowledge, that early in the history of logic it was found necessary to distinguish them by the use of technical terms, that is, by terms which mean, whenever they are used, just these characteristics of propositions. Thus, when we wish to call attention to the fact that our statements do or do not apply to a determinate part of the subject-matter of the proposition, we are said to be dealing with the proposition from the standpoint of its Quantity. When, on the other hand, we wish to emphasise the fact that the predicate does or does not belong to the subject, we are

said to be dealing with the proposition from the standpoint of its Quality. When, thirdly, we wish to distinguish the degree of certainty that attaches to our statements, we are said to be dealing with the proposition from the standpoint of its Modality. If to this statement we now add what was said in the first paragraph of the present chapter about the degrees of explicitness in predication being made from the standpoint of Relation, we have before us the four ways in which propositions may be classified. We shall now write down, for reference, the classification of propositions when looked at from each of the above-mentioned points of view.

RELATION

Categorical

Hypothetical

Disjunctive

QUANTITY QUALITY

Singular Affirmative

Universal Negative

Particular
Indesignate

MODALITY

Assertoric
Necessary
Problematical

Quantity of Propositions. The problem of the quantity of propositions is one which is concerned with the question whether we intend our statements to be true of a determinate or indeterminate part

of the subject-matter of such statements. It is, for

example, quite clear that when any one says, 'I have
seen Paris/ he is ordinarily understood to mean that
he has been to Paris, and visited some of its im-
portant boulevards, churches, galleries, etc. No one
would understand him to mean that he had become
acquainted with the whole of Paris. The truth of
the claim to have seen Paris would be that some
unspecified parts of Paris had been visited. Again,
no one who made the above statement would ordi-
narily wish to be understood that he had a thorough
acquaintance with those parts of Paris which had
come under his observation. The statement is in-
tended to claim an acquaintance, such as it is, with
certain parts of the French capital. From these
considerations, it is quite evident that the statement,
'I have seen Paris/ leaves undetermined both the
range and the thoroughness of the observation that
is claimed by the statement. Now, although a great
number of the statements we make about even the
most familiar and ordinary events of life are, in the
sense of these illustrations, quite undetermined, we
sometimes make statements which we intend to be
understood with no such limitation. To take a sim-
ple illustration, if one were asked, 'What is the most
direct route from Chicago to London?' the answer,
if one were given, would claim to be determinately
true of the subject of the inquiry, either of a speci-
fied part of the inquiry or of the whole of it. For
instance, the reply might take this form, 'Go by way
of the New York Central lines to New York, and
then inquire/ or it might take this form, 'Go to

New York, and then take passage with the Cunard
Line to London via Liverpool/ Let us take another
illustration. A mathematical problem is an inquiry
of a definite kind, and we may work the problem
up to a certain point quite sure that all the steps
we have taken lead us toward the true solution of
the whole problem. We may or we may not be able
to proceed beyond that point. The fact that we can-
not, does not invalidate the claim that we may make
of having solved a definite part of the problem. That
is to say, if the answers we make to questions, and
the statements in which we express our knowledge
contain in them a distinct reference to the extent
of the subject covered by such answers and state-
ments, they are called determinate whether th
whole or some definite part of the whole subject has
been considered.

We have seen that statements may be deter-
minate or indeterminate in what they assert. Our

thought, that is to say, may refer to a definitely
specified area of a given subject, or it may refer to
an indefinitely specified area. In the former case,
the definitely specified area may be either the whole,
or an indicated part of the whole. In the latter case,
we cannot tell whether the knowledge expressed in
the statement is true of the whole or of only a part
of the whole. Now these distinctions in the ordinary
use of language lie at the foundation of the logical
consideration of propositions from the standpoint of
quantity. Hence, the question of the quantity of
propositions is whether what a statement connotes

is true of a specified or unspecified part of what its
subject denotes. When, consequently, we speak
about the quantity of a proposition, we must be
understood to be interested in the meaning of a state-
ment from the standpoint of the number of the ob-
jects to which the statement applies. It is obvious
that the subject terms of all propositions which ex-
press quantity must be read in denotation.

If now we ask, To how many objects can we in-
tend our statements to apply? we may answer to
one, to more than one but less than all, and to all.
These are all the possible cases, and they afford a
clue to the classification of propositions from the
standpoint of quantity.

The Singular Proposition. When a statement is
made of one specified individual, that statement, in
logic, is said to be a singular proposition. 'Hannibal
was a great Carthagenian general' is, in this sense,
a singular proposition. It is a proposition that ex-
presses what an examination of a single instance of
the genus 'general' has led us to affirm. This is not
an exceptional case, for we are frequently led, in
the course of our experience, to examine single ob-
jects and to attempt some classification of them.
The child's questions, 'What is this?' 'Who made
that?' and the like are illustrations of the impor-
tance of this class of judgments in the progress of
intelligence and the advancement of knowledge.
Singular statements are concrete, or keep us in close
connection with what is concrete, and for this reason
are of great help in making exact, particular, and

precise the knowledge that, in one way and another,
we are daily acquiring. The examination of indi-
vidual objects is, also, a large part of the work of
any science, and much of the knowledge that science
has consists of the singular judgments it is able to
assert. We may say in passing that the student's
danger is that he will get away from the observation
of particular things, and that his education will
force him to premature generalisation in which a

form of words is substituted for a face to face acquaintance with the facts of his special subjects of study. If such should be the case, it is hardly possible that he will appreciate the importance of this type of proposition.

The Universal Proposition. Another class of propositions is met with when the subject terms of such propositions are general instead of individual. 'All democratic governments tend to issue in despotism' is a statement expressing a judgment that purports to be based upon the common character of the individuals that the general term signifies. Greek, French, British, American, etc., are the governments of which such a statement is held to be true, and yet not as Greek, French, etc., but as democratic. Statements of this kind are made because there is conceived to be a necessary connection between what the predicate and subject terms connote, and they apply to all individual or particular instances which possess the attributes of the subject term. In other words, whenever we affirm or deny of each of a total number of instances the meaning that attaches to

the predicate terms of propositions, we have what, in logic, is called a universal proposition.

Kinds of Universal Proposition. A question may arise as to whether there is any logical difference between a singular and a universal proposition, since in both cases, the subject term must be understood to be distributed, that is, to apply to the whole number of the instances that the connotation of the term implies. There can be no objection to taking these two cases as illustrating the same logical principle, namely, that from the standpoint of their quantity we intend our statements to apply to all the instances, whether to a specified one or to all, to which, in the nature of the proposition, the subject term can apply. The singular proposition may thus be taken as a particular form of the universal proposition. Another type of proposition which, like the singular proposition, has a concrete subject term, and which, on account of the definiteness of its denotation, has to be interpreted as a universal proposition may be considered in this connection. For example, in the proposition, 'A part is always less than the whole/ a part is a perfectly determined idea of quantity from the logical point of view, and the proposition in which it serves as a subject term must, therefore, be treated as a universal proposition.

The Particular Proposition. Whenever the number of instances denoted by the subject term oi; a proposition is, from the logical standpoint, undetermined, we are said to have a particular proposition. The question for us to bear in mind in decid-

ing the quantity of a proposition is simply whether
the number of instances of the kind connoted by the
subject term is a determined number or not. For
example, if we say that 'Five per cent of all college
students fail in their work,' it is clearly not meant
that we know the exact number of college students,
and therefore that we know the exact number who
fail ; the statement, if it is true, must be based upon
the examination of large numbers of students work-
ing under a great variety of conditions, and, when
so based, we feel warranted in saying, even with
respect to those students who have not had an oppor-
tunity to pass or to fail in any subject, that in the
period covered by their college course five per cent
of these will fail. Now what we wish to illustrate
by this example is that the statement is a universal
one because, although arithmetically we have no
idea of the number of failing students, we do have
in the subject term of our proposition, 'five per cent
of all college students,' an idea logically determined
from the standpoint of its quantity. 'Five per cent'
is just as definite as 'this one* of a given number,
and both are as definite as 'all' of the given number.
But if, on the contrary, in the absence of all knowl-
edge of any such statistical study as we have sup-
posed, we were required to express our judgment
as to the number of failures likely to be incurred
at any given time, we could not logically go beyond
the statement that 'Some students will fail in their
work.' This statement is true of an undetermined
number of students, and 'some,' as a sign of quantity

in propositions, means this. The propositions that
express judgments that have not determined the
quantity of their subject-matter are called particular
propositions.

The Indesignate Proposition. Whenever we ex-
press judgments of quantity, our statements, as a
rule, bear upon their face some definite indication
of the extent of their subject terms. From the
standpoint of quantity, all our statements are offered
as true of a number of determined or undetermined
individuals, and when a statement is made without
specifying which of these two possibilities is meant,
we are left in doubt as to how the statement is to
be taken. Now sometimes this occurs. The popular
wisdom of an age which gets itself hardened into
groyerbs is frequently defective in this respect.
'Dead men tell no tales,' is an illustration in point.
Are we to understand this of all dead men or only
of some dead men? Is there, that is, a necessary
connection between being dead and being unable to
appear as a witness in a trial, for example; or are
we to suppose that there is only an accidental con-
nection between them, and that in some cases the
testimony of dead men is admissible? 'Virtue is to
be rewarded/ is a proposition that is defective in

the same respect. Are we to understand this of each
and all the virtues, of the ordinary virtues of our
daily life as well as of the more heroic virtues that
are called out in exceptional circumstances; or are
we to limit the statement to the latter class of cases ?
If the latter, then the same set of questions recurs,

and we should wish to know whether a reward must
be attached to all of them or to only some of them.
These illustrations are sufficient to indicate a kind
of statement we sometimes meet with even in com-
mon life, statements that are quantitative by impli-
cation but are not explicitly so. How are we to
deal with them logically? Our first inclination is to
receive all such statements, according to the charac-
ter of their subject-matter, as universal or par-
ticular propositions. But if it is remembered that
all propositions are expressions of the judgments of
the person who states the proposition, and that they
are, from the standpoint of the person who hears
them, proposals for his acceptance or rejection in
the sense in which they are made, it will be obvious
that we are not allowed to interpret these statements
in any sense we wish ; our business is to understand
them in the sense they have for the person who
makes them. But, as we saw, these propositions
create a doubt that is based upon the possibility of
understanding the statements in either of two ways.
Whenever a statement raises a doubt of this kind,
a doubt that may be resolved by accepting either
the one or the other of alternative possibilities,
without indicating which alternative is to be
adopted, it is called an indesignate proposition. An
indesignate, or as it is sometimes called, an indefinite
proposition is one which implies the existence of a
determined or undetermined number of individuals
of which the statement is offered as true, but which
fails to state explicitly whether it is made of the

number of the determined or of the undetermined
instances.

Quality of Propositions. Our study in a previous
chapter has shown that terms always intend more
than they express, that they are aspects of a whole
meaning which as terms they do not fully bring out.
We have also learned that in order to get at the
full meaning of any term we must find it functioning
in some way in a proposition. It is only in a prop-
osition that we discover the full meaning of a term ;
the proposition is the express statement of the whole
meaning within which the meanings of terms may
properly be sought. In other words, it is the way
that terms function in propositions that gives the
key to the meaning of the proposition and of the
terms themselves. That is to say, we have to inter-

pret terms from the standpoint of their propositions
and proposition from the standpoint of their terms.
The reason is that each implies the other, and
neither can exist alone.

Coming now to the particular problem of this
section, we may see, in the light of what has just
been said, that terms may be related to one another
in propositions in one or the other of two ways, in
the way of inclusion or of exclusion. The fact that
terms are elements of the meaning expressed by the
proposition, is indicated, as we have already seen,
by the copula. The copula, we said, is the sign of
predication, the sign that S and P are to be taken
in the way required by the whole meaning expressed
in the proposition. One of the ways in which prop-

ositions require us to take their terms is, as we said,
with respect to whether they are inclusive or exclu-
sive of each other. And this requirement is indi-
cated by the copula, which according as it has or
has not the negative particle 'not,' distinguishes for
us the two kinds of Quality of prepositional state-
ments. When the terms are inclusive, this is indi-
cated by the copula 'is' or 'are;' when they are ex-
clusive, by the copula 'is not' or 'are not.' The
propositions that have respectively these two kinds
of copula are called affirmative and negative prop-
ositions. Affirmative and negative propositions,
therefore, are statements that give expression to
the inclusive and exclusive relationship of the terms
through which our meanings are expressed.

The Affirmative Proposition. Affirmative propo-
sitions, formally considered, are those in which the
copula is either 'is' or 'are.' From the standpoint
of the character of the thought expressed in them,
affirmative propositions may be defined as the ex-
pression of our positive meanings. By a positive
meaning we understand one which combines in a
whole content of thought two or more features of
the object thought about. Stated differently, a pos-
itive meaning is one that may be analysed into ele-
ments each of which expresses some feature of the
meaning which the proposition as a whole expresses.
For example, the meaning of the proposition, 'All
mammals are vertebrates' is, that there is a genus
which, when looked at from the standpoint of an-
atomy, must be described as a vertebrate, but which

if looked at from the standpoint of physiology must
be described as a mammal. Let us call the genus,
or the whole meaning of any proposition, SP. Then
our positive meaning, SP, may be analysed into S
and P, and these terms may be used to express the
intended meaning in the proposition 'S is P.' To

develop the significance of affirmative predication
further, we may say that in any statement of the
form 'S is P/ S and P are not isolated or independent
terms ; S is not merely S, nor is P merely P. What
the proposition affirms is that the S that is P is an
SP, and only because it is SP can we say that it is
P. But P can be predicated of S only if it also is
SP. SP underlies both terms, and gives to the mean-
ing that the proposition 'S is P' expresses its posi-
tive character.

The Negative Proposition. Negative proposi-
tions, formally considered, are those in which the
copula is either 'is not' or 'are not.' Materially, that
is, from the standpoint of the character of the
thought expressed in them, negative propositions
may be defined as the expression of our exclusive
meanings. By a negative meaning, therefore, we
understand one which excludes from a whole con-
tent of thought one or more attributes of the object
thought about, either because it does not at all, or
because it does not now, form part of the connotation
of the whole content of thought. Stated otherwise, a
negative meaning is one which may be analysed into
elements one or more of which is incompatible with
some fact or truth which we have already accepted.

In the chapter on terms we discussed negative
meaning, and the conditions under which such mean-
ings arise were explained. These conditions can be
reviewed profitably in the present connection, and
they will be found to throw light upon the general
statement in the present parapragh of what we
understand a negative meaning to be.

We shall pass on to other aspects of the same
problem. We may call attention then to the fact
that the predicate terms of negative propositions
are to be read in connotation. The reason for this
is that logical negation expresses incompatibility in
the meanings of terms. For example, 'Apples are-
not pears/ does not express merely the perceptual
differences of the things we call apples and the things
we call pears ; what the proposition means is that if
we know what attributes pears have, they will be
found not to be the attributes which apples have.
Now, as we see by this illustration, the difficulty
about negative statements is that they seem to break
the connection that, as we said, must bind S and P
together in logical propositions. For example, we
have shown that, in order to make any statement of
the kind S-P, we have to suppose that P is predi-
cated of S on the ground of the common likeness that
underlies the differences of S and P. It is, in other
words, because S and P make a reference to the same
subject, although to different aspects of it, that pred-
ication can take place at all. Can we say that in neg-
ative propositions there is the same identity in dif-
ference that is the ground of every logical state-

ment? It would seem that we can; only the differ-
ences, in this case, have come in our thought to be a
special motive for the judgment we assert. In other
words, in affirmative propositions we express like-
nesses amid differences, while in negative proposi-
tions we express differences amid likenesses. The
negative proposition has this characteristic because,
by making difference the motive of our assertions,
we can sometimes best conserve the unity of idea
that every prepositional statement requires.

The Relation of Affirmative and Negative Prop-
ositions. A study of the relation of affirmative and
negative statements will throw still further light
upon the meaning of negation. In affirmative state-
ments, thought moves between two extremes, the
extreme of tautology on the one hand, and the ex-
treme of nonsense on the other. If we take affirma-
tion in one extreme way, we can only express iden-
tical meanings, 'A boy is a boy/ and this is taut-
ology. If we take affirmation in another extreme
way, we can only express incompatible meanings,
'A stove is a gold mine/ and this is nonsense. Now
it is the function of negation to save us from mean-
ingless tautological or nonsensical assertions.
For instance, the case of tautology, when taken
absolutely, is a denial of the minimum of difference
which must exist if we are to make our assertions
significant. Merely to predicate an object's exist-
ence of itself, or to affirm a meaning of itself, is
nothing but trifling. If we should mean by the

predicate only what we mean by the subject of a
proposition, we should state in the whole proposi-
tion no more than we stated in either of its terms.
Thus, 'A is A' has exactly the meaning of A, whether
A is read denotatively in both terms, or connota-
tively in both terms. If A is A is a significant state-
ment, we must at least read A denotatively in one
term, and connotatively in the other. In other
words, the identity which unites the subject and
predicate of logical propositions must not go to the
extreme of eliminating all differences from the
meaning which logical propositions state. The
affirmative proposition, because its chief interest
is in identity, is particularly open to the danger of
overlooking the differences that make the subject
and predicate of such propositions distinct terms.
Now, when this happens, when identity usurps the
whole functions of assertion, we can be saved from
the fatuity of tautology by resorting to negation as
the only means at our disposal for opening the way
to some significant statement. Thus, if we oppose
any tautology with a denial, the burden of the proof
of what we assert is thrust upon us, and this con-
sists in showing the grounds on which our negation

rests. For example, if we deny that 'A boy is a boy/
we may do so because, as we may point out, he is
also a son, and that this relationship is compatible
with the fact of boyhood from which, in the tauto-
logical statement, we were unable to get away.
Negation serves, in such a case, to prevent us from

standing intellectually stock-still; and, as we often
find, the denial of truism may sometimes be the
open way to the truth.

The other extreme to which affirmative judg-
ments may lead us consists in the development of
differences to such an extent that the unity of the
judgment is threatened or completely destroyed.
This may occur, for example, when the material of
the judgment is forced to render so many predicates
that the universe of discourse, which in all logical
judgment sets the limit to which differences can be
carried, is in danger of being superseded, and the
qualities which the material may have in other uni-
verses of discourse are brought in to satisfy the
demand for differences which has, so to say, got out
of hand. When, for example, the student of psy-
chology speaks of auditory sensations being brought
in over the auditory nerve, and when the text-books
of physiology speak about the striated muscles being
under the control of the will, there is a confusion
of universes of discourse, and we can only force the
statements within their respective bounds again by
a refusal to accept them as significant assertions.
The statements are incompatible with the body of
knowledge of their respective sciences, and the nega-
tion is in each case in the interests of this body of
accepted knowledge.

Exceptive and Exclusive Propositions. Whenever
a subject of discourse is qualified by such words as
except, only, but, unless, alone, none but, etc., it
immediately becomes uncertain to what, in such

cases, the predicate applies. For example, if we say,
'All free persons know how to obey,' it is quite ob-
vious that we are predicating 'the knowledge of how
to obey' of 'the persons who are free.' If, however,
we were to say 'None but the free know how to obey,'
we should be saying something quite different, al-
though most persons would understand that we were
still predicating 'the knowledge of how to obey' of
'the persons who are free.' If, again, we said, 'Only
the free know how to obey,' it might be asked
whether we had said something identical with one of
the other statements, or something different from
both. And, further, if we said, 'No one unless he is
free knows how to obey,' the problem would become
still more complicated.

In view of the difficulties of interpretation occa-
sioned by such statements as those to which atten-
tion has just been called, it is customary for logic
to point out that all propositions whose subject
terms are qualified by such words as except, only,
but, are either exceptive or exclusive propositions.
In the exceptive and the exclusive proposition the
subject term is an infinite or non-S term, because all
the qualifying words, except, but, only, etc., are
understood as carrying a negative signification.
Examples are : 'All except honor' = 'All that is not
honour;' 'None but the free' = 'No one who is not
free ;' 'Only natives' = 'No one who is not a native.'
It should be observed, moreover, that exceptive and
exclusive propositions are always universal, there
are no particular propositions of either kind. That

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is to say, the subject terms of these propositions
denote always a determinate number of individuals.
But while the exceptive and exclusive propositions
distribute their non-S terms, they differ from each
other in quality. That is to say, all propositions
which qualify their subjects in the manner indicated
are either affirmative or negative. In the light of
these statements we may consider these classes of
propositions separately.

The exceptive proposition is affirmative. It ha&

the genera] form, SaP. Examples are : 'All planets
except Venus and Mercury are beyond the earth's
orbit' = 'Any planet that is not Venus or Mercury
is beyond the earth's orbit;' 'All members but the
Irish voted for the measure' = 'All the members
who do not belong to the Irish party voted for the
measure/

In an exceptive proposition the individuals de-
noted by the subject term are determined by taking
out of a class a certain number of individuals to
which the predicate term is meant not to apply. It
will be seen that if the part of the class to which
the predicate term does apply is to be distributed,
the part taken out must be distributed also. What
an exceptive proposition says, therefore, is that a
statement is true of that part of a class which re-
mains when stated exceptions to it are definitely re-
moved. The truth of such a statement is maintained
of everything that cannot be brought under the ex-
ception, that is, of everything that is not the speci-
fied exception. Consequently, what we are talking

about, in an exceptive proposition, is anything,

within the universe of discourse, that is definitely
non-S. Thus, if a circle represents a universe of
discourse, and any shaded portion of it the excepted
part, which may be called S, the unshaded part will
then represent the denotation of the subject of
predication, that is, non-S. The exceptive proposi-
tion may in these terms be represented thus :

SaP

The exclusive proposition is negative. It has the
general form, SeP. Examples are : 'None but the
brave deserve the fair' = 'No one who is not brave
deserves the fair;' 'Only graduates are eligible' =
'No one who is not a graduate is eligible.'

The exclusive proposition determines its subject
term in the same way as the exceptive proposition,
that is, by taking out of a class some determinate
number of individuals, and making all other indi-
viduals of the class the subject of predication. Thus,
if S be the excluded individuals, non-S will be the
subject of which predication takes place. But since
exclusive propositions are negative, the individuals
denoted by non-S will necessarily have qualities
which are incompatible with their possessing those
connoted by the predicate term; incompatibility of
qualities is what we mean by negation. Hence, the

exclusive proposition definitely denies P of every
individual which does not have the qualities also of
S ; nothing that is not S is P. If, now, we represent
any excluded part of a class by the shaded portion
of a circle, the exclusive proposition may be shown
as follows:

SeP

Compound Propositions. We have said that ex-
ceptive and exclusive propositions are always uni-
versal. This is not because particular propositions
do not qualify their subject terms by such words as
only, except, etc., but because when they do, they
must be treated as compound propositions. By a
compound proposition, or, as the older logicians
called them, exponible propositions, is understood
one whose meaning requires a number of distinct
propositions for its complete expression. 'Milton
and Dante -wrote religious poetry of the highest
merit,' is a simple example. The meaning of the
statement obviously is, (a) 'Milton wrote religious
poetry of the highest merit,' and (b) 'Dante wrote
religious poetry of the highest merit.' A more com-
plex example is, 'Men who are honest though poor

will be respected and helped.' The whole sense of
this can be expressed in the two statements (a)
'Poor men who are honest will be respected,' and
(b) 'Poor men who are honest will be helped.' From

these examples we can see that a separate expres-
sion must be given to each significant idea of any
complex of ideas.

Bearing in mind what a compound proposition
is, let us turn to the particular propositions which
qualify their subject terms by the use of exclusive
words or phrases. These propositions, we have said,
are compound. An example is, 'Some only who en-
list will find their way to the firing line/ This
obviously cannot mean, 'Some who do not enlist will
find their way to the firing line;' that is, it cannot
be treated as a particular exclusive proposition.
What the statement means is (a) 'Some who enlist
will find their way to the firing line/ and (b) 'Some
who enlist will not find their way to the firing line.'
The following must also be treated as a compound
proposition, 'Excepting a few, all these answers are
wrong.' What the proposition states is (a) 'Some
of these answers are wrong,' and (b) 'Some of these
answers are not wrong.' From these examples it
seems obvious that whenever we qualify, in the way
indicated, the subject terms of particular proposi-
tions, that is, whenever 'some' is used in its exclusive
sense, the proposition must be resolved into two
independent particular propositions, the one affirm-
ative and the other negative. In the light of these
cases, we may also understand why the particular
proposition which has no such exclusive significance
must be interpreted as either affirmative or nega-
tive, and not as both. For instance, 'Not all for-
eigners are to be mistrusted' means 'Some foreigners

are not to be mistrusted;' and if any one were to
add to this interpretation, 'Some foreigners are to
be mistrusted/ he would be going beyond what is
said to a secondary implication of what is said. The
latter statement is doubtless implied in the original
statement, but it is not what that statement asserts.
Modality of Propositions. The knowledge we
have of different subjects, as we are all aware, varies
not only with respect to the nature of these subjects
themselves, so that one kind of knowledge we call
history, and another science, and another phil-
osophy, but also with respect to the degrees of our
attainments in any of these departments of knowl-
edge, so that we speak about these several subjects
with differing degrees of confidence. If, for ex-
ample, the student has diligently pursued the study
of bacteriology for a number of years he will not
only know a great deal about the nature and condi-

tions of the changes that microscopic organisms
produce in their hosts, but he will have developed,
with his increasing knowledge of the subject, a cer-
tain degree of confidence in his ability to describe
these changes, to prepare cultures, and to do many
things besides. If the same student has not given
a good deal of time to the study of history, he will
not feel the same degree of confidence that we ob-
served in the former case, if he were asked to name,
for instance, the causes that produced the French
Revolution. There are, then, different degrees of
knowledge, and these get reflected in the degrees of
confidence with which we express what we know. It

is this fact that logic refers to under the term Mo-
dality. The meaning of this statement may become
clearer if it is pointed out that the term modality
does not refer to any uncertainty that may exist
as to the nature and relations of the object of judg-
ment, but only to the degrees of certainty of our
knowledge of the object. Modality, that is to say, is
a logical distinction; it characterises our thoughts
about things, and not the things themselves. Whether
there is any uncertainty in things themselves can-
not be discussed in an elementary logic, but that
varying degrees of certainty and uncertainty attach
to our knowledge of things is a fact well known to
all.

It is usual, in logic, to distinguish three degrees
of certainty, and to throw these into typical preposi-
tional forms when we wish to express the modality
of our thought. The propositions which set forth
the modality of our judgments are called assertoric,
problematic and apodeictic. We may state what is
to be understood by each of these in order.

The Assertoric Proposition. An assertoric prop-
osition has the same form as the affirmative cate-
gorical proposition, and yet is not to be understood
in the same way. The categorical proposition ex-
presses the way that S and P are related in the uni-
verse of discourse that defines the limits of the judg-
ing activity, and, therefore, relates to the matter of
the judgment. The assertoric judgment, on the
other hand, expresses one of the degrees of certainty
of our knowledge about the subject-matter. For

example, if we were to say, 'All men are biped/ we
should most likely be understood to express a judg-
ment founded upon common observation, and that
is what the categorical proposition of the form,
*S is P,' usually does. If, however, with respect to
this judgment, we were asked, 'What makes you
think so?' we should possibly hunt around the var-
ious corners of our knowledge for a reason for think-

ing that walking on two feet is characteristic of all
men. If from such an excursion and search we
were to return without anything that threw light
upon the question, we should probably reply, 'I don't
know, but he is a biped.' We should, that is, assert
with emphasis our original statement, and thereby
express our confidence in the correctness of the
original statement. What, therefore, an assertoric
proposition does is to assert that S is actually P, or,
stated another way, that 'S is P' is actual, whether
any reason, other than perception or memory sup-
plies, can be given or not.

The Problematic Proposition. A problematic
proposition states that 'S is possibly P,' or the fact
expressed by 'S is P' is possible. The possibility
does not imply any uncertainty in the fact expressed,
but only an uncertainty in the state of our knowl-
edge about the fact, an uncertainty that makes it
impossible for us to state with any higher degree
of confidence the correctness of what we say. For
example, the student who is reading this section of
logic may say, 'My understanding of the subject is
possibly correct.' What he means by this is not

that his understanding may be described as possibly
correct, for there is no such thing as 'possibly cor-
rect,' but that the statement, 'My understanding of
this subject is correct' is a possibility in his own
case. If we take a simpler case this will become
clear. 'The rose is possibly white' does not mean
that 'possibly white' is the colour that the rose has,
for there is no such colour. We are to understand
the adverb to qualify not any part of the statement,
but the whole assertion 'The rose is white,' and
then, as in the other case, this statement expresses
a possibility.

If this is the view that we must adopt of prob-
lematic propositions, what, we may ask, is the
ground of the implied uncertainty? The uncertainty
is not due, as in assertoric propositions, to the fact
that there are no discoverable reasons for the state-
ment, but that the discovered grounds of the state-
ment are of such a nature that we can never be sure
that we have all the elements necessary to give our
statement any higher degree of certainty. To illus-
trate : the student's understanding of this paragraph
must, as we know, be correct or incorrect, just as the
rose must have any one or other of the colours that
belong to the species rose. If we have not seen the
rose in question, we know only that it is either red
or pink or white or yellow, and because it may be
something else than what we assert, we merely say
that it is possibly white. So in the case of the stu-
dent: his understanding is either correct or incor-
rect, but because the alternatives have not been de-

termined with respect to the case in hand, he can
only say that his understanding of the paragraph
is possibly correct. A possibility, therefore, means
the presence of alternatives between which no
ground of decision has as yet been found.

Judgments which involve human volition as one
of their factors, even when these judgments involve
no alternatives, are said to be problematic. For
example, 'I may go tomorrow,' means that 'I will
go tomorrow' is the statement of a fact that is pos-
sible. Here we have not a series of alternatives as
the ground of the uncertainty of the judgment, but
the absence of some of the factors that are neces-
sary for a more positive statement. All actions that
depend on human volition are said to be contingent,
and therefore a judgment that involves volition as
one of its factors must always be problematic.

The Apodeictic Proposition. Apodeictic judg-
ments are necessary : 'S must be P.' There exists,
in this case, necessary grounds for the matter of
fact judged. 'S is P' is necessary. Necessity is a
word that must be used carefully. This is obvious
if we call attention to the different kinds of neces-
sity upon which our apodeictic statements depend.
Mathematical statements, although not expressed in
the form of apodeictic propositions, are necessary.
For example, 'A straight line is the shortest dis-
tance between two points.' What the mathematician
understands by this statement is that the shortest
distance between two points must be what we mean
by a straight line. The idea of a straight line

carries that meaning necessarily. Here, then, we
have necessity ' resting upon the clearness with
which an idea itself is conceived or apprehended,
and not on anything else. Another class of neces-
sity is met with when our judgments rest upon
other judgments which may or may not be neces-
sary. For example, the equality of triangles on
equal bases and between the same parallels is a
case of necessity resting upon grounds that are
themselves necessary. In all truly apodeictic judg-
ments there is presumed to be an inter-connection
of fact that makes the fact asserted by the judg-
ment necessary.

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QUESTIONS

1. What is the ground of the difference between the three types of propositions?

2. Describe* the four main classes of categorical propositions.

3. Explain and illustrate what you understand by the quantity of propositions.

4. What is a singular proposition? Illustrate and state its importance.

5. What is a universal proposition?

6. What is the relation of the singular and universal proposition?

7. What is a particular proposition, and with what form of universal proposition is it most likely to be confused?

8. Describe and illustrate the indesignate proposition.

9. What do you understand by the quality of propositions?

10. What are the characteristics of affirmative propositions?

11. Describe and illustrate a negative proposition.

12. Why must the predicate of negative propositions be read connotatively?

13. What is the relation of tautology to affirmative statements?

14. In what way can tautological statements be overcome?

15. What is the logical status of nonsense?

16. In what respects are exceptive and exclusive proposi-
tions alike?

17. State and illustrate the characteristics of exceptive
propositions.

18. What is an exclusive proposition? Illustrate.

19. Why are there no particular exceptive or exclusive
propositions?

20. What is a compound proposition? By what other name
is it known? Illustrate.

21. Explain what is meant by the modality of propositions.

22. What is an assertoric proposition, and how does it
differ from the categorical proposition?

23. Explain and illustrate the problematic proposition.

24. How will you classify judgments which involve human
volition as one of its factors?

25. Describe and illustrate the apodeictic proposition.

EXERCISES.

1. Write in parallel columns a list of six singular and six
general propositions, and be ready to defend the as-
signed character of these propositions.

2. What kind of proposition is, 'Water is a liquid composed
of one part oxygen and two parts hydrogen.' Give rea-
sons for your answer.

3. What is the distribution of the predicate term of the
proposition in the preceding question?

4. Give three illustrations of indesignate propositions.

5. What kind of proposition is, 'Oxygen is necessary for
the maintenance of life'?

6. Without using the sign of quantity 'some,' give three
illustrations of particular propositions.

7. Classify the following propositions from the standpoint
of quantity, and in each case state the reason for your
classification :

(1) Each of the hunters shot a bird.

(2) Rivers generally run into the sea.

(3) Blood is thicker than water.

(4) Afflictions are often salutary.

(5) Can the leopard change his spots?

(6) Veteran soldiers are the steadiest in battle.

(7) Suspicion ever haunts the guilty mind.

(8) Knowledge is power.

(9) The longest road has an end.

(10) Almost any Turk hates a Greek.

(11) Philosophy and Psychology are necesary to a well-
rounded education.

(12) Only those who know are in the end to be trusted.

8. Illustrate how affirmative statements can be made either
tautological or nonsensical.

9. Write a complete account of how one negative state-
ment of your own selection may conceivably have come
to be made.

10. Write a list of three assertoric propositions, and show
how they differ from affirmative categorical proposi-
tions.

11. Explain the problematic nature of six propositions of
your own selection.

12. Write a list of three apodeictic propositions.

CHAPTER IX

IMPLICATIONS OF CATEGORICAL PROPOSITIONS

Relation of Quantity and Quality in Categorical
Propositions. When the subject term of a proposi-
tion is read in denotation, it refers to a determined
or undetermined number of individuals, and when
the predicate term of a proposition is read in conno-
tation, it either affirms or denies the meaning of the
predicate term of the individuals denoted by the
subject term. Now, since every proposition under-
takes to set forth both these relations of its subject-
matter, there are no propositions which do not pos-
sess both quantity and quality.

From the standpoint of their quantity, categor-
ical propositions, as we have seen, are either univer-
sal or particular; that is, logical statements are
always about a determinate or indeterminate part
of the subject-matter of such statements. From the
standpoint of their quality, categorical propositions
are either affirmative or negative; that is, logical

statements either affirm or deny an attribute of
some determinate or indeterminate part of their
subject. Combined in a single statement, these
facts and relations may be expressed thus : Propo-
sitions with distributed, as also those with undis-
tributed, subject terms are either affirmative or
negative in quality. There are thus four proposi-
tions, the universal affirmative, the universal neg-

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ative, the particular affirmative, the particular neg-
ative, whose relations may be shown in a table
as follows:

QUANTIT\ QUALITY

{a. Affirmative

b. Negative
Propositions ,

f a. Affirmative
Particular

[b. Negative

This table may be read: Propositions may be
universal in quantity and either affirmative or neg-
ative in quality ; or they may be particular in quan-
tity and either affirmative or negative in quality.

Structural Formulae indicating the Quantity and
Quality of Propositions. The problems that we are
to study in this chapter arise out of the fact that
propositions involve the relations both of quantity
and quality. Whatever else the student can or can-
not do with a proposition, it is of fundamental im-
portance that he should be able to determine it both
with respect to its quantity, and also with respect to
its quality. The student will find ic entirely possible
to acquire a considerable degree of facility in thus
determining the propositions that come before him
for study ; and, moreover, a little additional industry
in this matter will carry him a long way toward
overcoming some of the difficulties that he will meet
farther along the road. When he has become prac-
tically familiar with these distinctions, it will be a

great convenience if, for the propositions that em-
body these distinctions, he write formulae which
indicate their quantity and quality. The value of
such formulae is that they enable one to deal only
with the essential aspects of assertions, and they
shorten the method of referring to these essential
aspects. Like any other formulae, those used in

logic are more or less arbitrary devices, and are to
be justified by their usefulness. They are in no
sense a substitute for the logical facts and relations
which they are merely the means of expressing.

Our first aim then will be to distinguish by a
convenient symbol the four typical propositions
mentioned above. This is usually done by taking
the first vowel of the Latin word for affirmation
(affirmo), and the first vowel of the Latin word
for negation (nego) to denote the universal propo-
sition of the quality indicated by the word, and the
second vowel of each word in like manner to indi-
cate the respective particular propositions. Thus,
A and E, the first vowels in the words affirmo and
nego, are used to indicate the universal affirmative
and universal negative propositions respectively.
The second vowels in the same Latin words are I
and 0, and these are used to indicate respectively
the particular affirmative and particular negative
propositions. If, now, we add these facts to the
table printed above, we have the following result :

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QUANTITY QUALITY SYMBOL

f a. Affirmative A
1. Universal

[b. Negative E
Propositions -

{a. Affirmative I

b. Negative O

Whenever, in the foregoing pages, we have had
occasion to refer to the structure of a proposition
without respect to its quantity, we have written 'S
is P,' or 'S is-not P.' Whenever we have wished to
indicate the quantity as well as the quality of prop-
ositions, we have written 'All S is P,' 'No S is P,'
'Some S is P,' 'Some S is-not P.' This, however, is
too cumbersome a method when a simpler one is
possible. And, therefore, logicians have adopted
the device of substituting for the copula in proposi-
tions of the general form S-P, one or other of the
four vowels by which the four kinds of categorical
propositions are distinguished. In this way we get
the following structural formulae: SaP, SeP, SiP,
SoP, which are read 'All S is P/ 'No S is P,' 'Some
S is P/ 'Some S is-not P.'

The following table summarises the important
facts :

QUANTITY AND STRUCTURAL

QUALITY FORMULA READ

f 1. Universal Affirmative SaP All S is P

2. Universal Negative SeP No S is P
Propositions <j

13. Particulare Affirmative S&P Some S is,P

4. Particular Affirmative S$P Some

This table should be read : Propositions as to their
quantity and quality may be either universal affirm-
ative, with the structural formula SaP which
is read 'All S is P;' or universal negative, with
the structural formula SeP which is read 'No S is
P;' or particular affirmative, with the structural
formula SiP which is read 'Some S is P;' or par-
ticular negative with the structural formula SoP
which is read 'Some S is-not P.'

Distribution of the Terms of the Four Categorical
Propositions. The logical meaning of distribution has
been discussed in the chapter on terms, and we met
the same question again when considering the quan-
tity of propositions. We need, therefore, only repeat
what was shown more at length above, that by dis-
tribution is meant the width or extent of the mean-
ing expressed in a proposition. We have seen, for
example, that from the standpoint of quantity the
subject terms of universal propositions are dis-
tributed ; they denote a determinate number of indi-
viduals, each of which possesses, or does not possess,
in addition to the qualities connoted by the term
itself, those qualities also that are connoted by the
predicate term of such propositions. From the same
standpoint, the subject terms of particular proposi-
tions, on the other hand, are undistributed; they
refer to an indeterminate number of denoted indi-
viduals.

We have now to ask what influence the quality
of propositions has upon the distribution of pred-
icate terms. And first let us consider affirmative

propositions. In affirmative propositions we pred-
icate the attribute connoted by P of the object or
objects denoted by S. So far as they are affirmative,
propositions do not enable us to say whether there
are any objects, other than those denoted by the
subject term, to which the attributes of the pred-
icate term apply. Sometimes there are such objects ;
as, for example, The cat is a domesticated animal/
for, as we know, there are other domesticated ani-

mals than cats. Sometimes there are not, as, for
example, Terception is the consciousness of par-
ticular material objects present to sense/ for there
are no other objects to which such a description can
apply except perception. In view of these facts, it
is obvious that, from the form of the proposition, it
is quite impossible to determine whether universal
affirmative statements are to be understood in the
one or the other of the ways just indicated ; whether,
that is to say, they may be said to have distributed
or undistributed predicate terms. On account of
this uncertainty, it is customary, in the absence of
any reason connected with the subject matter to the
contrary, to regard the predicate terms of such
propositions as undistributed.

The predicate terms of negative propositions, on
the other hand, are distributed. The reason for this
is that it is only when every object which can be
included in the denotation of the predicate term is
excluded from the subject that the proposition can
have a negative force at all. For if all P's were
not definitely separated from the S, some P's might

be included in it, and this would not express the
meaning of negation. Negation, as we have seen,
has always a definitely exclusive force. And this is
true of negative propositions irrespective of their
quantity ; it is true of the particular as well as of the
universal negative proposition. Of the universal
proposition, SeP, this is easily seen to hold. For
if 'No S's are P's' has any meaning at all, it must
surely mean that not any of the S's are any of the
P's. That is to say, of none of the objects that have
the qualities connoted by S can we affirm that they
have also the qualities connoted by P. If that is
true, no P's are any of the S's. But the same thing
can be shown also of the particular proposition, SoP.
'Some S's are-not P's' must mean that none of the
objects denoted by S has the qualities connoted by
P ; and that is equivalent to saying that none of these
S's are at the same time P's. The objects denoted
by P, if there are any, are entirely excluded from
the number of objects referred to by S. If, in this
case, any difficulty arises on account of the un-
distributed nature of the subject term, we can only
say that the meaning of the proposition is that there
are at least some unspecified instances of S's that do
not have the characteristics of P; and that if, as
may or may not happen, you discover any S's that
do have these characteristics, then they are not the
S's to which the proposition refers. It follows,
from these considerations, that the predicate terms
of all negative propositions are distributed.

We may summarise the foregoing discussion in
the four following statements:

1. The subject terms of propositions that are
universal in quantity are distributed.

2. The subject terms of propositions that are
particular in quantity are undistributed.

3. The predicate terms of propositions that are
affirmative in quality are undistributed.

4. The predicate terms of propositions that are
negative in quality are distributed.

Thorough familiarity with the distribution of
the terms of categorical propositions is so essential
to the student's understanding of what follows that
he is urged to master the subject at this point of his
studies. Because of the importance of the subject,
and as a further aid to its mastery, we add the fol-
lowing tables each of which represents the facts
contained in the foregoing summary. The letters
D and U stand for distributed and undistributed
respectively :

PROPOSITION

STANDPOINT

Quantity

f
SUBJECT

D

a

>

PREDICATE

U

D

e

D

U

i

U

U

D

STANDPOINT

Quality

This table may be read as follows : From the stand-
point of quantity, the subject term of an A or uni-

versal affirmative proposition is distributed; from
the standpoint of quality, the predicate term of an
A or universal affirmative proposition is undistrib-
uted, etc.

Another way of stating the same set of facts is
to say that the subject terms of propositions that
are universal in quantity are distributed, and those
that are particular in quantity are undistributed;
that the predicate terms of propositions that are
affirmative in quality are undistributed, and those
that are negative in quality are distributed. The
following table represents these facts :

QUANTITY DISTRIBUTION

(Universal D

Subject terms J

[Particular ^U

QUALITY DISTRIBUTION

f Affirmative U

Predicate terms 1

[Negative D

Meaning and Classes of Implication. The group
of topics that are now to be discussed, and to which
the preceding pages are an introduction, is by some
writers brought together under the title of 'imme-
diate inferences/ and by others under the title 'in-
terpretation of propositions/ The objection that is
usually urged against 'immediate inferences' is that
an inference always involves the use of a middle
term, and is therefore mediate; and, consequently,

that it is a contradiction to speak of 'immediate' in-
ferences. The objection that may be brought
against 'interpretation of propositions' is that it
tends to confuse two different things, namely, the
import or meaning of propositions, and the question
of what other statements we are committed to in
making any statement whatever. We shall speak
of the 'implications of propositions,' since the ques-
tions that are to be considered in this chapter relate
to the various methods of determining the relations
that exist between our formally expressed proposi-
tions, and other unexpressed propositions with
which they are immediately connected. Implication
etymologically means 'folded-in,' so that the idea
the topic suggests is that folded within any state-
ment we make there are other statements that may
be brought to light by the use of appropriate meth-
ods. The practical value of this chapter consists in
the opportunity it affords of finding out that our
statements ordinarily mean much more than we
actually express in them.

We have to consider two main classes of impli-
cations :

(1) The Opposition of Propositions. By op-
position of propositions is meant the relation that
the truth or falsity of one proposition has to the
truth or falsity of other propositions dealing with
the same subject-matter, that is, having the same
subject and predicate.

(2) Eductions. By eductions is meant the
relation that one proposition accepted as true has

to other propositions dealing with the same subject-
matter from other points of view.

The Opposition of Propositions. The term oppo-
sition applied to propositions would strictly mean
that propositions could stand in this relation only
when the truth of the one involved the falsity of

the other, and vice versa. This was the original
meaning and use of the term in logic. But it was
found convenient to include under the same title a
consideration of propositions that are not incompat-
ible with one another. Opposition, as it is now used,
embraces, therefore, a study of the relations of any
two propositions referring to the same subject-
matter whether the truth expressed by one is or is
not compatible with that expressed by the other.
Thus, propositions relating to the same subject, but
differing in quantity, or quality, or both, are said
to be opposed to each other.

Since there are only four categorical proposi-
tions, it is evident that each stands in relation to
three others. Thus:

SaP is related to SeP, SiP, SoP.

SeP is related to SaP, SiP, SoP.

SiP is related to SaP, SeP, SoP.

SoP is related to SaP, SeP, SiP.

If we examine this list of possible oppositions,
we shall see that each proposition is related to (1)
a universal proposition, (2) a particular proposi-
tion, (3) an affirmative proposition, (4) a negative
proposition. In other words, all propositions are
related to others (1) of the same and (2) different

quantity, and (3) of the same and (4) different
quality. There are, consequently, four kinds of
opposition in which any proposition may stand.
Thus, the relation between

1. Universal propositions of different quality
is said to be one of contrariety : SaP, SeP.

2. Universal and particular propositions of the
same quality is said to be one of subalternation :
SaP, SiP; SeP, SoP.

3. Universal and particular propositions of dif-
ferent quality is said to be one of contradiction:
SaP, SoP; SeP, SiP.

4. Particular propositions is said to be one of
subcontrariety : SiP, SoP.

We shall consider each of these kinds of opposi-
tion in the order in which they have been named;
and since any statement we make may be either true
or false, we shall have to examine the propositions
that stand in opposition on the supposition both of
their truth and falsity.

Contrariety. Contrary opposition exists between
universal propositions of a different quality; that

is, between SaP and SeP. Thus, contrary proposi-
tions differ in quality only.

If what any universal proposition states is true,
what its contrary states must be false. For example,
if it is true that 'All men die/ it is false that 'No
men die.' If it is true that 'No men are angels,' it
is false that 'All men are angels.' If, therefore, we
accept the truth of what either SaP or SeP states,
the falsity of what its contrary states follows as a

matter of course, for the reason that the same pred-
icates or qualities cannot belong, and not belong, to
the same subject. On the other hand, if what any
universal proposition states is false, what its con-
trary states is left in doubt. If, for example, it is
false that 'All men are six feet tall,' we are left in
doubt as to whether 'No men are six feet tall,' be-
cause some men may be.

Let us connect these facts with what we have
already learned. We saw, in the chapter on terms,
that if two species of a genus differ from one an-
other more than they do from any of the other co-
ordinate species, the relation in which they stand is
one of contrariety. If, for example, within the genus
G the species S have the characteristic P, then how-
ever great and numerous the increasing differences
between one species and another, they cannot be so
great and numerous that, within the genus, P can
be denied of any of the species. Based upon the
degree of their variation from the genus, all the
species, as we have seen, have a recognised place
within the genus. But whatever the variations that
occur, the species are held together by their common
likeness, and so long as predication is concerned
with this common likeness, so long can we not en-
tertain any proposition which denies it of any or of
all the species of the genus. If SaP is true, the
proposition that denies that S is P, SeP, must be
false, and vice versa.

Let us look at the other case where something
is falsely predicated of all the species. Now what is

thus predicated cannot be the genus, for the genus
can only be predicated truly. If anything is falsely
predicated, it must be something that is either an-
other genus, when the statement would be abso-
lutely false, or something that is or may be a differ-
entia, when the statement will be partially false.
If, for example, 'All flesh is grass' were to be inter-
preted literally, the statement would be false, be-
cause it predicates a genus that is wholly mislead-
ing; and if one were to say that 'All vertebrates
live in the water,' that would be false, because it

predicates what is or may be a differentia, some-
thing that belongs to one of the species though not
to all of them. In order to detect the falsity in these
instances, we must know that what is predicated is
either a wrong genus or a differentia, and this is not
possible without going beyond what is given in a false
statement. Hence, if all we know is that P is
wrongly predicated of S, we cannot say whether P
belongs in part or not at all to S, and, therefore, can-
not infer the truth of the contrary of the original
proposition. The contrary of a false universal, that
is to say, is involved in doubt.

Again, the relations of contrary propositions
may be studied from the side of the denotation
of their terms. Thus, it cannot be true that 'All'
and 'None' of the objects denoted by the subject
term of a proposition have the qualities connoted
by the predicate term ; the truth of the one excludes
the truth of the other. That the falsity of one prop-
osition involves its contrary in doubt may be shown

as follows: If some of the objects denoted by the
predicate term of an affirmative proposition, and
none of the objects denoted by the same term in a
negative proposition, belong to the group of objects
denoted alike by the subject terms of these proposi-
tions, then it is obvious that in the one case P falls
partly within, and in the other wholly without, the
group of objects denoted by the subject terms of
the two propositions. If, now, we make the state-
ment falsely that 'All S falls within P without ex-
hausting it/ we connot affirm truly the contrary of
this statement, 'No S falls within P/ because there
is another alternative to the one offered by the con-
trary, namely, the case where S falls partly within
and partly without the class of objects denoted by
P; and which of these two cases is true cannot be
determined without examining the cases themselves.
Representing these facts diagrammatically thus :

we must say that if SaP is false, SeP cannot be
true without disposing of the alternative case SiP.
But this cannot be done formally, but only by an
examination of the subject-matter of these propo-
sitions.

Subalternation. Subaltern opposition exists be-
tween a universal and a particular proposition of
the same quality; that is, between SaP and SiP;

SeP and SoP. Thus, subaltern propositions differ
in quantity only.

If what the universal proposition states is true,
what its subaltern states is also true. This follows
from the fact that universal propositions distribute
their subject terms. Thus, if something is true or
false, as the universal states, of each of a class of
objects, it is true or false of any number of them,
since these must be identical with some of the for-
mer. The truth, therefore, of the particular is in-
volved in the truth of the universal proposition.
Hence, as may be seen by studying the accompany-
ing diagram, if any part of the S that falls wholly

SaP SiP SeP SoP

within P, (SaP), or wholly without P, (SeP), were
to fall partly without or partly within P, some part
of S would, in the one case, fall partly within (SiP) ,
and, in the other, partly without (SoP) P, and it is
of these parts that the statements of the respective
subaltern propositions is made.

On the other hand, if what the universal proposi-
tion states is false, what its subaltern states is left
in doubt. The truth of the particular is not involved
in the falsity of the universal, and cannot, there-
fore, be the ground of the latter's falsity. But, as
we shall see, it may be. We have studied already
one ground of falsity of universal statements. We

have seen, for example, that when the contrary of
any proposition is true, that proposition is abso-
lutely false. But we have also seen that if we start
with the falsity of a universal statement, nothing
can be affirmed as to the truth or falsity of its con-
trary. Now, in contrast to the falsity involved in
the contrary relation, that involved in the subaltern
relation is only relative, that is, the falsity may be
due not to the fact that S-P asserts something con-
trary to fact, but that it is asserted without regard
to existing limitations. In other words, since there
are degrees of error, as well as of truth, SaP and
SeP may owe their falsity to the fact that only SiP
and SoP are true respectively. But, here again, if
we start with the falsity of the universal, we cannot
say that its subaltern is true or false; truth or
falsity, in this case, simply remain possible alter-
natives between which we can decide only by going
outside wha't is given in the original proposition.
And this is equivalent to saying that the subaltern
is always involved in doubt when all that we know
is that the universal or subalternans is false.

What we have seen is that the truth of a univer-
sal involves the truth of its subaltern ; but that the

falsity of a universal involves its subaltern in doubt.

Let us now consider how the universal is affected
by the truth or falsity of its particular, subaltern,
proposition. And, first, let us take the case where
the subaltern is true. If the only thing we know
about a group of objects is that some of them are
in a particular place, it is obvious that we cannot

say that they are all in that place; and the reason
is not that some are in another place, for that ex-
ceeds the knowledge contained in the original prop-
osition, but that some may be. For a similar reason,
we cannot affirm that 'No trees are in leaf/ if all
that we know is that 'Some trees are-not in leaf/
From the truth of a particular proposition, there-
fore, we can only conclude that its subalternans the
universal of the same quality is doubtful. Let
us take, secondly, the case where the subaltern is
false. Here the falsity of the subaltern involves
the falsity of the subalternans. Thus, if 'Some apples
are blue' is false, it is likewise false that 'All apples
are blue/ and if 'Some apples are-not red' is false,
it is likewise false that 'No apples are red/ The
reason for this case is found in the fact that par-
ticular propositions affirm or deny a predicate of
certain unspecified objects of a class, and not of the
class as a whole. If, therefore, we know that a
statement is false in some case, we know that it
cannot be true of all cases, since all cases must in-
clude the case in which it is known to be false.
Falsus in uno, falsus in omnibus. We are dealing
here with the exception under which a rule breaks
down.

Contradiction. Contradictory opposition exists
between a universal and a particular proposition
that differ from each other in quality; that is, be-
tween SaP and SoP, SeP and SiP. Thus, contradic-
tory propositions differ both in quantity and quality.

If what any universal proposition states is true,

what its contradictory states must be false. If it
be true that 'All men are willing to give their lives
for a cause/ it is false that 'Some men are-not will-
ing to give their lives for a cause.' If it is true that
'No men are utterly selfish/ it is false that 'Some
men are utterly selfish/ If, on the other hand, what
a universal proposition states is false, what the con-
tradictory opposite states must be true. For ex-
ample, if it is false that 'Every man has his price/
it is true that 'Some men cannot be bought/ and if
it is false that 'None of the candidates were suc-
cessful/ it is true that some were. Further, the
truth or falsity of particular propositions involves

the falsity or truth of their contradictories. If
'Some one is going to get hurt/ is true, it is false
that 'No one is going to get hurt/ but if the state-
ment is false, then 'No one is going to get hurt* is
true. If 'Some people are short sighted' is true, it
is false that 'No people are short sighted / but if it
is false that 'Some kinds of ignorance promote vir-
tue/ it is true that 'No kinds of ignorance promote
virtue/

We may express these results in the single state-
ment that the truth of one of the propositions in
contradictory opposition involves the falsity of the
other ; and the falsity of one, the truth of the other.
Of any pair of contradictory propositions, one must
be false, and the other true. Contradiction is, there-
fore, the most complete form of logical opposition.

Subcontrariety. Subcontrary opposition exists
between particular propositions of different quality ;

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that is, between SiP and SoP. Thus, subcontrary
propositions differ in quality only.

If we make the two statements that 'Some men
are blue-eyed' and 'Some men are-not blue-eyed,'
each of these statements is true, and they are in
subcontrary relation to each other. But the truth
of either one of them is not sufficient to establish
the truth of the other. If, for example, we repre-
sent our two propositions thus :

SiP SoP

it will be evident that in each case P, in part or
whole, is predicated of a different part of S.
If, consequently, we know that 'Some indeterminate
number of men are blue-eyed,' (SiP), this is not a
sufficient ground for saying that the rest are, or are
not, blue-eyed. The fact that we are dealing with
particular propositions which have undistributed
subject terms, that is, terms that do not take into
account a determinate number of instances of the
class, but only more or less of them, prevents us
from saying anything definite of the rest of the class
with respect to their being or not being blue-eyed.
Of the propositions, therefore, that exist in subcon-
trary opposition, we may say that the truth of
the one leaves the truth of the other in doubt.

Propositions in the subcontrary relation cannot

both be false. In other words, the falsity of one in-
volves the truth of the other. For example, if it is
false that 'Some men are four-footed,' it is true that
'Some men are-not four-footed.' That is, it is only
on condition that some men are not four-footed that
we can deny the truth of the statement that 'Some
men are four-footed.' This view of subcontrary
opposition is required by the fact that if both par-
ticular propositions were false, their contradictories
would both be true; but, as we have seen, SaP and
SeP cannot both be true, for if one is true the other
is proved to be false. But if, as we have seen, the
falsity of the universal 'All men are four-footed/
for example involves its contrary in doubt, we
can at least say that its contradictory 'Some men
are-not four-footed' is true.

The Square of Opposition. The accompanying
diagram, called the Square of Opposition, is a me-
chanical devise which has long been traditional in
logic, and is intended as an aid to the better under-
standing of the doctrine of opposition. The univer-
sal propositions are placed at the top, the particular
propositions at the bottom of the diagram; the
affirmative propositions are placed on the left, and
the negative ones on the right. The lines connecting
any two propositions indicate the kind of opposition
that exists between them. The top and bottom lines
which are horizontal and parallel to each other con-
nect propositions of the same quantity ; the side lines
which are perpendicular and parallel connect prop-
ositions of the same quality. The long diagonal lines

connect propositions that are different in both quan-
tity and quality.

Let us now see how it may be used to throw
light on the doctrine of opposition. It will be ob-
served at once that every proposition has its con-
tradictory, and in contradiction, it will be remem-
bered, we have the most complete form of logical
opposition. To work the relations of opposition out
under the control of the contradictory relation seems
to simplify the whole matter for most students. We
summarise the doctrine of opposition below, and the

student is required to follow the statements out on
the Square of Opposition. Thus, if

SaP is true, its contradictory and its contrary
are false, and its subaltern is true.

SaP is false, its contradictory is true, and its
contrary and its subaltern are doubtful.

SeP is true, its contradictory and its contrary
are false, and its subaltern is true.

SeP is false, its contradictory is true, and its
contrary and its subaltern are doubtful.

SiP is true, its contradictory is false, and its
subcontrary and subalternans are doubtful.

SiP is false, its contradictory and sub-contrary
are true, and its subalternans is false.

SoP is true, its contradictory is false, and its
subcontrary and subalternans are doubtful.

SoP is false, its contradictory and sub-contrary
are true, and its subalternans is false.

It may be helpful to represent these facts and
relations diagrammatically. This we may do by
drawing only so much of the Square of Opposition
as embodies the relations in which a given proposi-
tion stands, utilising the arrow head to indicate the
direction in which given relations are to be read.
For example, the lines _^J diverge from a common
point and indicate, according to their direction, the
propositions we are considering and the relations in
which they stand. It is obvious that the example
chosen is the proposition. Since, then, the direc-
tion of the lines tells us what propositions we are

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dealing with, and in what relations of opposition
they stand, we may indicate at the ends of the lines
whether, in those relations, the proposition is true
(T) , false (F) , or doubtful (D) . Further, we may
indicate the original proposition by writing its given
truth or falsity in a circle. Following these direc-
tions, we have the accompanying result :

A summary of the doctrine of opposition is given
in the table on page 279.

Nature and Methods of Eduction. In the course
of our study, we have seen that all our judgments
are related to other judgments referring to the same
subject-matter, and, consequently, that every judg-
ment implies more than it asserts. Put more
directly, every judgment commits us not only to
what we assert, but also to the acceptance of all
the other judgments which are implied in what we
assert. Now when these implied judgments involve
a change in the point of view from which the sub-

ject-matter of the original judgment is viewed, they
are called eductions.

We may classify the methods of eduction as ob-
version, conversion, contraposition, and inversion.
But only two of these methods, obversion and con-
version, are fundamental. In the following sections,
we shall study the fundamental methods first, and
follow this with a consideration of the derived
methods, contraposition and inversion.

Given

SaP

SeP

SiP

SoP

F

T

F

""I F

D

D

T

ScP ?

F

F

T

f F

D

T

D

D

F

D

{ F

F

T

T

RnP)

F

D

D

I F

T

F

T

TABLE OF OPPOSITIONS

Obversion. Other terms by which this method
is sometimes known are Permutation, Aequipollence,
Immediate inference by Private Conception. Obver-
sion is the logical form of the double negative with
which we have all become acquainted in the study

of grammar. Like the double negative, it has the
force of changing an affirmative statement into a
negative one, and a negative statement into an
affirmative one. Obversion_effects no change in the
meaning of what is assertednbuT~onTy in its em-
phasis. For example, 'Barkis jgL.willin* ' by obver-
sion becomes 'Barkis is-not unwillin';' 'To do this
is-not unnecessary' becomes by obversion To do this
is necessary.'

In obversion only the quality of the original
proposition, called the obvertend, undergoes change ;
the quantity and the meaning remain the same. But
if the quality changes, the predicate term of the
obvertend must also undergo modification if the
meaning is to remain unaffected. What exactly is
this modification? It cannot be enough to say that
the characteristic of the obverse of a proposition is
that it has for its predicate term the negative of
the predicate of the proposition from which it is de-
rived, although, of course, this is, from the formal

point of view, true. Nor can we say that the con-
notation of the obvertend is affected, for that is the
question we are raising. If we are to understand
the particular significance of obversion, we shall
have to interpret it as a method that affects the
meaning of a proposition by a change in what the
proposition denotes. That is to say, the particular
range of the objects signified by the obvertend is
different from that of its obverse. For example, in
the illustrations used above, it is obvious that
Barkis' attitude must be one of willingness or un-

willingness; and of any action we may say that it
is necessary or unnecessary. Now, since obversion
is, in part, a matter of negation, we carry over into
that process all the characteristics that make nega-
tion significant. We have seen that negation is very
largely a matter of the emphasis that we give to
our knowledge, and of the definiteness or indefinite-
ness of our acquaintance with what we assert.
Thus, if we are not sure of the degree of Barkis'
willingness, we may express the actual state of our
information or opinion by saying that he is not-
unwilling. If we wish to suggest, but not to state
explicitly, the degree of necessity of the things we
do, we may say that they are not-unnecessary. A
guarded statement of the latter kind, it will be ob-
served, becomes more emphatic by obversion, for
we are thereby led to assert without qualification the
necessity of our actions.

There are two steps in the process of obversion ;
the first consists in changing the quality of the
original proposition without changing its quantity;
the second consists in negating the predicate term
of the original proposition. To consider the first
step we should observe, with respect to quantity,
that if the original proposition is universal the de-
rived proposition is universal, and if the original
proposition is particular the derived proposition is
particular; and, with respect to quality, that if the
original proposition is affirmative the derived prop-
osition is negative, and that if the original proposi-
tion is negative the derived proposition is affirm-

ative. Combining these two considerations, we find
that, in obversion, an A proposition always changes
to an E, an E to an A, an I to an O, and an to an
I. With regard to negating the predicate term of
the original proposition, the second step in obver-

sion, we may observe that if we use a short horizontal stroke over the symbol of an affirmative predicate term to indicate that that term has been negated, it will be obvious that obverted propositions are characterised generally by having for their predicate terms the so-called infinite or non-P term. It follows that if the predicate term is already a negative or infinite term, the effect of negating it will be to remove the sign of negation. The method of indicating negation by the short horizontal stroke over the symbol of an affirmative term is used throughout this book, and this fact should be noted; a horizontal stroke over any term, whether predicate or subject term, will have the meaning of negation. Thus, U will mean non-S, M will mean non-M, just as P* means non-P. With these explanations the method of obversion should be sufficiently clear. In the following table we illustrate the method of obversion in each of the four categorical propositions :

Obvertend

SaP

SeP

SiP

SoP

First Step

Second Step
Obverse

SeP

SaP

SoP

SiP

SeP

SaP

SoP

SiP

Conversion. This is a process by which we affirm
or deny of the predicate term of an original prop-
osition, called in this relation the con vertend, what
was asserted by the subject term of the same prop-
osition. If, for example, we know that 'JMlocarpin
when taken internally is followed by a slowing of
the heart beat,' we are able, by conversion, to place
pilocarpin among the agents which have the effect
of slowing the heart beat in any investigation we
may make about the conditions under which the
heart beat is slowed. In other words, the terms by
which in one proposition we qualify a subject, may
themselves become of direct interest to us, and in
looking about for predicates which shall qualify
them, we find in the original' proposition something
that is serviceable for this purpose. To state gen-
erally the fact that conversion denotes, we may say
that if we make any statement in the S-P form,
conversion is the answer to the question whether we
are able, because we have made this statement, to
make another which will have the form P-S. Hav-
ing said something about S, can we, therefore, say
something about P?

That this is a very reasonable inquiry will ap-
pear if we recall what was said about the possibility
of predicating of any term S another P. We saw
that this possibility rests upon the fact that S is not
merely S, and that P is not merely P. In any judg-
ment we are dealing with a complex phenomenon,
and our statements reflect this fact. We, therefore,
said that the S that in any proposition is P is an

SP, and, as we also saw, the P that is predicated
of S has its roots running down into, and derives
its character from, the same ground that makes of
S a significant term. In other words, the P of any
proposition is also an SP. It is this fact that under-
lies the process and problem of conversion. If S is
P at all, then the conditions of its being P are those
that will enable us to reverse the relation, and to
declare that P is S. This is the general statement
of the fact of conversion, but what the limitations
are under which conversion may legitimately take
place must be ascertained from the study of con-
crete cases. In other words, conversion is not a
wholly formal process, it is not a mere manipulation
of symbols; but a study of the formal relations of
the terms of the proposition brings to light some
of the limits of this type of thinking.

Formally considered, conversion is the method
by which the predicate term of one proposition,
called the convertend, becomes the subject term of
another, called the converse, and the subject term
of the former proposition becomes the predicate
term of the latter. It will be seen, then, that the
terms of the converse must be the same as the terms
of the convertend. Stated simply, the terms of the
converse are derived from the convertend by the
transposition of its terms : S-P becomes P-S. Again,
we should observe that in conversion there is no
change in the quality of the proposition : an affirm-
ative proposition remains affirmative, and a neg-
ative proposition remains negative. And, further,

the quantity of propositions sometimes is, and some-
times is not affected by their conversion. This will
be shown in our examination of the four categor-
ical propositions, and the reason for it will then be-
come clear. But before we examine each kind of
proposition to ascertain whether and in what form
it is capable of conversion, we wish to call attention
to the rule which governs all cases of conversion,
namely: If a term is distributed in the converse
it must have been distributed in the convertend.
Practical direction for applying this rule may be
laid down thus : Quantify the predicate, and trans-
pose terms.

The simplest cases of conversion are met with
in the universal negative and the particular affirm-
ative propositions: SeP and SiP. The universal
negative proposition has two distributed terms, and
the particular affirmative proposition has two un-
distributed terms. It follows from these facts that
if we transpose the terms of each proposition, with-
out changing the quality, no term in the converse
is distributed that was not distributed in the con-
vertend. If, for example, the whole of P, in the
universal negative proposition, lies outside the whole
of S, then the whole of S falls outside the whole of
P. In the case of the particular affirmative prop-
osition, some of S is identical with some of P, and,
therefore, it follows that the same part of P is
identical with the same part of S. Under these
conditions, it is possible not only to say that 'S is
P,' but also that T is S.' When, as in these two

cases, we convert a proposition without changing
its quantity, we are said to convert simply, or, as
the Latin word has it, simpliciter.

Conversion by limitation, or per accidens, that
is, conversion that involves a change in the quantity
of a proposition, is necessary in the case of the uni-

versal affirmative proposition, SaP. The reason for
this is that, being an affirmative statement, the
predicate term is undistributed, and when this be-
comes the subject term of a new proposition, it does
not present a determinate number of objects for the
predicate to qualify. For example, 'All the books
are on that shelf cannot imply that 'All the things
on that shelf are books ;' there may be other things
on the shelf than books. All, therefore, that we are
warranted in saying is that 'Some of the things on
that shelf are books,' a statement that differs in
quantity from the original proposition. The stu-
dent may find examples of universal affirmative
propositions which, on account of the nature of
their subject-matter, admit of simple conversion;
but the form of the proposition does not show this.
'A straight line is the shortest distance between two
points/ that is to say, definitions, may serve to show
what is meant. So long, however, as we confine
attention to the form of the proposition, SaP con-
verts by limitation to PiS.

A particular negative proposition cannot be con-
verted at all. In such a proposition the subject
term is undistributed, and the predicate term is dis-
tributed. If, therefore, we transpose the terms, we

have a proposition with a distributed subject and
an undistributed predicate, that is a proposition of
the form 'All S some P.' Now the only proposi-
tion that we have of this form is the universal
affirmative, and we should be required to take this
as such a proposition. But this we cannot do, be-
cause the converse of a proposition must be of the
same quality as the convertend, and, moreover, no
negative proposition has an undistributed predicate
term. But if, in order to overcome this difficulty,
we were to distribute this term, we infringe the
rule of conversion which states that if a term is
distributed in the converse it must have been dis-
tributed in the convertend. In no way, therefore,
can we convert a particular negative proposition.
It may sometimes be true that SoP and PoS are
both true, but we must go outside the formal rela-
tions of S and P in the propositions to see this. For
example, 'Some anarchists are-not Italians/ and
'Some Italians are-not anarchists' are both true.
But we do not always get a like satisfactory result
merely by transposing the terms of particular nega-
tive statements. For example, 'Some men are-not
professors' is true, but 'Some professors are-not
men' is false, so long, that is, as we only mean by
men membership in the human race. These cases
depend upon a knowledge of more than the original
proposition states, and there is no possibility of
ascertaining the precise nature of that knowledge
from a study of the formal relations of S and P in
a particular negative proposition.

We add below a table of all possible conversions :

Convertend

SaP

SeP

SiP

SoP

Converse

PiS

PeS

PiS

TABLE OF CONVERSIONS

Contraposition. Sometimes called Conversion by
Negation, and Contrapositive Conversion. The con-
trapositive of a given proposition may be described,
according to the method by which we arrive at it,
as the converted obverse. The rule, consequently,
that we should follow to reach the contrapositive
of any proposition is: First obvert the original
proposition, and then convert the proposition thus
obtained. If we follow this rule, the contrapositive
will be seen to be a proposition that has for its
subject term the negative of the predicate of the
original proposition, called in this case the obver-
tend. S-P becomes P-S- Now, since obversion is
involved in the process of reaching a contrapositive,
and conversion does not change it back again, the
contrapositive differs in quality from the original
proposition. And since the quantity of a proposi-
tion, as we have seen, is sometimes affected by con-
version, namely, when the proposition is a univer-
sal affirmative proposition, the quantity of the con-
trapositive will, in that case, be changed, but in all
other cases it will be unaffected.

The contrapositive of any proposition may be
obverted, and the proposition thus obtained will

in the section on obversion. Such a proposition is called the obverted contrapositive. In this case P^-S, the contrapositive of S-P, becomes by obversion P-&

The results of the above statements, expressed symbolically, are given in the following table of contrapositives :

Original Proposition

SaP

SeP

SiP

SoP

Obverse

SeP

SaP

SoP

SiP

Contrapositive

PeS

PiS

PiS

Obverted Contra

positive

PaS

PoS

PoS

TABLE OF CONTRAPOSITION

Not many examples of contraposition are neces-
sary if the student has mastered the fundamental
processes of obversion and conversion. We confine
ourselves to one:

Original
Proposition

SaP

All acids are substances that turn
blue litmus paper red

Obverse

SeP

No acids are substances that do
not turn blue litmus paper red

Contrapositive

PeS

No substances that do not turn
blue litmus paper red are acids

Obverted
Contrapositive

PaS

All substances that do not turn
blue litmus paper red are non-acid

EXAMPLE OF CONTRAPOSITION

Inversion. The inverse of a proposition has for
its subject the contradictory of the subject of the

original proposition (invertend). S-P becomes "S-P.
Like contraposition, inversion is arrived at indi-
rectly through the use of the two fundamental
forms of eduction. And since we can obtain by
obversion the contradictory of a term only when
that term forms the predicate of a proposition, S
must be made the predicate of a proposition before
its contradictory can be ascertained, that is, con-
version must have taken place at some stage in the
process of inversion. In other words, S must have
been made the predicate of a proposition, and then
that proposition must have been obverted if we are
to get a non-S term. Inversion can apply only to
the two universal propositions, SaP and SeP, and in
each case we get a particular proposition of the gen-
eral form ST-P. We must follow a separate rule in
each of these cases. To invert a universal affirmative
proposition, the rule reads: Obvert and convert
alternately until a proposition of the required form
is found. The rule for the universal negative prop-
osition reads : Convert and obvert alternately until
a proposition of the required form is found. We
show the necessary steps in each of these cases in
the following table :

Original
Proposition

SaP

Obverse

SeP

Converse

PeS

Obverse

PaS

Converse

SiP

Inverse

SoP

Original
Proposition

SeP

Converse

PeS

Obverse

PaS

Inverse

SiP

TABLES OF INVERSION

, We may obvert these inverses, and thus obtain
the obverted inverses. Thus, SoP will give SiP, and
5iP will give ~SoP. It will be "observed that from
the universal affirmative proposition we get, by in-
version, a particular negative proposition, and from
the universal negative proposition a particular
affirmative proposition, and that by obversion these
inverses are given the same quality as their re-
spective original propositions.

Summary of Eduction. In this section we give
first an outline schema of the characteristics of the
propositions arrived at by eduction, that is, we show
the character and relations of the terms of all the
eductive propositions. Thus:

Original Proposition

S-P

Obverse

S-P

Converse

P-S

Contrapositive

P-S

Obverted Contra
positive

P-S

Inverse

S-P

Obverted Inverse

S-P

SCHEMA OF EDUCTIVE PROPOSITIONS

In the following table we show, secondly, all the
eductions of each of the four categorical proposi-
tions in a form which indicates throughout the
quantity and quality of the propositions :

Original Proposition

SaP

SeP

SiP

SoP

Obverse

SeP

SaP

SoP

SiP

Converse

PiS

PeS

PiS

Obverted Converse

PoS

PaS

PoS

Contrapositive

PeS

PiS

PiS

Obverted Contra
positive

PaS

PoS

PoS

Inverse

SoP

SiP

Obverted Inverse

SiP

SoP

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QUESTIONS.

1. Classify categorical propositions from the standpoint (1) of their quantity and (2) quality.

2. What are the quantitative and qualitative characteristics of logical statements.

3. What symbols are used to distinguish the four categorical propositions, how are they derived, and what exactly do they represent?

4 Explain what is meant by a structural formula.. What is the general structural formula of a categorical proposition?

6. Write the structural formulae of all the categorical propositions, and explain how they are derived.

6. What do you understand by the distribution of terms?

7. What determines the distribution of the subject terms of propositions?

8. From what standpoint is the distribution of the predicate terms of propositions determined?

9. What is the distribution of each of the terms in each of the four categorical propositions?

10. Explain why the predicate terms of affirmative propo-

sitions are undistributed.

XI. Explain why the predicate terms in SeP and SoP are distributed.

12. Classify in any suitable way the distribution of all the terms of all the categorical propositions.

13. What is meant by the implication of propositions?

14. What other terms have been used to describe the fact of implication, and why are these not suitable?

15. What are the main classes of implication?

16. What do you understand by the Opposition of Propositions?

17. Name all the relations of opposition of categorical propositions.

18. Between what propositions can the relation of contrariety exist?

19. How do contrary propositions differ from, and in what respects do they argee with, each other?

20. If one of the propositions existing in a contrary relation is true, what can you say of the other?

21. Explain why a proposition is doubtful if its contrary is false.

22. Between what propositions can the subaltern relation exist?

23. How do subaltern propositions differ from, and in what respects do they argee with, each other?

24. Why does the truth of the subalternans involve the truth of the subaltern?

25. Explain why a proposition is doubtful if its subaltern is true.

26. Why is a proposition false if its subaltern is false?

27. Between what propositions can the contradictory relation exist?

28. How do contradictory propositions differ from, and in what respects do they argee with, each other?

29. Explain why the truth or falsity of a proposition involves the falsity or truth of its contradictory.

30. Between what propositions can the subcontrary relation exist?

31. How do subcontrary propositions differ from, and in

what respects do they argee with, each other?

32. Why is a proposition doubtful if its subcontrary is true?

33. Explain why a proposition is true if its subcontrary is false.

34. What is the Square of Opposition?

35. What are Eductions?

36. Classify the Eductions.

37. Explain and illustrate the method of obversion.

38. Upon what characteristics of propositions does the method of conversion rest?

39. Explain and illustrate the method of conversion.

40. What is the rule of conversion?

41. Name and illustrate the classes of conversion.

42. Why cannot SoP be converted?

43. Are there any particular negative propositions that can be converted? Illustrate.

44. If your answer to the previous question is in the affirmative, explain why logic says that SoP cannot be converted.

45. What is contraposition?

46. What steps must be taken to securj the contrapositive of a proposition?

47. Why is the contrapositive of a proposition sometimes called the converted obverse?

48. What is inversion?

49. What is the method of finding the inverse of SaP?

50. How do you proceed to find the inverse of a universal negative proposition?

EXERCISES

NOTE State propositions in logical form when answering a question, and write the formula for each proposition involved in your answers.

1. Write all the relations of Opposition of:

(1) We are not all college professors.

(2) Few books in logic are easy reading.

(3) The old paths are best.

(4) Improbable events happen almost every day.

(5) The longest road comes to an end.

(6) Unasked advice is seldom acceptable.

(7) Only ignorant persons hold such opinions.

(8) Infallibility is a myth.

2. Give the converse of:

(1) Mercy but murders, pardoning (= if it pardons) those that kill.

(2) We cannot all command success.

3. Give the obverse of:

(1) Not every advice is a safe one.

(2) Rivers generally run into the sea.

4. Give the contrapositive of:

(1) No one is altogether reliable.

(2) Every mistake is not a proof of ignorance.

5. Give the inverse of:

(1) He that bridleth his tongue is greater than he that taketh a city.

(2) Natives alone can stand the climates of Africa.

CHAPTER X

CATEGORICAL ARGUMENTS.

The Problem of the Chapter. In the previous cnapters we have studied mainly the three following problems: (1) the nature of simple assertion or the judgment, (2) the logical expression of these judgments or the proposition, and (3) the problem of logical implication. In the next two chapters, we shall still be occupied with judgments and their propositions; and, although the new problems that are to come before us are more complex than those we have studied, they will appear simpler, because everyone may be presumed to have already some acquaintance with them. The fact of common ex-perience that underlies the topics of these chapters is, that we connect statements of various kinds with one another in numerous ways, and that we do this with a view to making other assertions that, it seems to us, could not be made as surely in any other way. Often the actual statements we make are not debatable, they are readily accepted by the person to whom we are speaking, and may, therefore, be re-

garded merely as reminding him of certain points
of common agreement; and if, beyond this simple
function, they have any use, this must be found m
what they suggest, and not in what they actually
state. In other words, we are accustomed to use
certain significant statements for the purpose of

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making them the bases of certain other significant
statements which we wish the person to whom we
are speaking also to accept. Now it is quite obvious
that about such a general fact as this we may ask
whether there are any rules of procedure that may
be followed, if the suggested truth is to be accepted.
We may ask, that is, whether there are any service-
able ways of connecting statements when these are
used as the basis of others the truthfulness of which
we wish particularly to recommend. This is the
question we are to consider in this and the following
chapters, a question that is technically known as the
problem of the syllogism. To state the problem
somewhat technically, we are now to enter upon a
study of the combination of propositions, and of the
laws of their inter-connection.

Two Preliminary Questions. Before taking up
the specific topics to which the present chapter is
devoted, there are two questions to which some at-
tention must in the first place be given, a ques-
tion about the syllogism, and a question about the
particular kind of syllogism that we are immediately
concerned with. About the syllogism we may ask
whether it is a problem that is set by the judgment,
by the nature and limitations of human thought,
and one, therefore, that reveals the structure of the
thinking or knowing mind ; or, if this is not the case,
whether it is a problem that grows out of our effort
to communicate what we know. In the latter case,
the syllogism is not a problem that is set directly
by the judgment, but one that arises out of the

nature of the proposition. Now it is not possible,
nor perhaps is it necessary or desirable, to enter
into a full discussion of the question thus suggested ;
but, because of its bearing upon our understanding
of the nature and function of the syllogism, we may
point out more specifically that the question really
asks whether the syllogism is a method by which the
human mind thinks when it is seeking to gain knowl-
edge; or whether it is a method by which we lay
bare, for ourselves and others, the grounds on which
our knowledge is supposed to rest. That is, we
are asking whether the syllogism is, as in the one
case, an instrument for acquiring knowledge; or,
as in the other, an instrument for the exposition of

knowledge. In making this statement disjunctive,
we are not to be understood to mean that the syllo-
gism may not serve both functions, nor to deny
that the two functions may be inter-dependent. In-
deed, what we have seen to be true of the relation
of the proposition to the judgment, namely, that the
former, being the expression in words of the latter,
is controlled by motives that grow out of our desire
to communicate what we know, may be expected to
be true also of the syllogism a series of inter-
connected propositions in its relation to the more
complex process of reasoning. The view that the
syllogism is a method by which we expound and
communicate the knowledge that is acquired by
reasoning seems to have a high degree of probability,
and it may be allowed, in the main, to determine
our discussions in the following sections. From this

point of view, the syllogism will come before us as a
series of problems connected with the nature and
connection of propositions, and we must consider
the present chapter as a continuation of those imme-
diately preceding it in which we were developing the
character of prepositional statements.

Turning now to the second inquiry, we may
raise the question whether we are to study in this
chapter the connection between any kinds of state-
ment, and any kinds of connection between state-
ments. The answer to both parts of the question
must be, No. There are forms of statement that,
so long as these forms are retained, do not belong
to logic at all. We pointed this out above when we
were studying imperatives, inter rogatives, optatives,
and exclamations. There are also, as we have seen,
forms of logical statement that are not categorical,
and which, as we shall see later, present problems
quite distinct from those that are. Such, for ex-
ample, are the hypothetical and disjunctive prop-
ositions. We exclude from the scope of this chap-
ter both classes of statement, and consider only
the relationships that hold between categorical
propositions. There are also kinds of connection
between categorical statements that are not logical
in the restricted sense in which we are using the
word here. Such, for instance, are the connections
between ideas that the psychologist discusses under
the head of association. Such, also, are the con-
nections between ideas based upon the mathematical
principle of proportion: A is greater than B, B is

greater than C, therefore, A is greater than C.
Whatever the logical character of these cases may
be, they do not, on any strict interpretation, belong
to the present chapter which is confined to a study
of the connection of categorical propositions which

is illustrated in the Aristotelian syllogism.

Nature of the Syllogism. We may describe a syllogism as a series of three propositions which are related to each other in such a way that the truth expressed in one of them, called the conclusion, depends upon the truth expressed in the other two, called the premises, taken together. Let us -illustrate this statement in the following simple case:

All insects are arthropods.
All bees are insects.
All bees are arthropods.

In this syllogism, there are three inter-related propositions, each one of which has been written separately. It is obvious to first inspection that the truth of the last written statement, 'All bees are arthropods/ avowedly rests upon the truth of the other two taken together. That is to say, the truth of every conclusion is a truth that rests upon a connection of facts that it requires two propositions, at least, completely to express.

Our understanding of this type of argument will be facilitated if we learn to think about the syllogism from the standpoint of the conclusion it states, and not from the standpoint of the premises it expresses. The reason for doing so is found in the

nature of the thought processes themselves. In these processes, as we saw when studying the judgment, emphasis is laid primarily upon the answer to the cognitive question, What is it? and only subordinate importance is attached to the method by which the answer is reached. Whether the process of thought is relatively simple or complex, substantive emphasis is laid upon the solutions that are found to the problematic situations that stimulate the judging activity, and it is the function of the conclusions of syllogisms to express such solutions. From this point of view, the premises must be looked upon as expressing the grounds of the fact or truth stated in the conclusion of the syllogism. Indeed, it is only as stating the grounds of what is expressed in the conclusion that the premises are premises at all. In like manner, a conclusion can be a conclusion only if it is regarded as the statement of a grounded assertion. The grounds of assertion may be relatively simple as in our judgments of perception; they may be relatively complex, as in the syllogism; but every judgment is a grounded assertion, and when such assertions are referred to their grounds, when, that is, the reason for holding the assertions is in any way appealed to, such assertions are properly called conclusions. Premises and conclusions are thus correlative terms, and can be understood only from the standpoint of their mutual implication.

Further light is thrown upon the nature of the
syllogism if we recall that the mental process under-

lying the syllogism is a process of reasoning. The
mental process underlying the proposition, as we
have seen, is called a judgment. When, for example,
we discern the aspects in which objects differ from,
and are like, each other, directly, that is, by having
the objects before us and comparing the one with
the other, this mental process, involving discrim-
ination, abstraction, and synthesis, is called judg-
ing, and the mental attitude in which the results of
such a process is asserted is called a judgment. Now
the mental process underlying the syllogism is not
essentially different from that underlying the judg-
ment. Like the judgment, reasoning rests upon com-
parison, but unlike it, there is no means of direct
comparison of one object with another. In this
case, we compare each of the objects we are trying
to relate with a third object in order to detect
whether they have anything in common with it.
That is, we compare objects, through the observed
likeness or difference that each has to a third. This
is called indirect comparison, and the process of
reasoning in which this is carried out is called me-
diate reasoning. In contrast to the so-called imme-
diate reasoning or judgment, mediate reasoning is
a process underlying the Aristotelian syllogism, and
we may call the stated results of such a process an
argument. It is such an argument that gets ex-
pressed in the syllogism.

Structural View of the Syllogism. We may, now,
point out certain characteristics of the syllogism
that are conditioned by the fact that it is composed

of a series of interrelated propositions. Proposi^
tions, for instance, may be said to bear the same
relation to the syllogism that terms do to the prop-
osition, that is, they may be regarded as its con-
stituent elements. But as terms do not form prop-
ositions by being brought together by the copula,
so, we may say, the syllogism is not built up by
the union of propositions. The propositions of a
syllogism express distinguishable features of a
complex process of thinking, and it is the purpose
of the syllogism to make clear the inter-connection
between the several aspects of our thoughts-about-
things. In other words, the movement of thought
in syllogistic reasoning turns upon a common ele-
ment represented in the syllogism by the middle-
term, and it is only through this common element
that there exist grounds for the truth of any medi-
ated judgment. From this point of view, the middle
term is as characteristic a feature of the syllogism
as the copula is of the proposition.

Certain other features of the syllogism come into
prominence when we consider it from the stand-
point of its structure. For instance, every syllo-
gism has three and only three propositions, the
conclusion, and two premises. The conclusion is a
statement of the relation between two terms which
are named, from the place they occupy in the syllo-
gism, the major and minor terms. The subject
1 (S) of the conclusion is the minor term of the syl-
llogism, and the predicate (P) of the conclusion is
jthe major term of the syllogism. Since now the

premises of a syllogism are propositions, they also
state a relationship between terms, but not a rela-
tionship between any terms. Their function is to
state the relationship that the major and minor
terms have respectively to a common or middle
term (M). The proposition that states the rela-
tionship between the major and middle terms is
known as the major premise. The proposition thall
states the relationship between the minor and the!
middle terms is known as the minor premise. Ill
should be observed that the nature and validity of
categorical arguments do not depend upon the order
in which the propositions are named, but upon the
connection between the propositions of which they
are comprised. It is usual, however, to write the
major premise first, the minor premise second, and
the conclusion last.

With these facts in mind, it is possible to give a
definition of the syllogism that emphasises the con-
nection of the elements that are always present in
these kinds of arguments. From this point of view,
the syllogism is a method by which we relate two
terms (S and P) through the relation that each has
to a common or middle term (M).

Rules of the Syllogism. In the previous section,
we pointed out that the syllogism has a definite
structure which is determined by the fact that its
three constituent propositions are related to each
other through a middle term. The rules of the syl-
logism may be classified with respect to these facts,

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-with respect to the terms, and with respect to
the propositions of the syllogism. With respect to
its terms, the rules are definitely rules of distribu-
tion. With respect to its propositions, the rules
refer to the quantity and quality of the propositions.

RULES OF DISTRIBUTION

I. The middle term must be distributed in one, at least, of the premises.

II. If a term is distributed in the conclusion, it must have been distributed in one of the premises.

The reason for the first rule is, that the validity of the syllogism depends upon the reference of the major and minor terms unambiguously to the same common term, and this is done with certainty only if the middle term is distributed, at least, once. If the middle term is undistributed in each premise, the major term might be related to one part in the major premise, and the minor term to another part in the minor premise. Whenever this is the case, we have four and not three terms in the two propositions, and thus the syllogistic character of the argument is destroyed. For example, from the statements that 'All rash men are confident,' and 'All brave men are confident/ we cannot conclude that 'All brave men are rash/ for the reason that the confidence that each has is or might be a different kind of confidence; there is, in other words, no middle term or common factor to serve as a basis of comparison. If, however, the middle term is distributed in one, at least, of the premises, the part

of the term denoted by the undistributed middle in the other premise is included in this distribution, and there is thus a common basis of comparison for the major and minor terms. Thus, we can affirm that 'No Americans are Englishmen' on the ground that 'All Englishmen are Europeans/ and 'No Americans are/ The fallacy involved in breaking the rule for the distribution of the middle term is called the fallacy of Undistributed Middle.

The reason for the second rule is, that we must not make a statement, in the conclusion, about a determinate number of the objects denoted by a term when, in the premises, our statement has been about an indeterminate number of these objects. In other words, we must not go beyond our accepted facts. Stated conversely, to support a conclusion which denotes, in either of its terms, a determinate number of the objects to which the term applies requires that all these objects shall have been denoted in one of the premises. When this rule is not observed by the major term, the fallacy that results is an Illicit Process of the Major, and when it is not observed by the minor term an Illicit Process of the Minor Term.

RULES OF QUALITY

I. If the conclusion is affirmative, both premises are affirmative ; and conversely.

II. If the conclusion is negative, one premise, and only one, is negative; and conversely.

In discussing these rules, which refer to the
relation of identity, or of non-identity, of two
classes, on the ground of their identity or non-

identity with a third, it is important to observe that
we can argue a relation of identity only on the basis
of an identity of relation, and a relation of non-
identity only on the basis of a non-identity of rela-
tion. In other words, the relation of S and P to M
must be either so far identical as to warrant the
statement of the complete or partial identity of S
and P; or so far non-identical as to warrant the
statement of the complete or partial non-identity
of S and P. If the conclusion is a statement of
identity, the grounds for such a statement cannot
be found in a relation of non-identity; nor can we
find grounds for a statement of non-identity in a
relation of identity. Hence, if the conclusion is
affirmative both the premises must be of the same
quality ; and if the conclusion is negative, one of the
premises must be of that quality.

Why can we not ground any statement upon two
negative propositions? Because, in that case, there
is no identity of relation between S and M and P and
M, on which to base such a statement. From the ex-
clusion of both S and P from M, we cannot argue
to the identity of S and P, nor can we argue to the
non-identity of S and P. Two negative premises
cannot, therefore, support any conclusion, nor can
any conclusion be inferred from them.

RULES OF QUANTITY

I. A particular conclusion cannot be supported
by two particular premises.

II. If a conclusion is particular, one, and only
one, of the premises supporting it can be particular.

With regard to the first rule, let us suppose that
the particular affirmative, and the particular neg-
ative, conclusions, SiP and SoP, can be supported by
two particular propositions. In the former case, the
premises must be both particular affirmative, and
then the middle term is undistributed whichever
place it occupied in the premises. This would give
the fallacy of the undistributed middle. In the sec-
ond case, one premise must be particular affirmative,
and the other particular negative, and then there
can be only one distributed term, namely, the pred-
icate of the negative premise. If this is the middle
term, the major term will be of wider extent in the
conclusion, which is a negative proposition, than in
the major premise, the fallacy of illicit process of

the major. If, on the other hand, the middle term
is not the predicate term of the negative premise,
the argument fails on account of the fallacy of undis-
tributed middle.

With regard to the second rule, the particular
conclusion must be either affirmative or negative.
If it is affirmative, the premises will both be par-
ticular affirmative, II., that is, propositions whose
terms are all undistributed. A syllogism whose
premises were both particular affirmative would be
fallacious on account of undistributed middle. If,
on the other hand, the conclusion were particular
negative, one of the premises would have to be par-
ticular negative, 01, 10, that is, propositions only
one of whose terms is distributed. If this were the
middle term, then, all the other terms being undis-
tributed, the conclusion being negative would involve

the syllogism in an illicit process of the major; and
if that term were not the middle term, the syllogism
would involve an undistributed middle. Only one
premise, therefore, of a particular conclusion can
be particular.

Figures of the Syllogism, The propositions that
together constitute the premises or grounds of a
syllogism are characterised, as we have seen, by the
fact that they have a common or middle term. Now
since each premise has two terms, a subject term
and a predicate term, and one of these is the middle-
term of the syllogism, it is obvious that the middle
term may be either the subject term or the pred-
icate term of the major premise, and either the
subject term or the predicate term of the minor
premise. That is to say, the middle term of a syl-
logism may occupy four different positions in the
propositions which, when taken together, are the
premises of the argument which the syllogism is
the means of stating. Now the fact that the middle
term of a syllogism may occupy different positions
in the premises of different arguments is referred
to by the term Figure. The Figure of a syllogism,
in brief, is determined by the position of the middle
term in its major and minor premises.

The number of Figures depends upon the num-
ber of different positions that the middle term may
occupy alternately in the premises of a syllogism.
Theoretically, there are four. Thus :

1. The middle term may be the subject term
of the major, and the predicate term of the minor
premise.

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2. The middle term may be the predicate term
of each premise.

3. The middle term may be the subject term
of each premise.

4. The middle term may be the predicate term
of the major, and the subject term of the minor
premise.

In the order named, the syllogisms whose form
corresponds to the alternative possibilities just
named are said to be in the First Figure, the Second
Figure, the Third Figure, and the Fourth Figure re-
spectively. Written in outline, syllogisms in these
Figures will present the following appearance:

First
Figure

S P

Second
Figure

P-#

S $,

S P

Third
Figure

M P

M S

S P

Fourth
Figure

P M

M S-

S P

As an aid to the retention of the positions of
the middle terms in each of the Four Figures, we
may add the following suggestion. If we connect
by a line the middle terms of the premises in the
Four Figures as just shown in outline, we shall
get this result:

II

M

M

III

M

M

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The upper point of these lines is the position occu-
pied by the middle term of the major premise, and
the lower point of the lines is the position occupied
by the middle term of the minor premise in the
Four Figures respectively. If now to these lines
we add dotted lines to represent the major and
minor premises, our diagram will assume this as-
pect:

M

III

M

M/

A diagram like this, of course, may mean something
or nothing according as the student can bring to it
an interpreting idea. A student informed me that,
for a number of a class in logic, the two end figures
were thought of as snakes fighting or hissing at
each other. The two middle figures were thought
of as people sitting back to back because they were
cross with each other. As this information came
to me two years after the course was taken, it may
be presumed to have, for one at least, some mne-
monic value.

Special Rules of the Four Figures, Each of the
Four Figures has its own special rules, which are
applications of the general rules of the syllogism to
the specific form that categorical arguments as-
sume in these Figures. We shall state and prove
the rules for each Figure in order.

FIRST FIGURE

RULE 1. The minor premise must be affirmative.

Let us suppose the minor is negative. Then,

M P the major must be affirmative, and the

S M conclusion negative. Therefore, the major

term will be undistributed in the major

S P premise, and distributed in the conclusion ;

illicit process of the major. Hence, the
minor premise cannot be negative, and must be
affirmative.
RULE 2. The major premise must be universal.

If the minor premise is affirmative, the
middle term is undistributed, and must,
therefore, be distributed in the major
premise. And since the middle term is
subject of this premise, the proposition
must be universal.

SECOND FIGURE

RULE 1. One premise must be negative.

Since the middle term is the predicate of
P M each premise, one of the premises must be
S M a negative proposition to avoid the fallacy

of undistributed middle.

S P

RULE 2. The major premise must be universal.

The major term being the predicate of a
negative proposition in the conclusion, is
distributed. It must, therefore, be dis-
tributed in the major premise. But since

there it is the subject of the proposition,
the major premise must be universal.

THIRD FIGURE

RULE 1. The minor premise must be affirmative.
Let us suppose that the minor is negative.
Then, the major premise must be affirm-
ative, and the conclusion negative. There-
fore, the major term will be undistributed
S P in the major premise, being the predicate
of an affirmative proposition, and distrib-
uted in the conclusion, being the predicate of a neg-
ative proposition. This involves illicit major.
Hence, the minor premise must be affirmative.

RULE 2. The conclusion must be particular.

Since the minor premise is affirmative, the
minor term, being predicate, is undistrib-
uted, and must, therefore, be undistributed
in the conclusion also. But the minor term
is the subject of the, conclusion which,
therefore, must be particular.

FOURTH FIGURE

RULE 1. If either premise is negative, the major

is universal.

P M If either premise is negative, the conclu-
M S sion is negative, and the major term of the

conclusion must be distributed. It must,

S P therefore, be distributed in the major

premise. But since there it is the subject,
the premise must be universal.

RULE 2. If the major premise is affirmative, the
minor must be universal.
If the major premise is affirmative, its
middle term is undistributed. It must,
therefore, be distributed in the minor
premise. And since there the middle term
is the subject, the premise must be uni-

versal.

RULE 3. If the minor premise is affirmative, the
conclusion is particular.
If the minor premise is affirmative, the
minor term is undistributed. In the con-
clusion, therefore, this term must be un-
distributed. The conclusion, therefore, is
particular.

RULE 4. If the minor premise is negative, both
premises are universal.
If the minor premise is negative, the minor
term is distributed. It must, therefore,
be distributed in the conclusion which will
then be universal. But a universal con-
clusion requires two universal premises.
The Moods of the Syllogism. If now we con-
sider the structure of the syllogism from the point
of view of the quantity and quality of the proposi-
tions which enter into it, we meet with the facts
which are denoted by the term the Moods of the
syllogism. By the Moods of the syllogism is meant
the character of a syllogism as determined by the
quantity and quality of its constituent propositions.
There are, as we have seen, four categorical prop-

ositions, SaP, SeP, SiP, SoP, and any combination
of three of these, theoretically, may form the con-
stituent propositions of a syllogism. For example,
a syllogism may have in its premises and conclusion
only universal affirmative propositions. But it may
have in its major premise a universal affirmative, in
its minor premise a universal negative, and in its
conclusion a universal negative proposition. Every
syllogism must express itself by the use of the four
categorical propositions three at a time, and, there-
fore, no syllogism can fail to have a Mood. That is
to say, each of the constituent propositions of a syl-
logism has both a quantity and a quality, and when
we have named the quantity and quality of each
proposition, in the order of major premise, minor
premise, and conclusion, we have named the Mood
of the syllogism. Thus, in the examples just used,
the mood of the first is said to be AAA, that of the
second, AEE.

The Valid Moods of the Syllogism. The Mood of
a syllogism, we have said, is determined by the
quantity and quality of its constituent propositions.
The question that now comes before us is, How many
of the possible combinations of three out of the four
categorical propositions, taken as major and minor
premise and conclusion, will give us valid moods,
that is, syllogisms whose conclusions logically de-
pend upon the premises on which they are said to
rest? In answering this question, it will simplify
our task if, leaving the conclusions out of consider-
ation, we ascertain the combinations of propositions

which are possible as premises. Since, as we have
seen, there are four categorical propositions, each
of these may serve successively as the major prem-
ise of a syllogism, and each may serve successively
as the minor premise of the same syllogism. Thus,
writing the major premise first and the minor sec-
ond, we shall get the following sixteen combina-
tions :

AA EA IA OA

AE EE IE OE

AI El II 01

AO EO IO OO

If, now, we examine this list of possible prem-
ises, it is apparent that some must be rejected by
the rules of the syllogism that we have stated in
another section. Certain combinations are disqual-
ified because they violate the rule against negative
premises, for example, EE, EO, OE, and 00; cer-
tain others must be eliminated because they offend
against the rule about particular premises, for ex-
ample, II, 10, and 01. There remain, after the dis-
qualified members have been eliminated, the follow-
ing combinations :

AA EA IA OA

AE IE

AI El

AO

These we must consider as the only premises that
can be appealed to in support of any conclusion
which we may be concerned to maintain.

Relation of Moods to Figure. There is, however,
a further question that requires an answer, namely,
whether we can throw the defence of a conclusion
upon any of the above-mentioned premises in any
of the Figures without affecting the validity of the
argument. Or, to state the same question con-
versely, Is each of the above pairs of premises ca-
pable of rendering a valid conclusion in each of the
Four Figures? We are asking, what effect, if any,
the statement of a syllogism in either of the Four
Figures has upon the validity of the argument.

There are two methods that may be adopted in
seeking an answer to this question. And first we
shall examine each of the above combinations of

premises in the light of the special rules of each
Figure, accepting those that conform, and rejecting
those that do not conform to the requirements of the
particular Figure.

In the First Figure, the major premise must be
universal, and the minor affirmative. The only com-
binations of premises that stand these tests are, AA,
AI, EA, and El. If we draw the proper conclusion
in each case, we may write the four valid moods
for this figure as follows :

AAA All EAE EIO

It will be observed that in this figure we are able
to support by premises a conclusion stated in any
one of the four propositions A, E, I, and O.

In the Second Figure, the major premise must
be universal, and one premise negative. The only

combinations of premises that satisfy these require-
ments are AE, AO, EA, and EL With their respect-
ive conclusions, these premises give the following
Moods :

AEE AGO EAE EIO

The conclusions in the Second Figure, it will be ob-
served, are negative propositions, either E or 0.

In the Third Figure, the minor premise must be
affirmative, and the conclusion particular. The fol-
lowing are the combinations of premises in which
the minor is affirmative : AA, AI, EA, El, IA, and
OA. From each of these we may draw, as required,
particular conclusions, and the valid Moods will be
as follows:

AAI All EAO EIO IAI OAO

In the Fourth Figure, if either premise is neg-
ative, the major is universal; if the major premise
is affirmative, the minor is universal; if the minor
premise is affirmative, the concluson is particular,
and if the minor is negative, both premises are uni-
versal. The only combinations of propositions
which satisfy these conditions are: AA, AE, EA,
El, IA. To draw conclusions from these premises,
we must remember that when, in this figure, the
minor premise is affirmative, the conclusion must be
particular. The valid moods are :
I

AAI AEE EAO EIO IAI

In this figure, we may support conclusions stated in
each of the four propositions, excepting the univer-
sal affirmative.

The second method of determining the valid
Moods is to examine each of the combinations of
premises in each Figure, and observe whether it
satisfies the requirements of a valid argument.
Since we have eliminated those combinations of
premises which do not meet the rules of quantity
and quality as stated above, the validity of the argu-
ment will depend upon its satisfying the rules of
distribution. We shall give examples below foryall
the Figures, and the student is urged to work out
the entire list. This will be a review exercise, and
it will help him to fix definitely the .essentials con-
nected with the Figure and Mood of syllogisms, and
the distrbution of terms.

To begin, we may write the structural formulae
for the Figures in which we are to examine the given
combination of premises. Thus:

I II III IV

M-^-P P M * M P P M

S M S M ' M S M S

S P S P S P S P

In the vacant spaces of each premise may be written
the combination of premises we are wishing to ex-
amine, and in the vacant space of the conclusion,
the conclusion that these premises support.

When this has been done, our first question will
be : Is the middle term distributed in one, at least,

of the premises? The second question will be: Is
each distributed term of the conclusion, when there
is one, distributed also in one of the premises?

We give the following examples chiefly as a
guide to the student in working out the entire list.
AE in all the Figures.

I II III IV

MaP PaM MaP PaM

SeM SeM MeS MeS

SeP SeP SeP SeP

In the First Figure, this argument is invalid be-
cause the major term is distrbuted in the conclusion
and is not distributed in the major premise: Illicit
process of the major.

In the Second Figure the argument is valid.

In the Third Figure the argument is invalid be-
cause the major term is distributed in the conclusion
and is not distributed in the major premise : Illicit
process of the major.

In the Fourth Figure, the argument is valid.
AI in all the Figures.

I n III IV

MaP PaM MaP PaM

SIM SdM I MiS MiS

SiP ^Sf SiP Si 3

In the First Figure, the argument is valid.

In the Second Figure, the argument is invalid
because the middle term is not distributed in either
premise : Undistributed middle.
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In the Third Figure, the argument is valid.

In the Fourth Figure, the argument is invalid
because the middle term is not distributed in either
premise: Undistributed middle.

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QUESTIONS

1. In what respects are the problems of this and the im-
mediately following chapters related to those of the pre-
ceding chapters?

2. What general view of the syllogism is assumed in the
discussions of this chapter?

3. What particular forms of statement are and what are
not studied in this chapter?

4. Discuss the advantages and disadvantages of viewing
the syllogism from the standpoint (1) of its premises
and (2) of its conclusion?

5. What mental process underlies the syllogism, and how
does it differ from that which underlies the judgment?

6. What do you understand by the major, minor and mid-
dle terms of the syllogism?

7. Define the syllogism from the standpoint of its con-
tained terms.

8. Define and illustrate the following: Premise, Conclu-
sion, Major premise, Minor premise, Undistributed mid-
dle, Illicit process.

9. With respect to what aspects of its contained proposi-
tions are the rules of the syllogism determined?

10. Explain why the middle term of a syllogism must be distributed in at least one of the premises.

11. Why is there no separate rule relating to a term in the conclusion that is undistributed?

12. Why must the premises of an affirmative conclusion be affirmative?

13. Explain why a negative conclusion can be supported only if but one of its premises is negative.

14. Why cannot a particular conclusion be supported by two particular premises?

15. What is meant by the Figure of a syllogism?

16. Describe the formal characteristics of each of the Figures.

17. What do you understand by the Special Rules of the Four Figures?

18. What is meant by the Moods of the syllogism?

19. How do you determine all the theoretically valid Moods of the syllogisms?

20. What is the relation of the Moods to the Figures of the syllogism?

21. What two methods may be adopted to determine whether a particular argument is valid in a given Figure?

EXERCISES

NOTE Write the formula for each proposition and syllogism in your answers to the following questions.

1. Point out (1) the conclusion, (2) the middle term, (3) the major term, (4) the minor term, (5) the major premise, (6) the minor premise in the following arguments :

(1) The receiver of stolen property should be punished; you have received stolen property, and, therefore, should be punished.

(2) Theft is crime; theft was encouraged by the laws of Sparta, therefore, the laws of Sparta encouraged crime.

(3) Only those messages which have been prepaid will be delivered; this message has been prepaid, and, therefore, will be delivered.

2. Name all the rules of the syllogism which are broken by each of the following Moods:

AIA, EEI, IEA, 101, IIA, AEI.

3. Prove from the rules alone, irrespective of Figure, that
IE can yield no valid conclusion.

4. In what Figures do the following premises yield a valid
conclusion :

AA, AI, EA, OA.

5. Why cannot a particular negative proposition stand (1)
as a premise in the First, (2) as a major in the Second,
(3) as a minor in the Third, or (4) as a premise in the
Fourth Figure?

6. Arrange the following arguments in the order of major
and minor premise, and conclusion, and determine their
Figure, Mood, and validity:

(1) All colours are physical phenomena, but no sounds
are colours, and therefore no sound is a physical
phenomenon.

(2) Whatever is given on the evidence of sense may be
taken as a fact; the existence of God, therefore, is
not a fact, for it is not evident to sense.

(3) Every candid man acknowledges merit in a rival;
every learned man does not do so; therefore, every
learned man is not candid.

7. What can be determined respecting a syllogism under
each of the following conditions:

(1) That only one term is distributed, and that only
once.

(2) That only one term is distributed, and that twice.

(3) That two terms only are distributed, each only once.

(4) That two terms are distributed, each twice.

CHAPTER XI
OTHER FORMS OF CATEGORICAL ARGUMENT

Their Relation to the Syllogism. The syllogism
may be considered from either of two points of view,
from the point of view of its premises, or from the
point of view of its conclusion. If we attend par-
ticularly to the premises, we shall think of the syllo-
gism as a method by which from given data we
arrive at a conclusion; if we attend particularly to
the conclusion, we shall think of the syllogism as a
method by which we state the grounds on which
a position already arrived at is held to rest. These
two ways of regarding the syllogism are not con-
tradictory, nor is our view of the nature of the syl-
logism affected by the possibility of this two-fold

approach to its problems. There results only a
slightly different emphasis in one's exposition; in
the one case, the conclusion, in the other, the prem-
ises, come to be the focus of our logical interest.

The reason why we may alter, in the way just
indicated, our exposition of the syllogism is that the
syllogism does not express a series of consecutive
steps by which the judgment actually proceeds for-
ward from data to conclusion, or backward from
conclusion to grounds; but it represents, in a con-
ventional form and order, the simplest inter-connec-
tions of a complex process of reasoning. It is some-
times brought forward as an objection to syllogistic

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reasoning that it is not an instrument of the dis-
covery of truth ; but the objection rests upon a mis-
understanding. The truth about any subject-matter
is discovered by thinking, and the syllogism is not,
and does not affect to be, a substitute for thinking.
We may even say that unless truth already exists,
unless some kind and degree of thinking has taken
place, the syllogism has no function to perform.
The syllogism presupposes the existence of truth,
and is not the condition of its existence. It repre-
sents the results of our reflection upon the truth
that is already in our possession, a reflection that
is directed towards finding out the reasons why
truth assumes a demonstrative character. Now this
is not a small nor an easy thing. It is, however, an
eminently practical thing. For when thought takes
itself to task, and, by reflection upon its own proc-
esses, demands that the conditions of truth be
erected into principles of demonstration, we may be
led to see how far from being demonstrative are
many of the beliefs that we hold most confidently.

These remarks have a practical bearing upon
the subjects of this chapter, and may prepare us to
understand why our thoughts-about-things can be
thrown into a variety of forms which conform in
principle only to the Aristotelian syllogism. The
discussion of these arguments should lead us to see
that even in logic we are not bound in the state-
ment of our thought to the formal primness of the
three-term syllogism.

Enthymeme. This is the name of a categorical
argument which omits, in statement, one of the con-
stituent factors of the syllogism. Now since there
are three propositions, two premises and a con-
clusion, in a categorical syllogism, the omission of
either one of these from the syllogism results in an
enthymeme. But it must not be supposed that the

omission of one member of a syllogism destroys the
syllogistic character of the reasoning, for, as the
term itself implies, the omitted member still func-
tions in the mind of the person who states his
thought in this particular form. The enthymeme,
consequently, is a particular way of stating a cat-
egorical argument, it is not a new form of categor-
ical syllogism.

According as the omitted member of the syllo-
gism is the major premise, the minor premise, or
the conclusion, the resulting enthymeme is said to
be of the First Order, the Second Order, and the
Third Order respectively. An enthymeme of the
First Order, consequently, is a syllogism which is
abbreviated by the omission of the major premise.
For example, Those who have no occupation have
nothing in which to interest themselves, and are,
therefore, unhappy.' An enthymeme of the Second
Order is a syllogism which is abbreviated by the
omission of the minor premise. For example, Those
who have no occupation are unhappy, because they
have nothing in which to interest themselves.' An
enthymeme of the Third Order is a syllogism which
is abbreviated by the omission of the conclusion.

For example, 'Those who have nothing in which to
interest themselves are unhappy, and those who
have no occupation have nothing in which to interest
themselves/

In the enthymeme, as in the fully expressed
syllogism, the order in which the propositions are
stated is wholly a matter of convenience, and does
not affect the nature or validity of the argument. In
case of the enthymeme, however, it must be made
obvious by the use of such words as 'and,' 'because/
and 'therefore,' which members of the syllogism we
are undertaking to express.

It may be questioned whether the enthymeme
has both Mood and Figure. Perhaps the best
answer to this inquiry would be that a syllogism in
any Figure and Mood may be stated as an enthy-
meme by the omission of one of its constituent prop-
ositions. But since Mood and Figure are character-
istics of arguments only when fully expressed in the
three-term syllogism, the most that we can say is
that an enthymeme implies a Figure and Mood, and
not that it has either.

Polysyllogism. In the enthymeme, we have an
example of the elliptical character of thought. Think-
ing, indeed, is ordinarily carried on by means of the
smallest number of factors necessary to its success
definitely present to consciousness. When the
thought is a simple one, and the inter-connection of
its parts consists of a relation of three terms, any
one of the relations may fall into the background
without invalidating or making doubtful its truth.

This is, as we have seen, the case of the enthymeme.
When, however, thinking becomes complex, and the
inter-connection of its parts involves relations of
many terms, it is much more necessary to simplify
our methods, if thinking is not to break down under
the weight of the terms into which the subject-
matter of thought is analysed. In this case, what
we do is to build up a series of enthymemes or
abbreviated syllogisms, and such a series is called
a polysyllogism. A polysyllogism is, therefore, a
series of inter-connected enthymemes representing a
continuous chain of reasoning.

It is customary to denote the syllogisms into
which a polysyllogism may be analysed by the terms
prosyllogism and episyllogism. The application of
these terms depends entirely upon whether we are
thinking of the constituent syllogisms in the for-
ward direction, that is, of the first syllogism as
being connected with the second, and the second
with the third, etc. ; or whether we are thinking of
them in the reverse order, that is, of the second
syllogism as being connected with the first, the
third with the second, etc. When we think of the
constituent syllogisms in the former way, each syl-
logism is called a prosyllogism; and when we think
of them in the latter way, each syllogism is called
an episyllogism. The terms prosyllogism and epi-
syllogism, consequently, are used relatively, and any
syllogism in a train of reasoning may be both a pro-
and an episyllogism. It is obvious that the first

syllogism in such a series can be only a prosyllogism,
and the last only an episyllogism.

Types of Polysyllogism Trains of reasoning
of the type just described fall into two main classes,
progressive and regressive. We shall describe each
of these briefly, and merely for the purpose of show-
ing their logical structure.

A progressive, synthetic, or episyllogistic train
of reasoning proceeds from the premises of a pro-
syllogism to the conclusion of an episyllogism. A
polysyllogism of this character develops progress-
ively the consequences of the premises which form
its starting point. Stated otherwise, the progressive
polysyllogism advances from the conditions to what
is conditioned, from causes to effects. Probably
the most familiar illustrations of this class of poly-
syllogism for the student are to be found in the
direct proofs of geometrical propositions. A re-
gressive, analytic, or prosyllogistic train of reason-
ing proceeds from the conclusion of an episyllogism
to the premises of a prosyllogism. In such cases

we go back from a conclusion to show the grounds
upon which it rests. Stated otherwise, we are said
to reason from the conditioned to its necessary con-
ditions, from effects to causes.

Illustrations of these two classes of polysyllo-
gisms will be found in the following sections in which
we consider the various forms that such trains of
reasoning may assume. In this and the preceding
section we have been considering the general charac-
teristics of a group of syllogisms; in the sections

that follow we are to study the cases that fall under
one or other of the two main classes of the group.

Sorites. This is a polysyllogism whose constitu-
ent syllogisms are all in the First Figure, and from
which all the conclusions, except the last, are omit-
ted. Or, since a syllogism which omits one of its
propositions is an enthymeme, we may regard a
sorites as a series of enthymemes from each of
which, except the first, one premise is omitted, and
from each of which, except the last, the conclusion
is omitted.

There are two forms of sorites, progressive and
regressive, which are usually distinguished as the
Aristotelian and the Goclenian respectively. An ex-
amination of each of these will serve to set the
nature of this class of arguments more clearly in
the light.

An Aristotelian sorites is a progressive series of
enthymemes in which the omitted conclusion of each
prosyllogism forms the minor premise of the suc-
ceeding episyllogism. A familiar example may be
taken from Rom. VIII., 29, 30 : 'For whom he fore-
knew, he also foreordained to be conformed to the
image of his Son, . . . and whom he foreordained,
them he also called; and whom he called, them he
also justified: and whom he justified, them he also
glorified/ A Goclenian sorites so called from Pro-
fessor Goclenius of Marburg (1547-1628) its dis-
coverer is a regressive series of enthymemes in
which the omitted conclusion of each prosyllogism
forms the major premise of the succeeding episyl-

logism. For example: 'One must take pains if he
is to be a successful man; industry is necessary to
taking pains ; health is necessary to industry ; a reg-
ulated diet and sufficient recreation and rest are
necessary to health ; and, therefore, a regulated diet
and sufficient recreation and rest are necessary if
one is to become a successful man/

The symbolic expression and analysis of each

of these forms of sorites may be given thus :

ARISTOTELIAN SORITES GOCLENIAN SORITES

S is A Z is P

A is B Y is Z

B is C X is Y

C is P S is X

S is P S is P

Analysis :

S is A) Z is P ^|

A is B C Y is ^ I

f (S is B)) ('(Y is P)J

j B is C J Z is Y

((S is C) -) ((X is P;"|

C is P C S is X V

S is P) S is P J

Each of these forms is subject to special rules
which we shall proceed to state and prove,
l

THE SPECIAL RULES OF THE ARISTOTELIAN SORITES

RULE 1. Only one premise, and that the last,
can be negative.

Let us suppose that two of the premises are neg-
ative. Then the conclusion of the syllogism in

which the first negative premise occurs will be neg-
ative. But since this negative conclusion is neces-
sarily a premise of the next succeeding syllogism,
its concluson will be negative, and so on, until a
negative conclusion enters as a premise into a syl-
logism which has the second negative premise. But
as we have seen, from two negative premises no
conclusion can be inferred. Only one premise, there-
fore, can be negative.

This negative premise must be the last. Let us
suppose that some other premise is negative. In
that case, the conclusion of the syllogism into which
it entered would be negative. This conclusion, serv-

ing as the minor premise of the following episyllo-
gism, would give a conclusion that is negative, that
is, one in which the major term is distributed. But
since the major term in the affirmative major prem-
ise is undistributed, the argument would fail on ac-
count of an illicit process of the major. No premise,
therefore, except the last can be negative.

RULE 2. Only one premise, and that the first,
can be particular.

Since every premise, except the last, must be
affirmative, it is evident that the conclusions of the
constituent syllogisms, except the last, must be
affirmative. If now the first premise is particular,
the conclusion of the first prosyllogism will be par-
ticular. And if any other premise, except the first,
were particular, there would occur somewhere in the
series two particular affirmative premises, and this,

in the First Figure, involves the fallacy of undis-
tributed middle.

THE SPECIAL RULES OF THE GOCLENIAN SORITES

RULE 1. Only one premise, and that the first,
can be negative.

If more than one premise were negative, one of
the constituent syllogisms would be involved in the
fallacy of negative premises. And since, if any
premise is negative, the conclusion must be negative,
that premise must be the one which contains the
predicate term of the conclusion, that is, the first
premise in this particular case.

RULE 2. Only one premise, and that the last,
can be particular.

If any premise is particular, the conclusion of
the syllogism in which it occurs would be particular ;
and if this conclusion became a premise of another
syllogism whose premise was already particular,
there would be involved, in the First Figure, the fal-
lacy of undistributed middle. Only the last premise,
therefore, can be particular.

Epicheirema. This is a regressive chain of

reasoning in which one, or both, of the premises is
expanded by the addition of a reason. In other
words, it is an argument in which one of the prem-
ises is an enthymeme, but in which both may be.
If only one of the premises is supported by a reason,
the epicheirema is called single, and when both are
so supported, double. A single epicheirema, there-

fore, is a regressive chain of reasoning in which
one of the premises is supported by a reason. For
example :

All rational beings are to be treated with respect, inas-
much as they are made in the image of God.
Slaves are rational beings.
Therefore, slaves are to be treated with respect.

Father Clarke.

A double epicheirema is a regressive chain of
reasoning in which both premises are supported by
a reason. For example :

All Malays are cruel, because all savages are.

All the aboriginal inhabitants of Singapore are Malays,

because all the natives of that part of Asia are.
Therefore, all natives of Singapore are cruel.

Welton.

The formulae for these two kinds of epicheirema
may be written as follows :

SINGLE DOUBLE

Every M is P, because it is X Every M is P, because it is X

Every S is M Every S is M, because it is Y

Every S is P Every S is P

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QUESTIONS

1. What characteristic of human thinking underlies the forms of argument studied in this chapter?

2. What is an Enthymeme?

3. Name and illustrate the distinct types of Enthymeme.

4. How do we know whether any expressed proposition of an Enthymeme is major or minor premise or conclusion?

5. Do Enthymemes have Figure and Mood? Explain.

6. What is a Polysyllogism?

7. Under what conditions does human thinking assume a polysyllogistic form?

8. Explain and illustrate the meaning of the terms Pro-syllogism and Episyllogism.

9. Describe and illustrate the general characteristics of a Progressive Polysyllogism. By what other names is it known?

10. Describe and illustrate the general characteristics of a Regressive Polysyllogism. By what other names is it known?

11. What is a Sorites?

12. Describe and illustrate the character of an Aristotelian Sorites. Write also its structural formula.

13. Describe and illustrate the character of a Goclenian So-rites. Write its structural formula,

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14. What is an Epicheirema?

15. Explain and illustrate each type of Epicheirema, and write the formula.

EXERCISES

NOTE Write the formula for each of the propositions and syllogisms contained in your answers to the following questions.

1. What is the logical character of the following argu-ments :

(1) He must have committed the murder, for he was the only person present with the deceased at the time.

(2) Nations are justified in revolting when badly gov-
erned, for every people has a right to good govern-
ment.

(3) Death cannot be an evil, for it is universal.

(4) The planet Mars resembles the earth in possessing
atmosphere, water, and moderate temperatures,
and these conditions on the earth are necessary to
its being inhabited.

(5) He must be mad to do such a thing.

2. What is the logical character of the following argu-
ments :

(1) Misfortunes sometimes are circumstances tending to
improve character, circumstances tending to im-
prove character are promoters of happiness, what
tends to promote happiness is for the general well-
being, therefore, misfortunes sometimes promote
general well-being.

(2) A wise man is one who seeks to gain knowledge, the
man who seeks to gain knowledge must be indus-
trious, the industrious man has to make sacrifices,
to make sacrifices is always a hardship, and, there-
fore, a wise man always lives a life of hardship.

3. Prove that in an Aristotelian Sorites only the last prem-
ise can be negative, and only the first particular.

4. Construct an Aristotelian Sorites with a particular
negative conclusion.

5. Prove that in a Goclenian Sorites only the last premise
can be particular and only the first negative.

6. Construct a Goclenian Sorites with a particular negative
conclusion.

7. Give one example of each class of Epicheirema.

CHAPTER XII

DISJUNCTIVE AND HYPOTHETICAL PROPOSITIONS AND
ARGUMENTS

The Disjunctive Proposition. We have already
distinguished the various types of logical proposi-
tion, and discussed their relation to each other. We
have seen that in the categorical proposition P is
affirmed or denied of S simply. The disjunctive
proposition, on the other hand, is the expression of
an alternative predication. In the disjunctive prop-
osition, the character of S seems to waver between
a number of alternative possibilities, P or Q or M,
and we are not able to determine which of these

really, or for our purpose, belongs to S. 'S is either
P, or Q, or M,' is a typical disjunctive proposition.

Before proceedings to the discussion of the dis-
junctive syllogism, there are several questions about
the disjunctive proposition which require attention.
And, first, we may note that the alternatives which
form the predicates of such a proposition, are not
any alternatives, but are usually alternatives that
have something in common. We have met the con-
verse of this statement in the chapter on division,
where we saw that the species of a genus were to be
understood as a series of alternatives which had a
common nature. What we mean to express in our
disjunctive propositions, is, therefore, not unfa-
miliar; and the formal statement 'S is either P or Q

or M' may be interpreted to mean that P and Q and
M are predicates which are, or may be, contained
under the wider predicate R which can be asserted
of S. For example, 'He is either a lawyer, a doctor,
a teacher, or a clergyman,' may be expressed in the
simpler statement, 'He is a member of a learned pro-
fession/ The alternatives of disjunctive proposi-
tions are usually of this class, and fall within a
single domain or universe of discourse. They con-
form, as do all other statements, to the limitations
of relevant assertion. But whether every instance
of alternative predication is actually thought of in
its relation to a limiting universe is what we cannot
affirm. All we hold is that logical alternatives imply
a common basis, and that it is this common basis
that gives to disjunction its distinctive meaning.

Second, the question whether the alternatives of
a disjunction should be treated as mutually exclusive
or not has aroused a good deal of discussion, and
there seems to be no simple answer to it. The
meaning of the question may be made plain if we
give it a formal expression. When it is said that
'S is either P or Q or M,' is it necessarily implied
that S cannot be both P and Q and M? There can
be no doubt that in a great many instances the alter-
native predicates do, as a matter of fact, exclude
each other. For example, we may say that 'Plato
was born in either 429 or 427 B. C.' About the in-
surrection in Mexico we may say, 'It will either suc-
ceed or be crushed.' Some logicians maintain that
this is the only sense in which disjunctive predica-

tion can be understood in logic, and that the in-
stances in which this does not occur are due, as
Bradley says, to "our slovenly habits of expression
and thought," and are "no real evidence against the

exclusive character of disjunction." On the other
hand, attention may be called to the fact that we
do express our meanings in disjunctive forms which
cannot or need not be interpreted in this exclusive
manner. For example, ' He is either a fool or a
knave' may mean that he is the one or the other,
but it is quite possible for a knave to be a fool, and
a fool, a knave. In such cases as this, where the
truth-import and the statement-import are not neces-
sarily the same, we are following the line of least
error if we choose the less determinate meaning, in
the absence of any indication that the more deter-
minate meaning is the one intended. What the
statement *S is either P or Q or M/ therefore, means
is that S cannot be neither P nor Q nor M ; it must
be one, and, unless otherwise indicated, it may be
more than one. We must be guided in our interpre-
tation, not by the form of the proposition, but by the
nature of its subject-matter.

Third, the series of alternatives that constitute
the predicates of disjunctive propositions must be
exhaustive. That is, they must determine com-
pletely the alternative possibilities in the given in-
stance. If we say The water is either hot or cold/
the statement is misleading, if we assume that
all the alternatives of the disjunction are ex-
plicitly stated. But if we say The water is either

hot or cold or of some mean temperature/ the state-
ment is true, and, in principle, exhaustive. It would
seem, therefore, that to secure an exhaustive enu-
meration of alternatives were more fundamentally
important than to make them exclusive ; and in any
case we can say that the latter is sometimes im-
possible where the former presents no particular
difficulty.

The Nature and Classes of the Disjunctive Syllo-
gism. The syllogism whose major premise is a dis-
junctive proposition is called a disjunctive syllo-
gism. The significance of such a syllogism consists
in the fact that conclusions may be inferred from
premises that are indeterminate in content; or,
that the truth of any proposition may rest upon a
number of conditions, one or more of which may be
undetermined in character.

We may distinguish two classes of disjunctive
argument, according as the nature of the subject
of the disjunctive major premise requires two, or
more than two, terms to state exhaustively the alter-
native possibilities. If the major premise of a dis-
junctive argument has two alternatives in its pred-
icate, the argument is called a simple disjunctive
syllogism; if the predicate term of such an argu-
ment presents more than two alternatives, the argu-
ment is called mixed. The reason for this distinc-
tion is that the character of the other two proposi-
tions of the syllogism is affected by the consider-

ations to which we have adverted. For in such
arguments as we are at present concerned with, it

is evident that we can only affirm or deny one or
more of the alternatives presented by the major
premise, such affirmation or denial giving us the
minor premise; and deny or affirm the remaining
alternative, or alternatives, such denial or affirma-
tion giving us the conclusion of the syllogism. Thus,
the general rule to which disjunctive arguments
must conform is that to affirm or deny one or more
of the members of a series of alternatives is to deny
or affirm the remaining member or members. Now
if the disjunctive major premise presents only a
pair of alternatives, the minor premise and con-
clusion of the syllogism are both categorical prop-
ositions; there is, in other words, only one disjunc-
tive premise, and that the major. Such an argu-
ment is called a simple disjunctive syllogism. If,
on the other hand, there are more than two alter-
natives in the disjunctive major premise, one, or
both, of the other propositions of the syllogism must
be disjunctive also. In such a case, we call the argu-
ment a mixed disjunctive syllogism.

The Moods of the Disjunctive Syllogism. Each
class of disjunctive argument has two moods, de-
pending upon whether the minor premise affirms or
denies one or more of the alternatives presented by
the major premise. The names of these moods,
like those that we shall meet with in our study of the
hypothetical syllogism, are derived from the Latin
words which denote the quality of the propositions
which constitute the minor premise and conclusion
respectively. For example, if the minor premise is

negative, and the conclusion is affirmative, the mood
of the syllogism is called the Modus Tollendo Ponens,
that is, the mood which by denying affirms. If, on
the other hand, the minor premise is affirmative,
and the conclusion is negative, the mood is called
the Modus Ponendo Tollens, that is, the mood which
by affirming denies. These statements will be
understood if read in connection with the formulae
for the two classes of disjunctive syllogism in each
of these moods which follow :

DISJUNCTIVE SYLLOGISM

MOOD

Ponendo Tollens

Modus
Tollendo Ponens

SIMPLE

A is either B or C.
A is B.

A is either B or C.
A is not B.
A is C.

MIXED

A is either B or C or D.

A is B.

A is not either C or D.

A is either B or C or D

A is not B.

A is either C or D.

The Validity of Disjunctive Arguments. A fur-
ther question relates to the validity of these moods.
We have seen that disjunctive propositions are
required to state their alternatives exhaustively,
that is, to enumerate alternately all the possibilities
presented by the subject-matter under consideration.
We have also seen that in some cases the alternatives
are at the same time exclusive, that is, incompat-
ible. Thus, 'A is either B or C' may mean (1) 'A
is either B or C, but not statedly both;' or it may
mean (2) 'A is either B or C, but statedly not both/

that is, the equivalent of 'A is either B or else C.'
Now in whichever way we understand the disjunc-
tive proposition, an argument based upon it is valid

in Modus Tollendo Ponens, because all disjunctive
arguments imply the presence in the subject of one
or more of the alternatives specified in the predicate
of the major premise. That is to say, the subject
cannot be neither of the predicated alternatives.
The meaning of the subject professedly is to be
found within the number of enumerated predicates.
Hence, whether the predicates are exclusive or not,
to deny one or more of a subject is to bring the
subject nearer to one or more of the remaining
predicates. That is, the Modus Tollendo Ponens em-
phasises the exhaustive character of the disjunctive
major. On the other hand, the Modus Ponendo Tol-
lens is valid only when an exclusive reading of the
major is understood. For example, when we say
of any one that 'He is a fool or a knave/ we cannot
infer that because 'He is a fool/ that 'He is not a
knave/ unless it is distinctly understood that the
individual case precludes the possibility of him being
both. Thus, if we wish to state this meaning unam-
biguously, we should have to say 'He is either a fool
or else a knave/ thereby implying that he is not
both together. When, therefore, the disjunctive
major takes the form of 'statedly not both or all the
predicates/ the Modus Ponendo Tollens is a valid
mood for disjunctive arguments. This mood empha-
sises the exclusive character of the disjunctive
major.

The Hypothetical Proposition. Any proposition
which states a connection between two possibilities
is hpyothetical. For example, 'If water is heated at
standard pressure, it will boil at 100 C.' There are
two characteristics of a hypothetical proposition to
which attention should be given. _JThe firat_is_that
it isjhe form of statement in which w_a express our
judgments when the material of these judgments is
possible^ not actual. This does not mean that the
material dealt with may not be actual, it means only
that we are not concerned with it as existing, but
with the situations in which it is possible for it to
exist. Thus, to take the judgment which is ex-
pressed in the proposition 'If eggs are scarce, they
will be dear.' In this proposition we are not assert-
ing that 'eggs are scarce,' nor are we affirming that
'they are dear;' we are merely stating that 'when-
ever eggs are scarce, they_ are_ &t_:the same time
dear.' In other words, we are stating a connection
between 'it is possible for eggs to be scarce,' and
'it is possible for them to be dear.'

The second characteristic of hypothetical prop-
ositions relates to the kind of connection that they
affirm. This may be brought out if we regard the
judgments underlying hypothetical statements to be
concerned with the development of the consequences
that follow from a supposition. What leads to the
erection of a supposition is, doubtless, some feature
of an actually existing situation which cannot be
brought under direct observation; but the supposi-

tion itself is not part of the situation in the same

sense that the feature itself is. Any supposition is a
suggestion which is based upon a wider range of ex-
perience than the circumstances which calls it forth,
and we fall back upon this broader experience to
guide us in dealing with a situation that is proble-
matical. Now problematic situations can be de-
veloped only in a series of possibilities, and possi-
bilities are expressed in hypothetical propositions:
'If A is B, it is C.' The part of the hypothetical
proposition which states the supposition or condition
is called the antecedent, the part which states the
result of the supposition is called the consequent.

is thus affirmed by hypothet-

ical propositions is a relation of dependence between
antecedent and consequent, such Jhflt the truth ?*

lishment of the_ antecedent. The hypothetical
proposition thus states a rule under which we may
bring for testing any fact or situation about which
we are at all doubtful. It should be observed that
it is the nature of the thought expressed, and not
the form of the expression that constitutes any
proposition hypothetical. While usually we intro-
duce hypothetical statements with 'if,' they may be
prefaced by 'granted that/ 'suppose that,' 'allowing
that,' 'whenever,' 'wherever;' and sometimes there
is no verbal sign to indicate that our thought is
hypothetical, as, for example, 'Trespassers will be
prosecuted/ 'Deserters will be shot on sight/ etc.

The Hypothetical Syllogism. Any syllogism in
which the major premise is a hypothetical proposi-

a hypothetical syllogism. In hypothet-

ical arguments the minor premise and the conclusion
are both categorical propositions. Now since the
major premise states a connection between two
possibilities, the. ^jnin^r^premise must state some-
thing about one or other of these possibilities cate-
^gorically if there is to be an inference. The only
things that can be stated are that either of the pos-
sibilities has or has not been verified. Theoretically,
this would give four kinds of hypothetical syllo-
gism, the minor premises of which would affirm and
deny separately the antecedent and consequent of

the major premise. Two of these, however, fail to
give the proper basis for an Inference, .namely, when
minor premise HpmVfl thfii<U^ p(V^ PT1 ' < 'i and when
consequent. The reason for the fail-

ure is that we are in each case required to go be-
yond what is contained in the major premise. For
example, when we say 'If A is B, it is C,' we are not
to be understood to mean that the only condition of
'A being C' is that 'A is B.' We said above, for in-
stance, that 'If eggs are scarce, they are dear;' but,
of course, they may be dear for other reasons as
well, a corner on the market by the cold storage
interests, for example. Hence, if we were to deny
the antecedent of this proposition, 'Eggs are not
scarce/ and use this as a minor premise, we could
not infer that 'they are not dear.' . The antecedent
of a hypothetical proposition states a condition, but
3bes not offer itself as the sole condition of the
truth of the consequent. If, on the other hand,

we were to affirm the consequent, 'Eggs are dear/
we cannot infer that 'they are scarce/ and the rea-
son is the same. The forms of the syllogism are
reduced, therefore, to two, in one of which the
minor premise affirms the antecedent of the major,
and in the other the minor premise denies the con-
sequent of the major. In reference to these forms
of the syllogism, we may state the general rule of
hypothetical arguments as follows : When two pos-
sibilities are related as antecedent and consequent,
the truth of the consequent follows from the truth
of the antecedent, and the falsity of the antecedent
follows from the falsity of the consequent.

The Moods of the Hypothetical Syllogism. Corre-
sponding to these two forms of hypothetical argu-
ment we may distinguish two moods of the syllo-
gism. There is first the argument in which the
minor premise affirms the antecedent of the major
premise, the Modus Ponens ; and, second, the
argument in which the minor premise denies the
consequent of the major premise, the Modus Tol-
lens.

The antecedent and consequent of the major
premise of any hypothetical syllogism may be either
affirmative or negative. In each of the two moods,
therefore, we may distinguish four forms of hypo-
thetical argument as follows: (1) the antecedent
and consequent of the major premise may both be
affirmative; (2) the antecedent may be affirma-
tive, and the consequent negative; (3) the antece-
dent may be negative, and the consequent affirm-

ative; (4) both antecedent and consequent may be
negative. It will be evident that arguments in these
moods will have sometimes an affirmative and some-
times a negative proposition in the minor premise,
and the same will be true of the conclusion. The
names of the several forms of the moods of hypo-
thetical syllogisms, like those of the disjunctive syl-
logism, are derived from the Latin words which de-
scribe the quality of the propositions which consti-
tute the minor premise and the conclusion. We
shall briefly characterise each mood and give exam-
ples and formula for the different forms of the two
moods.

i. Modus Ponens, the mood in which the minor
premise affirms the antecedent of the major premise,
and the conclusion affirms the consequent. Argu-
ments in this mood are said to be Constructive.
The validity of arguments in this mood is based
upon the fact that we are bound to accept whatever
follows from any data we have accepted. If, for
example, we accept as a possibility a fall in temper-
ature, we are bound to accept whatever is condi-
tioned upon this possibility, say, colder weather.
We may, therefore, construct a hypothetical argu-
ment in this mood as follows :

A fall in temperature means colder weather.
The temperature is falling.
Therefore, the weather will be colder,

The different forms of the Modus Ponens are
given here with illustrations of each form.

1 i) Modus Ponendo Ponens, the mood which by

affirming affirms.

If A is B, it is C. If any county increases in wealth,
it increases in power;

A is B, The United States is increasing in

wealth,

A is C, Therefore, the United States is in-

creasing in power.

(2) Modus Ponendo Tollens, the mood which by

affirming denies.

If A is B, it is-not C. If any import duty is imposed
simply for revenue purposes, that
duty is not protective;

A is B. The English import duties are im-

posed simply for revenue purposes;

A is-not C. Therefore, they are not protective.

(3) Modus Tollendo Ponens, the mood which by

denying affirms.
If A is not B, it is C. If any swan is not white, it is

black ;

A is-not B. Australian swans are not white,
A is C. Therefore, they are black.

(4) Modus Tollendo Tollens, the mood which by

denying denies.

If A is-not B, it is-not C. If any war is not defensive,
it is not just;

A is-not B. The wars waged by Napoleon the

Great were not defensive,
A is-not C. Therefore, they were not just.

2. Modus Tollens, the mood in which the minor
premise denies the consequent of the major premise,
and the conclusion denies f f h^ antPppHpnt Argu-
ments in this mood are said to be Destructive. The
validity of arguments in this mood follows from the
relations expressed by the major premise. For if
B follows of necessity from the existence of A,
'If A then B,' the failure of B to appear must mean
the absence or non-existence of /L An illustration
of an argument in this mood is :

If no men were mad, asylumsjwould be useless,
Asylums are-not useless,
Therefore, s_ome men are mad.
The different forms of the Modus Tollens are
given here with illustrations of each form.^

(i) Modus Tollendo Tollens, the mood which by
denying denies.

If A is B, it is C. If any country is civilised, it has
a population amongst whom educa-
tion is general;

A is-notjC^ The people of Russia are not gener-
ally educated;

A is-not B. Therefore, Russia is not a civilised
country.

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(2) Modus Ponendo Tollens, The mood which by
affirming denies.

If A is B, it is not C. If any social institution is
justifiable, it oppresses no class of
the community;
A is C. Slavery does oppress a class of the
community,
A is-not B. Therefore, it is not justifiable.

(3) Modus Tollendo Ponens, the mood which by
denying affirms.

If A is-not B, it is C. If any railroad is not required
in the district through which it runs,
it is a financial failure;
A is-not C. The great American lines are not
financial failures,
A is B. Therefore, they are required in the
districts through which they run.

(4) Modus Ponendo Ponens, the mood which by
affirming affirms.

If A is-not B, it is-not C. If any country has no
capital invested abroad, its imports
will not exceed its exports;

A is C. England's imports do exceed her ex-
ports,

A is B. Therefore, England has capital in-
vested abroad.

Dilemmas. We come now to the study of dilem-
mas, a class of arguments which combines in various
ways characteristics of the three kinds of proposi-

tion already studied, the categorical, the disjunctive,
and the hypothetical. The peculiar feature of a
dilemmatic argument is that it presents a choice
between two alternatives. When used for rhetor-
ical purposes these alternatives are of such a kind
that, whilst one of them must be accepted, both lead
to disagreeable results. To force by argument the
acceptance of one or other of a pair of alternatives

is the chief function of the dilemma, and as the re-
sult of such an argument an opponent is said 'to be
on the horns of a dilemma/ Arguments in which
the choice rests among three alternatives are not
dilemmas in the strict definition of the term, but
trilemmas, just as those which force a choice among
four alternatives are tetralemmas. The principle?
of all these arguments, however, are the same, and
it will be sufficient to study them in connection with
the simplest forms, the dilemmas.

The dilemma may be defined as a syllogism with
a compound hypothetical major premise and a dis-
junctive minor. By a compound hypothetical prop-
osition is meant one in which there is a plurality
of terms in either the antecedent or consequent, or
in both. The simplest form of hypothetical prop-
osition, we have seen, is 'If A is B, it is C.' Such
a proposition may become compound by adding
terms to antecedent and consequent. 'If A is B, it
is C or D,' is a compound hypothetical proposition,
and we must understand it to mean 'If A is B, it is
C* and 'If A is B, it is also D.' That is to say, there
is no true disjunction in this case, but only an ab-

breviated expression of two simple hypothetical
propositions. The same remarks hold good also of
the other forms that compound hypothetical prop-
ositions may assume; for example of, 'If. _A is B or
C^iLisJ) ;' 'If A is B or C, it is D or E.' Proposi-
tions of this type form the major premises of dilem-
matic arguments. The reason why propositions of
this type constitute the major premise of dilemmatic
arguments is quite clear. For if the dilemma is
thought of as an argument which leads to a con-
clusion through the affirmation or denial of alter-
natives in the minor premise, the major premise of
such an argument must provide the basis for the
alternatives affirmed or denied in the minor premise,
and this it can do only when there is a plurality of
terms in the antecedent, consequent, or both, of
the major premise. In view of these more general
statements, the structure of the dilemma will be
evident from the following analysis :

1. The major premise is a compound hypothet-
ical proposition

a. with a one-term antecedent and a two-
term consequent,

with a two-term antecedent and a one-
term consequent,

c. or with a two-term antecedent and a two-
term consequent.

2. The minor premise is a disjunctive proposi-
tion,

3. The conclusion is

a. either a categorical proposition, when the
major premise has a one-term antecedent
or consequent.

b. or a disjunctive proposition, when the
major premise has a two-term antecedent
and consequent.

Classes of Dilemma. Dilemmas, which are gov-
erned by the laws of the hypothetical syllogism, are
of two kinds, Cojosiructive and Destructive. ^A
dilemma is said to be constructive when the minor
premise affirms the antecedent of the major, and to
be destructive when it denies the consequent of the
major disjunctively. Within each of these kinds,
there are two forms, Simple and Complex. A
dilemma is said to be simple when its major premise
has a single antecedent or consequent, and it is said
to be complex when both the antecedent and conse-
quent of the major premise contain two terms. We
proceed now to the study of each of these kinds of
dilemma, and to an examination of the forms that
they may assume.

i. Constructive Dilemma, an argument which
proceeds from the acceptance of the antecedent to
the acceptance of the consequent of the major
premise.

(i) Simple Constructive Dilemma, an argument
whose minor premise affirms disjunctively the ante-
cedent of the major, and whose conclusion categor-
ically affirms the consequent.

If either A or B, then C., If a science furnishes use-
ful facts, or if the study of it exer-
cises the reasoning powers, it is
worthy of being cultivated;

Either A or B. But either a science furnishes useful
facts, or its study exercises the rea-
soning powers;

Therefore, C. Therefore, it is worthy of being cul-
tivated.

(2) Complex Constructive Dilemma, an a r g u-
ment whose minor premise disjunctively affirms the
antecedent, and whose conclusion disjunctively
affirms the consequent.

If A then C, and if B then D. If Aeschines joined
in the public rejoicings, he is incon-
sistent; if he did not he is unpa-

triotic ;

Either A or B. But either he did or did not;
Therefore, either C or D. Therefore, he is either

inconsistent or unpatriotic.

2. Destructive Dilemma, an argument which
proceeds from the denial of the consequent to the
denial of the antecedent.

(i) Simple Destructive Dilemma, an argument
whose minor premise denies disjunctively the conse-
quent of the major, and whose conclusion categor-
ically denies the antecedent.

If A, then both B and C. If table-rappers are to be
trusted, the departed are spirits, and
they also exert mechanical energy ;

Either not B or not C. But either the departed are
not spirits or they do not exert me-
chanical energy;

Therefore, not A. Therefore, table-rappers are not
to be trusted.

(2) Complex Destructive Dilemma, a n a r g u-
ment whose minor premise disjunctively denies the
consequent of the major, and whose conclusion dis-
junctively denies the antecedent.
If A then C, and if B then D. If the industry of the
United States is well organised, there
is work for every efficient labourer
who seeks it, and if all labourers are
industrious, they will seek work.
Either not C or not D. But either some labourers
cannot get work, or they will not
seek it;

Therefore, either not A or not B. Therefore, either
the industry of the United States is
not well organised, or some labourers
are not industrious.

The Validity of the Dilemma. The logical value
of dilemmatic arguments has frequently been called
in question. Thus Jevons says, "Dilemmatic argu-
ments are more often fallacious than not." It may,
therefore, serve to emphasise the character of these
arguments if we indicate where their use may in-
volve us in error. The fallacious character of a
dilemma must be sought either in the major or in
the minor premise. In the major premise, the ante-

cedent or consequent may not express possibilities,

in which case the error will be easily detected; or
the asserted connection between them may be false,
in which case the error is likely to be obvious. For
example, if we do not admit that 'A is B' and 'A is C'
are possibilities, then we are not likely to admit that
'If A is B, it is C' is a possible premise of an argu-
ment. But if we admit both as possibilities, we may
not admit that the one follows as a consequence from
the other, and this will preclude 'If A is B, it is C'
from figuring as the major premise of an argument.
We thus see that before we can accept a compound
hypothetical proposition as the major premise of a
syllogism, we are required to admit that both ante-
cedent and consequence are possibilities, and that
they are related to each other as condition and con-
ditioned. For example, it is possible for a triangle
to be equilateral, it is also possible for a triangle to
be equiangular, but in this case wherever one of
these possibilities is realised the other is also found,
the one is conditioned by the other. These are the
facts that we express in the statement, 'If a triangle
is equilateral, it is equiangular/

Error arises most frequently, however, in the
minor premise. The reason for this is that the
alternatives may not be either exhaustive or ex-
clusive. The difficulty of getting a dichotomous
alternative which is exhaustive is due partly to the
complex nature of the subjects of discourse, and
partly to the fact that the major premise of these
arguments is concerned only with the relation of

antecedents and consequence, and not with disjunc-
tive relations. The proposition 'If A is B, it is C
or D' means, as we have seen, that 'A is B' is the
condition of both 'A is C' and 'A is D/ When,
therefore, we affirm these two disjunctively in
the minor premise of an argument, we must do so
on other grounds than that they are antecedents or
consequent of a compound hypothetical major pre-
mise. Hence, to quote Jevons, "if we were to argue
that 'if a pupil is fond of learning, he needs no
stimulus, and that if he dislikes learning, no stimulus
will be of any avail; but as he _is_ either fond of
learning or dislikes it, a stimulus is either^ needless
or of no avail,' we evidently assume improperly the
disjunctive minor premise. Fondness and dislike
are not the only two possible alternatives, for there
may be some who are neither fond of learning nor
dislike it, and to these a stimulus in the shape of
rewards may be desirable. Almost anything can be
proved if we are allowed to pick out two of the
possible alternatives which are in our favor, and
argue from these alone."

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QUESTIONS

1. What kind of predication underlies the disjunctive prop-
osition?

2. What relation has disjunctive assertion to the universe
of discourse?

3. Discuss the question whether the alternatives of a log-
ical disjunction are exclusive.

4. "The alternatives of a disjunctive proposition must be
exhaustive." Explain.

5. What are the characteristics and significance of a dis-
tinctive syllogism?

6. Discuss and illustrate the main classes of disjunctive
syllogism.

7. Why do we distinguish classes of disjunctive argument?

8. What are the functions of the minor premise and con-

clusion of a disjunctive syllogism?

9. In what Moods may a disjunctive syllogism be stated?

10. How will your interpretation of 'A is either B or C' be affected, if the alternatives are understood to be ex- clusive, and if they are understood to be not necessarily exclusive?

11. Why is the disjunctive syllogism in Modus Tollendo Ponens valid whichever view of alternation we take?

12. Why is a disjunctive syllogism in Modus Ponendo Tol- lens valid only if we give an exclusive reading of the major premise?

13. What is a hypothetical proposition?

14. Name and state the difference between the main classes of hypothetical proposition.

15. What is meant by saying that the material of the judg- ments which are expressed in hypothetical propositions is possible not actual?

16. "Hypothetical propositions state the connection of a sup- position and what follows from it." Explain.

17. Into what two parts may a hypothetical proposition be analysed?

18. What are the characteristics of a hypothetical syllogism?

19. Why does the denial of the antecedents, and the affir- mation of the consequents of the major premise of a hypothetical syllogism make it impossible to state any valid conclusion?

20. What are the rules of valid inference for hypothetical arguments?

21. In what Moods may a hypothetical argument be stated validly?

22. In what Mood is a hypothetical argument constructive?

23. Describe and illustrate the Modus Ponens, and state why hypothetical arguments in this Mood are valid.

24. State and illustrate the different forms of the Modus Ponens.

25. In what Mood is a hypothetical argument destructive?

26. Describe and illustrate the Modus Tollens, and state why hypothetical arguments in this Mood are valid.

27. State and illustrate the different forms of the Modus
Tollens.

28. What is it to be 'on the horns of dilemma'?

29. How do dilemmas, trilemmas and tetralemmas differ
from one another?

30. Define a dilemma.

31. What are the various theoretically possible forms of
dilemma?

32. What is a constructive dilemma?

33. Describe and illustrate the various forms of constructive
dilemma.

34. What is a constructive dilemma?

35. Describe and illustrate the various forms of destructive
dilemma.

36. What must we admit with respect to the major premise
of a dilemma before it can serve as the basis of a valid
conclusion?

37. What sources of possible error are found in the minor
premise of a dilemmatic argument?

EXERCISES.

1. Write three disjunctive propositions in which the alter-
natives are exhaustive and exclusive.

2. Construct on the basis of your answer to the previous
question three arguments in Modus Ponens.

3. Construct three disjunctive syllogisms in Modus Tollens.

4. Write three hypothetical propositions, only one of which
may be introduced by 'if.'

5. State the nature and Mood of the following arguments,
and examine their validity:

(1) If the study of logic furnishes the mind with a mul-
titude of useful facts, like other sciences, it would
deserve to be cultivated ; but it does not furnish the
mind with a multitude of useful facts; therefore,
it does not deserve cultivation.

(2) Mars must have warmth sufficient for protoplasmis
metabolism, if life exists there; but life is not pos-
sible there, since the planet has not sufficient
warmth for the purpose named.

6. What are the nature and validity of the following argu-
ments :

(1) If you say what is just, men will hate you; and if
you say what is unjust, the gods will hate you.
you must say one or the other. Therefore, you
you will in either case be hated.

(2) If he were clever, he would see his mistake; and if
he were candid he would acknowledge it. But either
he does not see his mistake, or will not acknowl-
edge it. Therefore, he is either not clever or not
candid.

CHAPTER XIII
INDUCTION AND METHODS PRELIMINARY TO INDUCTION

General Statement of the Problem. In the fore-
going chapters, knowledge was said to have two
sides, from one of which it is seen to be almost
wholly identified with what we call truth, and from
the other it appears to be almost wholly concerned
with what are called facts. On whichever of these
two sides of knowledge we may chance to look, we
are exposed to the danger of neglecting the other,
and thus of forgetting that the distinction of truth
and fact is only relative. If we say that the dis-
tinction is one that concerns the contrast that is
ordinarily made between our thoughts-about-objects
(truth) and the objects-thought-about (facts), it
will not require a great deal of analysis to show that
truth and fact are not two separate things, but two
ways of looking at the same thing; and conse-
quently, that if we try to separate them, in order
to give exclusive existence to either, we can get rid
of the one only by losing our grasp also upon the
other. Thoughts without things are empty, and
things without thoughts are meaningless.

Our previous discussions have led us to lay em-
phasis mainly upon the various ways in which our
thoughts-about-things are capable of constant im-
provement and expansion. We may be said to have
taken for granted the existence of truth, and our

problem was to study the methods by which one
truth is or may be connected with another; to ex-
pound in an elementary way the systematic char-
acter of truth. From this point of view, the syllo-
gism appeared as an instrument for bringing par-
ticular truths under general rules; it enabled us to
see what were the conditions of the connection of
one truth with another. In definition and classifi-
cation we were studying how to make truth more
explicit, to rid it of ambiguity, and to bring out
other important features. In brief, we have been
studying the judgment as the- distinctive element
in knowledge, and expounding the relations that

judgments may sustain to each other.

In the present chapter, we turn to another group
of problems that is suggested when attention is
given to facts rather than, truths. Now about
facts, the logical consideration of which is commonly
referred to as induction, we are primarily interested
to know how facts are constituted; what we mean
by fact, and what conditions fact must satisfy if
the world of fact, like the world of truth, is to be-
come systematic. Broadly stated, the problem of
induction is an inquiry into the process by which,
when we start with particular facts, universally
valid statements about reality can be established.

What is Meant by Fact. There are several fea-
tures of this statement of the problem of induction
that need elucidation. And first, what precisely do
we mean by fact? The word is used in a narrower
and a broader way. It is used in a narrow sense

to indicate the objects of our knowledge of the mate-
rial world, such as trees, mountains, railroads,
streets, houses, etc. In the broader sense, it is used
to indicate any object of knowledge, whether mate-
rial or not, of which we may be said to have knowl-
edge. Used in this latter way, a sensation, an idea,
a purpose, an emotion, when they are made the
objects of knowledge, would also be facts. If we
compare these two uses of the word, we shall see
that a single meaning underlies both; they differ
only in the range of its application. For both, a
fact is any object of which we are said to possess
knowledge.

We may observe further that by knowledge as a
conscious process is meant a judging process ; hence,
we may say that whatever is the object of a judging
process is a fact, and nothing else is. What a judg-
ing process is has been explained in earlier chapters,
and it is important here merely to remark that
it is only when objects are made the subjects of
judgments, and are qualified in distinctive ways,
that they can be spoken of as facts. Facts, then,
are objects that have been qualified by our thoughts
about them. Now there are a number of ways in
which facts are qualified by our thoughts about
them ; for instance, we think about them as possess-
ing certain qualities, as being in a certain place, as
continuing to exist for a certain length of time, as
related to other objects in numerous ways. The
important words in these instances are quality,

place, time, relation. In logic these are called cate-
gories.

The problem of the categories is much too diffi-
cult a subject for discussion in an elementary book
of logic, but the student is required to understand
at least what the word means and how it is used.
We may say, then, that the categories are names
for the differences in the forms of our thought about
things; and, because thoughts and things imply
each other, they indicate also a distinction in the
nature of the things about which we think. If we
remember that etymologically category means pred-
icate, the categories may be looked upon as a list of
the classes of attributes that can be predicated of a
subject in a logical proposition. Thus, if we say
that 'Man is an animal,' the term animal tells us
what kind of a substance man is; we are thinking
about man under the category of substance. If,
again, we say that The violets have a sweet odour/
we are thinking about violets under the category of
quality. How many categories or generic differences
in the forms of our thought about things there are
is a matter that does not concern us here; the list
varies with different writers, but Aristotle names
ten. The point to emphasise is that the predicates
of logical propositions can be classified under a
number of main heads which denote the general
forms of our thinking about things, and these forms
of thought are called categories. Until we have
thought the objects of consciousness under one or
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more of the categories in an act of judgment, they
are not properly called facts; a fact is, from this
point of view, any object of consciousness which
has been thought under one or more of the cate-
gories.

Nature of Reality. Our statement of the induc-
tive problem contains, secondly, the word reality. It
is, we said, about reality that we seek universally
valid judgments. What is reality? The answer to
this question, like that of the categories, is too diffi-
cult for an elementary discussion, and besides the
subject itself belongs to another department of phil-
osophy, namely, to metaphysics. But we may under-
stand the term well enough for our present pur-
poses, if we utilise the results of our examination
of the meaning of fact. Broadly stated, by reality
is meant the 'world of fact.' What such a phrase as
that just employed is ordinarily understood to
emphasise is that facts are not isolated, unrelated
things ; that they are, on the contrary, connected in
numerous ways with other facts. This is a matter
of our ordinary every day observation and expe-
rience. We put our hand in the fire and it is burned.
We eat too much or eat the wrong things, and our
bodies suffer. In the social world, we have a dis-
agreement with one person, and the behaviour of a
number of others toward us is affected thereby.
The movements of the planetary bodies regulate our
seasons, the rain fall determines the size of our

crops. These instances are sufficient to suggest,
what is true throughout our experience, that facts

do not exist apart from each other, but are, so to
speak, bound up in bundles together. Such bundles
or groups of fact we speak of as worlds of fact.
If we carry our observation further, it will appear
that as individual facts are related to each other so
these bundles of facts are connected in numerous
ways. The combinations of these more complex
groups we may also call worlds of fact. Thus we
have the world of commerce, the world of conduct,
the world of religion, the world of science. Within
each of these worlds, the facts, although diverse,
are generically related, they are facts of a given
kind. Looked at in one way, it seems as if these
several worlds had little if anything in common, and
that there were consequently a pluralism of such
worlds. A little closer study has convinced some
men, however, that we can detect a likeness between
some of these worlds on the ground that they are
concerned with material things, and that a likeness
exists between still others on the ground that they
are concerned with mental things. If this is true,
the many worlds are reduced to two, each of which
is very complex, and between which there is said
to exist no similarity at all. Whether this is true
or not we need not discuss ; it is a question that be-
longs to the philosopher, and there does not seem to
be any general agreement about it. The point to
emphasise is that whether there be one or many
worlds of fact, every one is agreed that when we
speak about reality we are speaking about those
worlds and the facts therein contained. When,

therefore, we say that the problem of induction is
an inquiry into the processes by which, starting
with particular facts, universally valid statements
about reality can be established, we mean that we
are interested in finding out the truth about these
worlds, what are the relations between the facts
which give these worlds their characteristic fea-
tures, and make them the permanent realities they
appear to be.

Our study of this problem falls into two parts.
In the first part, we shall consider a number of
processes preliminary to induction, and with which
induction frequently has been confused; in the sec-
ond part, we shall expound the inductive process
strictly so-called, a process, however, which we shall
see emerging into a clearer and clearer light in our
exposition of the first part. The present chapter is
devoted to the former task; the next four to the
latter.

Induction by Simple Enumeration. A prevalent
notion identifies induction with an examination of
a number of instances of a given phenomenon.
Whenever we are comparing a number of particular
facts for the purpose of discovering in what re-
spects they are alike, we are supposed, by those who
hold this view, to be engaged in an inductive pro-
cedure. In agreement with this supposition, the dis-
tinction has been drawn between perfect and imper-
fect induction. In the case of perfect induction, we
are dealing with a group of facts all the members
of which are known. Thus, we may make state-

ments about the days of the week or the months of
the year, and be quite sure that no instances, other
than those we have examined, will occur to make a
revision of our judgment necessary. We may say,
for example, that 'All the months of the year have
less than thirty-two days,' and 'The week consists
of seven days.' Whenever the group of facts we are
examining is known to be limited, we may collect
all the instances and observe each before making
the general statement. The enrollment of students
in a college class is such a definitely limited group,
and about it we may, for example, make the state-
ment that 'None of the students in this class is over
six feet tall.' Imperfect induction is based upon
the same principle of counting and comparing in-
stances, but we have no assurance that all the cases
that have been examined are all the cases that exist,
and, therefore, a lower degree of certainty is sup-
posed to belong to the statements that, under these
circumstances, we are able to make. This was the
view of induction commonly held during the Middle
Ages. It consists in stating that all the known in-
stances of a given kind possess a certain attribute,
and, therefore, that all instances of this kind will
be found to possess the same attribute. For ex-
ample, the Negroes of Africa for centuries had seen
no human beings who were not black; they would,
therefore, suppose that all human beings were black.
For many centuries each and every crow that had
been observed by Europeans was black; it was,
therefore, supposed that all crows were black. In

both these instances the induction has been found
to be erroneous. The fault to which every imperfect
induction is liable is that experience is likely at some
time to prove it wrong.

Both of these kinds of induction have been re-
jected by writers in the modern era, and especially
by Bacon and Mill. Perfect induction, Mill says, is
of no scientific value ; the conclusion is only a state-
ment in a different form of the premises. The con-
clusion, in other words, is merely an enumerative

judgment, a judgment which summarises the
data and does not lead beyond them. In induction
proper, we are said to go beyond what is con-
tained in our data ; we proceed from the known par-
ticulars to the unknown universal, from what is
true of a given case or number of cases to what is
true always and everywhere of all cases whatsoever.
Jevons, on the other hand, defends perfect induc-
tion, and in doing so states very well the value that
we may attach to this process. He says: "If Per-
fect Induction were no more than a process of abbre-
viation, it is yet of great importance, and requires
to be continually used in science and common life.
Without it we could never make comprehensive
statements, but should be obliged to enumerate
every particular. . . . The fact is, that the power
of expressing a great number of particular facts in
a very brief space is essential to the progress of
science. Just as the whole art of arithmetic con-
sists in nothing but a series of processes for abbre-
viating addition and subtraction, and enabling us to

deal with a great number of units in a very short
time, so Perfect Induction is absolutely necessary
to enable us to deal with a great number of par-
ticular facts in a very brief space."

The case of imperfect induction is not in prin-
ciple different. Imperfect induction, says Bacon,
"proceeds by merely citing instances and is a child-
ish affair (res puerilis) , and being without any cer-
tain principle of inference it may be overthrown by
a single negative instance." By a negative instance,
Bacon means an instance which contradicts all the
instances that previously have been examined. For
example, a single instance of a grey crow over-
throws the inference that all crows are black. Mill,
referring to imperfect induction, says that "it con-
sists in ascribing the character of general truths to
all propositions which are true in every instance
that we happen to know of. ... In science it
carries us but a little way. We are forced to begin
with it; we must often rely on it provisionally, in
the absence of means of more searching investiga-
tion. But, for the accurate study of nature, we re-
quire a surer and a more potent instrument." This
more potent instrument is "to be found in interro-
gating nature" by experiment, so as to discover the
conditions under which the phenomena occur.

The Value of Simple Enumeration. In the pre-
ceding section, we have examined the two forms of
induction by simple enumeration, and we have seen
that in perfect induction all the positive instances,
and in imperfect induction a larger or smaller num-

ber of the positive instances of a phenomenon are
available for observation. The conclusion that is
based upon a complete enumeration of the instances
does not go beyond these instances themselves,
whereas the conclusion that is based upon an in-
complete enumeration is understood to apply also
to instances that have not been examined and that
may not be known to exist. In the former case, the
conclusion may be described as an empirical general-
isation ; in the latter, the conclusion has the charac-
ter of an hypothesis which is held subject to revision
or rejection in view of our examination of other
instances that may come to light. These descrip-
tions serve to distinguish the scientific value of these
two forms of simple enumeration. Perfect induc-
tion belongs to the stage preliminary to induction,
whilst imperfect induction must be classed among
the steps of induction properly so-called. The lat-
ter, we shall reserve for future consideration, and
turn our attention immediately to the former.

Empirical Generalisation. Induction by complete
enumeration, which, as we said, leads to an em-
pirical generalisation, is not entirely a simple proc-
ess, and it suggests certain questions of importance
for the study of induction. These questions we shall
consider in this section. And first we should ob-
serve that if we ask why there is any such process
of combining in single statements a number of facts,
why we classify at all, we may perhaps say with
Mill, who in this follows Hume, that there is a ten-
dency of the mind "to generalise its experience, pro-

vided this points all in one direction." This abbre-
viation and summation of numerous facts and expe-
riences takes place as a measure of protection
against being overwhelmed with the diversity of the
events which life daily presents to each of us. It is
not a method that is peculiar to science; it is used
by all of us in common life. It has a practical
value; it does, as Mill points out, facilitate our
handling a great number of data. But because we
cannot escape using it, and because its employment
is so general, the method is not, therefore, altogether
simple. It presupposes the existence of ideas, of
the idea, at any rate, that all the instances we ex-
amine may possibly constitute a single class. When,
however, we ask by virtue of what particular idea
a number of facts constitute a class, we must re-
member that classes, as we saw in the chapter on
classification, are not ready made things ; there are,
as we said, no 'natural kinds/ nor, on the other
hand, are there any ready made ideas, except as
those have been acquired in the course of experience,
that can serve as principles of classification. The
fact is that we classify on the basis of observed like-
nesses, and the members of a class are determined
by the kind of likenesses with respect to which
each instance is examined. In science, the principle
of classification is consciously entertained; in com-

mon life, it is not brought into clear definition. In
the latter case, we are guided by the accidental at-
tributes of phenomena, and our generalisations
have, as a rule, the value merely of shorthand mem-

oranda ; by them we are able to get back to the facts
at any time we wish, but our understanding of the
facts is not thereby advanced. The process is not
for this reason without value, but its particular
worth is likely to be obscured if we fail to observe
its limitations. We may, therefore, repeat that
empirical generalisations do not make any group of
facts, for science or for common life, more intel-
ligible; they merely group together a number of
data, and thereby suggest that the observed mate-
rial may be connected in some more fundamental
way. It is because they hint at some underlying
principle of connection that empirical generalisa-
tions have a place in the method of scientific inves-
tigation.

Colligation of Facts. A method of dealing with
facts which emphasises more directly the impor-
tance of ideas in the development of knowledge is
that which is called by Whewell the "colligation of
facts by means of an exact and appropriate concep-
tion." Whewell states his view, and defends it
against the objections of Mill, by calling attention
to the presence of ideas in all our perceptions. He
says, "All perception of external objects and occur-
rences involves an active as well as passive process
of mind ; includes not only Sensations, but also
Ideas by which Sensations are bound together, and
have a unity given to them. From this it follows,
that there is a difficulty in separating in our per-
ceptions what we receive from without, and what
we ourselves contribute from within." He, there-

fore holds that, "we cannot obtain a sure basis
of Facts, by rejecting all inferences and judgments
of our own, for such inferences and judgments form
an unavoidable element in all Facts. . . . We
are not able, nor need we endeavour, to exclude
Ideas from our Facts; but we may be able to dis-
cern, with perfect distinctness, the Ideas which
we include." In agreement with this position,
what Whewell means by colligation is quite clear;
it consists in bringing together a number of ob-
served facts under a common description, as, to
use one of his own illustrations, when Kepler, hav-
ing made a number of observations on the suc-
cessive positions of Mars, brought them together
under the one conception of an ellipse. Mill con-
tends that the method of colligation does not differ
from an empirical generalisation, and since it
involves no inference, it is not an induction. We

do not need to go into the dispute between Whewell
and Mill on these points ; it is clear, from the state-
ments of what colligation means for Whewell, that
ideas are essential to the existence of facts, and that
a conception of the mind operates as a principle of
connection between facts. The relation between
fact and idea, however, is not always stated clearly
by Whewell, for he sometimes speaks as if the in-
ductive act consisted of a superinduction of concep-
tions upon facts, that is, as if facts and ideas were
external to each other. Green, in making the same
point, says that "Whewell . . . spoils his own
case (against Mill) by often writing as if the antith-

esis between ideas and facts were a valid one; as
if the 'superinduction of ideas' upon facts were
merely an operation that had to be performed ex
parte nostra in order to give science." The value
of WhewelPs insistence upon colligation lies in this :
it asserts that all our knowledge of the world of
fact depends upon a more or less conscious exercise
of the judging activity which carries us beyond a
merely empirical generalisation, and enables us to
regard the facts of observation under a new point
of view. These points of view, our author contends,
are supplied by, but are not necessarily derived
from, the mind itself. As we shall see later, the
point of view under which a group of facts becomes
intelligible is sometimes ascertained by a stroke of
genius, sometimes as the result of a laborious and
diligent search. But however it may have been dis-
covered, ideas and the facts that they make intelli-
gible are not two discrete and mutually exclusive
things; they are, as we have seen, only the reverse
sides of a single experience. It is only by an act
of analysis, as Whewell himself believes, that they
can be distinguished.

Parity of Reasoning. We often entertain beliefs
about new facts on the ground of the similarity of
these facts to other facts with which we are ac-
quainted. For instance, if the bull dogs that we
have known are unfriendly toward strangers, we
shall shape our conduct toward any dog that has
the general appearance of this breed in accordance
with the belief that no bull dog likes strangers.

This is an example of an empirical generalisation.
From it may be distinguished another type of rea-
soning which, while dealing with numbers of in-
stances, affirms that we may entertain a belief about
new facts, not because we have reason to entertain
it about similar facts, but because we may apply
to the new facts tests similar to those that were
used on the old. That is, if we have shown that X
is true of A, we may argue that it is true also of B,

not because it is true of A, but for the same reason
that it is true of A. This method of argument is
called parity of reasoning. Mill's illustration is
this: "Having shown that the three angles of the
triangle ABC are together equal to two right angles,
we conclude that this is true of every other triangle,
not because it is true of ABC, but for the same rea-
son which proved it to be true of ABC." Mill objects
to calling this an induction on the ground that it
"is not believed on the evidence of particular in-
stances," that is, it is not proved in each of the in-
stances, and, therefore, there exists no ground of
inference from the known to the unknown cases.
The importance of this type of reasoning at our
present stage of inquiry is that it raises definitely
the question whether numbers of instances are
necessary for an inductive conclusion.

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QUESTIONS

1. What do you assign to the distinction of truth and fact?

2. In what two ways may the word fact be used, and what common element is present in both uses?

3. 'Facts are objects that have been qualified by our thoughts about them.' Discuss.

4. What is a category, and what is the relation of categories to the judgment?

5. What is a fact from the standpoint of the categories?

6. What is meant by saying that reality is the world of fact?

7. What light does the study of the worlds of fact throw upon the problem of monism and pluralism?

8. How must we interpret the inductive problem, if by reality is meant the world of fact?

9. What view of induction is implied in so-called perfect and imperfect induction?

10. State and illustrate what is meant by perfect induction.

11. State and illustrate what is meant by imperfect induction.

12. What is Mill's criticism of perfect induction?

13. What is Bacon's estimate of imperfect induction?

14. What is Bacon's estimate of perfect induction?

15. What, according to Mill, is the value of imperfect induction?

16. What is the value of perfect and imperfect induction as instances of simple enumeration?

17. What is an empirical generalisation?

18. Why, according to Mill, do we generalise our experience?

19. 'Generalisation presupposes the existence of ideas.' Explain.

20. What is the value of empirical generalisation for science and for common life?

21. State Whewell's conception and explanation of the colligation of facts.

22. State Mill's objections to colligation.

23. What is Green's criticism of Whewell's position?

24. What is the essential truth of the doctrine of colligation?

25. What is parity of reasoning, and how does it differ from empirical generalisation?

26. Why does Mill refuse to regard colligation as a truly inductive method?

27. What is the importance of Mill's objection?

EXERCISES.

1. Give at least six examples of what are known as facts, and distinguish the factual and truth elements involved in these examples.

2. Make six statements of fact, and determine under what category each statement is made.

3. Give three illustrations of what is known as reality as distinguished from fact.

4. Give three illustrations each of perfect and imperfect induction.

5. Write out two examples from common life and two from science of an empirical generalisation.

6. Illustrate, by a carefully considered example, the meaning of a colligation of facts.

7. Give three illustrations of parity of reasoning.

CHAPTER XIV

SOME DESCRIPTIVE METHODS OF INDUCTION

Relation of Numbers of Instances to an Induction. The question with which we closed the last chapter, namely, whether numbers of instances are necessary for an induction, may be made the starting point of the present one. When induction is thought of as an inference based upon the examination of numerous instances of a phenomenon, it assumes, as we have seen, two forms : one, when we have assurance that all the instances are known; the other, when no such assurance can possibly be entertained. The former, we have considered, and it was said to be an illustration of a method of organising experience that is not confined to any special kinds of fact, but is used over the whole extent of our life.

The name that we gave to this method was empirical generalisation. The value of empirical generalisations lies in the fact that they enable us to deal with large numbers of data in a simple way; we can deal with collections of fact as single facts whenever we ignore the differences and are interested in the likenesses between the facts which enter into such collections. The assurance that every one feels in organising his experience in this manner is due to the limits within which it is consciously carried out. Empirical generalisations are held to apply only to the instances that have been examined.

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Numerous instances are necessary for an empirical generalisation, but such generalisations, since they do not carry us beyond the instances we have examined, cannot be regarded as inductive inferences.

The other form of induction by simple enumeration differs from the one just considered in the fact that not all the instances of the phenomenon have been observed, and the conclusion which the known instances are found to warrant is extended to other instances that have not come under observation. The question we are concerned with in such a case is whether, as Mill seems to hold, the validity of our inference is in proportion to the number of the instances examined, that is, whether the ground of the certainty of such an induction is found in the number of the instances on which it is based ; or whether it is due to some other characteristic of the instances, for example, to the nature of the instances themselves.

In attempting to answer this question, we may observe, in the first place, that the position held by Mill emphasises only one of the factors of an enumerative induction, and that, even if we hold, with him, that it is an essential factor, it nevertheless depends for its effectiveness on the co-operation of another factor of which no special mention has as yet been made. For no one is prepared to maintain that the mere fact of numbers, irrespective of the other qualities of the instances that an induction brings under review, can be the ground of an inference to other unknown instances. Mill's

position, therefore, must be understood to be that, although a greater degree of certainty attaches to any conclusion we reach respecting certain observed facts if the number of such observed facts is very great, and a lower degree of certainty if the number of such observed facts is relatively few, all the facts that enter into an induction must exhibit the qual-

ities or relations with respect to which the induction is made; and that, if we extend to other instances the conclusion reached with respect to any one group of instances, this is possible because the new instances resemble the old ones in their essential nature. Whether, therefore, we are interested in arriving at an induction or in extending to new cases the conclusion of an induction already made, the fact of the common nature of all the instances must be established or assumed if the induction itself is sound, or if it is to make an inference possible. In either case, the instances in question must all resemble one another in essential respects.

We may remark, in the second place, that, in the light of what has now been shown, the question of the relation of numbers of instances to the validity of an induction is an interesting rather than the most important aspect of the inductive problem. There is no doubt, for example, that, within limits, our confidence in the conclusion of an induction is increased by the number of instances by which it is known to be supported. But we must distinguish between our confidence in a conclusion and the

ground on which the truth of that conclusion is supposed to rest; and, we must remember, it is with this latter question that we are here concerned. But we may say, even with respect to our confidence in the truth of inductive conclusions, that, beyond certain limits which vary for different phenomena, this is not affected in an appreciable manner by any considerable increase in the number of instances of a given phenomenon that may be brought to our attention. For example, should we not feel a justifiable impatience with any one who, during the hours of only a single day, counted the number of objects within his observation that fell to the ground, and who informed us that that additional number of observed cases should be regarded as an additional reason for our confidence in the law of gravitation? And with respect to the truth of an inductive process, we may observe that the number of instances that need to be observed before a conclusion is reached varies according to the nature of the instances themselves, and the ability of the particular individuals who examine them. If this is true, the number of instances is a somewhat uncertain factor in the establishment of an induction, and there seems to be no reason why, if the nature and conditions of the observation are sufficiently unambiguous, the truth about a whole class of cases may not be reached as the result of the study of a single example. Indeed, in the history of science there have been instances in which some striking event has arrested attention, and set the problem

for the scientist, and in which the study of other
examples of the same phenomenon has been under-
taken mainly for the purpose of verifying the con-
clusions reached with respect to the single instance.
And, further, it may be said that, whether the truth
of an induction has been reached as the result of
an examination of one or many instances of a phe-
nomenon, we may infer certain facts of other in-
stances only when we assume that these also re-
semble the old one or ones in essential respects. In-
deed, this is only to state the significance that be-
longs to all scientific statements whatever, and it
gives the reason why all such statements are essen-
tially hypothetical. Thus, if we suppose that P is
a phenomenon under examination, and that X is
the characteristic with respect to which it is finally
determined, then we may say of any new example
M that 'If M is P, it is X ;' that is to say, X is pred-
icated of M, because it is P. We may, therefore con-
clude, both with respect to the establishment of an
induction and with respect to the possibility of ex-
tending an induction to further instances of a phe-
nomenon, that "the strength of an induction is not
proportional to the number of instances cited. The
generalisations that lead to the most trustworthy
hypotheses are based, not on the counting of the
number of instances, but on the weighing of their
quality and character. One crucial instance may be
worth a hundred others."

Logical Significance of Statistical Methods. The
progress of modern science has been associated so

intimately with the application of mathematical con-
ceptions to concrete phenomena that the conclusion
of the preceding paragraph may appear to be one-
sided, if not erroneous. To meet this objection, we
shall examine the logical character of the statistical
methods, and ascertain their place in an inductive
process. And, at the outset, we should observe that
whenever statistical methods are employed, the data
under observation can most often be given only in
the form of aggregates and averages. These meth-
ods, as a rule, are applied distinctly for the purpose
of ascertaining the numerical distribution of cer-
tain characteristics which have come under obser-
vation in a limited number of cases. Sometimes all
that it is necessary or possible to do is to ascertain
the total number of the recorded instances of the
phenomenon. Usually, however, the interests we
hope to satisfy by the use of the statistical methods
are more specialised than this. For instance, we
may wish to know what is the average occurrence
of some irregular group character, as, for example,
the average number of insane persons born per
generation in a particular family. Or we may wish
to ascertain the average amount of a constant group
character, as, for example, the average amount of
butter fat given per head by a particular breed of

cattle. And even when these methods are applied
to individuals, we still have in view the discovery
of group characteristics. On this point Thorndike
writes: "The sciences of human nature commonly
use measures of individuals only in order to get

measures of groups. Not John Smith's spelling
ability, but that of all fifth grade boys taught by a
certain method; not A's delicacy of discrimination
of weights, but that of all men; not B's wage, but
that of all railroad engineers during a certain
period ; not C's children, but the productivity of the
English race as a whole ; not individuals, but groups,
are commonly measured, compared and argued
about." An examination of the individuals enu-
merated in the census returns as to age, sex, married,
unmarried, etc., also illustrates that interest in the
characteristics of groups which prompts the use of
distinctly statistical methods of inquiry. Sociological
and insurance tables, as well as those of the phys-
ical, biological and psychological sciences, are based
upon the same interest. The particular service,
therefore, that the employment of statistical meth-
ods is able to render is to bind together diverse
numbers of fact of a particular kind, and thus to
provide a basis for the comparison of otherwise
incomparable aggregates. "The method of count-
ing . . . agreements and comparing results,"
says Gibson, "constitutes the Method of Statistics."
The conclusions to which statistical inquiries
lead are generalisations, but they are to be distin-
guished from the empirical generalisations spoken
of above in two respects. In the first place, statis-
tical conclusions may be taken as a type of scientific
as contrasted with empirical generalisation on the
ground that they are the products of a systematic
investigation of numbers of fact. By systematic in

this connection we mean that the basis of the class-
ification of data is in each case consciously chosen,
and that it is applied as a test of what can and what
cannot be included in the numeration. For example,
in an enumeration of houses in India, as Scripture
points out, great difficulty was experienced on
account of the indefiniteness of what was meant by
a house. Similarly, the Weather Bureau would find
it impossible to classify the hot, temperate, and cold
days during a single year because of the indefinite-
ness of the connotation of these terms. But if hot
is defined as a shade temperature above 75, cold
as a shade temperature below 35, and temperate
any degree between these two, it is readily seen that
there will be no difficulty in applying to the days
of the year these tests, and generalising the results.
In the second place, statistical conclusions are ex-
pressed always in quantitative terms. This is, of

course, not an accident; it is a result directly aimed
at. In this way, certain features of the objects of
our experience come to have a value and significance
which, under any other method of observation,
would be in danger of being overlooked altogether.
For example, isolated events, and events that occur
but rarely in our experience, unless they are very
striking, are liable to receive but a passing notice,
and to present but a small part of their meaning to
such casual observation. It is also true that we are
prone to overlook the import of those occurrences
which are brought regularly to our notice. Famil-
iarity breeds neglect as surely as do entire novelty

and strangeness. The average person seems to
dwell in safety between these two extremes, with
the result that the world presents him with few
problems, and stimulates him but rarely to sus-
tained intellectual effort. It is, however, a charac-
teristic of the scientific mind that there is nothing
so common that it does not deserve comprehension,
and nothing so rare that it is beyond consideration.
Out of this temper have been born those efforts to
reduce the passing show of our daily experience to
a definite system and order; and it has seemed, to
those engaged in it, not the leas worthy task, as it
has been not the least profitable, to count the num-
ber of times a given fact occurs, and to make num-
ber a part of the facts themselves. Among the
Greeks, Pythagoras interpreted the world in this
mathematical way ; and all our modern sciences, the
physical, biological and social, are employing statis-
tics in the belief that when the relative frequency
of the occurrences of a phenomenon is known, the
phenomenon itself has been more accurately ob-
served, and can be more exactly described.

Qualitative Methods of Observation. Statistics,
however, do not provide the only methods by which
the observation of phenomena is carried on. There
are classes of phenomena to which it cannot be
fruitfully applied. We have said that whenever
our material can be presented most advantageously
in the form of aggregates and averages, statistics
lend themselves as a means of bringing out features
of this material that in no other way receives ade-

quate recognition. But we are not always or only
interested in collective groups of objects. We are
also interested in objects as instances of a genus, as
instances in which the characteristics of a genus
are given concrete expression. For instance, when-
ever we call a certain flower a primrose, we are- not
describing the flower as an individual thing; rather
are we neglecting altogether what is peculiar to the
flower as an individual, what makes it this primrose

rather than that ; and are recounting the character-
istics which this object shares with an indefinite
number of other specimens of the same species. The
difference between this case and those that are
amenable to statistical observation is that in the
latter we need to collect together numbers of indi-
viduals before the important characteristics are
open to observation, whereas in the former, the indi-
vidual instance displays all the attributes that are
distinctive of the genus to which it belongs. Field
botany, as our illustration suggests, is a descriptive
science in the sense we are now indicating. Natural
history and descriptive geology also belong to the
same class. In these sciences, individual objects dis-
play universal characteristics, that is, those which
in our experience are found to belong to an indefi-
nite number of other objects of the same kind or
class. These common features of objects have their
interest, and they set for us problems which tax our
industry and challenge our efforts to solve. It is
obvious, in the light of these statements, that the
accurate knowledge which is the goal of our intel-

lectual life is not all of a single type, and that the
methods of observation which we adopt or devise
must be appropriate to the nature of the objects
which are the material of our study. Sometimes
we must avail ourselves of the quantitative methods
of statistical observation, sometimes of the quali-
tative methods of immediate perception.

The Nature of Scientific Observation. Whatever
the methods of observation may be, and however
numerous, they are determined by the nature and
purpose of observation itself. Now, in order to gain
a clear understanding of the nature and purpose of
observation, we may distinguish scientific observa-
tion from the attitude we are accustomed to main-
tain toward the ordinary events and circumstances
of our every day life. Those adjustments with our
environments which, during the course of our early
years, we have succeeded in acquiring have been
determined almost exclusively by practical consider-
ations, and they have been maintained as the habits
of our lives very largely on account of their value
as instruments of physical and social survival. The
earliest task that devolves upon the infant is to
come into relations with the world around him, and
his primary concern is with the world of material
things from which he may receive either benefit or
harm. It is only so far as it contributes to this end
that, in its earliest beginning, the mind of the child
is stimulated into activity, and his interest is
aroused in the things and persons which constitute
his world. Intelligence, that is to say, is a later

development than are those motor responses to environment through which the well-being of the individual is secured, and comes at first upon the scene of the individual's life, not in order to introduce any new interest or to initiate a new set of aims, but as the guide and servant of the practical which, through its means, is enlarged and rendered more efficient. These relations of the practical and intellectual in the order of their development throw an interesting light upon the function that intelligence plays in the maintenance of human existence ; for, as it was in the beginning, so does it remain for the greater part of each individual's life, there is no independent intellectual interest, and the functions of human understanding are determined throughout by the practical purpose which they instrumentally advance. If, in view of these considerations, we observe the characteristics of our ordinary life, we shall understand why, instead of displaying a careful attention to details, the perceptual consciousness has a conspective range which enables it to take in a large amount of detail without losing its practical effectiveness. What is not of practical importance fails to be noticed; only those features of the environment which are practically important are gathered up and made objects of attention.

How far perception, as it is ordinarily employed, is from giving accurate knowledge of the commonplace facts and events of life is well known. As an

example of the unreliability of everyday observation, we may cite the contradictory accounts of eye-witnesess of a common street accident. But, further, the conclusions and inferences that we base on such observations are, as a rule, no more trustworthy than the observations themselves. In our daily life we exhibit constantly, what Whewell calls, " a vague and loose mode of looking at facts/' As a result, to quote from the author just referred to, we remain "for a long time under the belief that a body, ten times as heavy as another, falls ten times as fast; that objects immersed in water are always magnified, without regard to the form of the surface; that the magnet exerts an irresistible force; that crystal is always found associated with ice; and the like. These and many others are examples of how blind and careless men can be, even in observation of the plainest and commonest appearances; and they show that the mere faculties of perception, although constantly exercised upon innumerable objects, may fail in leading to any exact knowledge."

If now we consider what may properly be called scientific observation, we shall see that this differs from immediate perception in important respects. Scientific observation, in the first place, has not the conspective range of immediate perception, but is

characterised by a close attention to detail within a
limited field. This difference is conditioned by the
difference in the purpose for which each exists.
The purpose that controls the character and direc-

tion of our perceptions was seen to have its origin
in the interests of our practical life. There is not,
on the other hand, any such thing as observation in
the strict meaning of the term, until our interest in
the world of the practical life has failed to be satis-
fied, either because the environment is too complex
for perception to cope with, or because the relevant
features of the environment have been hastily over-
looked. In either case, importance comes to be at-
tached to the details of a situation, and the condi-
tions are favourable for the development of an in-
terest in details quite apart from the regulation of
our ordinary practical activities. Scientific obser-
vation does not differ from immediate perception in
the fact that the former is, and the latter is not,
purposive, but in the character of the purpose which
prescribes the goal and directs the course of each.
In the case of scientific observation, the purpose
that renders the details of an event or situation im-
portant is theoretical; it springs from the interest
we have in gaining an intimate acquaintance with
these situations and events. That is to say, scien-
tific observation must needs be used when we are
launched upon a search for truth; it is an instru-
ment of our acquisition of knowledge. What things
are, and how they come to be what they are, are
the questions which emphasise the necessity of accu-
rate observation.

In contrast with immediate perception, scientific
observation is, in the second place, analytic ; it seeks
in the environment for those features which are

relevant to the theoretical purpose by which it is
guided. The difficulty that one experiences in his
earliest scientific efforts is due to this selective
character of observation. If, for example, we placed
an histological preparation under the microscope,
and, without any previous acquaintance with the
subject to which it relates, we were to attempt to
observe the character of the tissue, we should very
likely fail; and our failure would be due probably
to the fact that we had no defined purpose to guide
our selection of the relevant detail. The beginner
in any science is subjected to much loss of time and
unnecessary discouragement if the instructor does
not understand that scientific observation does not
consist in looking at a mass of detail, but in looking
for certain relevant aspects in a mass of detail. But
to look for something relevant implies that a pur-
pose is functioning in our examination of objects,

and it is this purpose or idea which the capable
instructor provides as the guide to his pupil's obser-
vation. We observe only what we are prepared to
observe, and mere collections of fact are useless
until an idea illuminates and makes them intel-
ligible. This view of scientific observation is illus-
trated in the work of all the great scientists. It
was conspicuously true, for example, of Darwin,
of whom his son writes : "He often said that no one
could be a good observer unless he was an active
theoriser. This brings me back to what I said
about his instinct for arresting exceptions, it was
as though he were charged with theorising power

ready to flow into any channel on the slightest dis-
turbance, so that no fact, however small, could avoid
releasing a stream of theory, and thus the fact be-
came magnified into importance." In other words,
we observe not with our senses but with our intel-
ligence. Or, as Huxley put it, what one sees when
he looks through a microscope depends as much
upon what is behind the eye-piece as upon what is
under the objective.

Experimental Observation. If we reduce the idea
of a scientific experiment to its lowest terms, we
may say that it consists in the interposition of an
instrument of precision between our sense organs
and the material we are studying. From this point
of view, a scientific experiment secures an extension
of the range of our perceptive organs, and, in so far
as it does this, brings out more of the detail of the
material under examination. The balances of the
physicist, the microscope of the biologist, the tele-
scope of the astronomer are devices for thus extend-
ing the field of scientific observation. But there are
limitations to experimental observation, as thus
understood, which often would hinder the progress
of truth if they were not offset by observation under
normal conditions. Hence, as Lotze says, "Observa-
tion often acquaints us with broad characteristics
of phenomena, which in experiment would have
been obscured by special conditions." The fact is
that observation and experiment supplement each
other, and there are cases when neither alone could
lead us as far as when both are used in conjunction.

There are also some phenomena to which experi-
mental observation cannot be applied at all, and for
our examination of these we must rely upon other
means of observation. In this connection, it may be
recalled that Darwin's great work was achieved by
the method of observation, in the broad sense just
described, rather than by the methods of experi-
mental observation.

A further consideration affecting our view of
the range of scientific observation is that, however
successful we may be in improving our present
apparatus, and in devising and constructing new
apparatus, there is, in all probability, a limit beyond
which our sense organs are not capable of being
supplemented in that way, and a point, consequently,
at which the observations we make by the use of
instruments of precision must stop. What the
scientist does when he has reached his actual per-
ceptual limits, and what he would attempt to do if
he reached the theoretically possible limits of per-
ception, is to supplement his actual observations
by guesses as to what, if perception were possible,
further observation would, in all probability, make
known. In some such way as this have the lumin-
iferous ether, atoms, ions, etc., become parts of the
actual working data of science, data, be it remarked,
that are regarded, by science, as truly material sub-
stances as are the grosser bodies that are now within
the range of present perception. This kind of obser-

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vation we may call, for the sake of convenience of
reference, theorising, or theoretical observation.

Another characteristic of experimental observa-
tion is that, like all observation, it must be used in
the service of the purpose which directs the obser-
vation. Hence the impossibility of any one being
an experimental scientist who is not thoroughly
acquainted with the mechanical structure of the
apparatus which he either uses or designs. There
is a quite prevalent notion, especially among stu-
dents and inexperienced instructors, that one is
necessarily an experimentalist if he works in a
laboratory and manipulates apparatus. To these,
no question could come with more pertinence than
this: Tor what purpose are you using this par-
ticular piece of apparatus, and precisely in what
way does it enable you to realise this purpose?' It
is not apparatus that lends significance to our ideas,
but ideas that make our apparatus intelligible in-
struments of observation. To lose sight of this
truth is to miss entirely the true meaning of experi-
mental science; for we may be as passively assimil-
ative when looking through a microscope as we
might be actively observant when using our natural
organs of perception. But when our apparatus
"passes into the service of an idea, and we proceed
to put our object under such conditions as the idea
requires for testing and verifying itself, our obser-
vation is no longer merely passive, but experi-
mental. A definite, purposive interference of some
sort with the production of the phenomenon to be

noted is the desideratum" of experimental observa-
tion.

At precisely what point can this interference
with the phenomenon be introduced most advanta-
geously? The answer to this question is given
unanimously by all the workers in the field of
science. Science seeks to control, not the nature,
but the conditions of the occurrence of phenomena.
"To observe with accuracy and convenience," says
Jevons, "we must have agents under control, so as
to raise or lower their intensity, to stop or set them
in action at will." Welton writes: "Appeal to ex-
periment is, then, necessary whenever simple obser-
vation alone will not make plain all the essentials
of a phenomenon; and its object is to eliminate all
the conditions which are not specially operative in
the particular case under observation." In like
strain Gibson says: "Control over the conditions
under which the object shall present itself for study
is the great desideratum and the factor in experi-
mental observation which most influences the pre-
cision and certainty of the results obtained. Such
control enables us to vary the circumstances, and to
repeat the observation as often as we please by
simply reproducing the concurrence of conditions
requisite for bringing into play the desired effect."

REFERENCES

SEE THE END OF THE NEXT CHAPTER

QUESTIONS

1. What are nature, extent and value of empirical general-
isations?

2. Does an empirical generalisation involve an inductive
inference? What is your reason?

3. Are numerous instances of a phenomenon necessary for
an empirical generalisation? Why?

4. Can imperfect induction be regarded as an example of
an inductive inference? State reasons for your answer.

5. What problem is involved in the fact that the con-
clusions of imperfect induction are extended to unex-
amined instances of the phenomenon in question?

6. What is Mill's position on the validity of imperfect in-
duction?

7. What influence does the fact that a large number of in-
stances of a phenomenon have been examined have on
the validity of an inductive inference?

8. What value may we give to number of instances in an inductive process?

9. What fact with respect to the nature of induction is involved in the hypothetical character of scientific statements?

10. What particular interest determines the use of statistical methods?

11. State and illustrate some of the questions that statistical methods enable us to answer?

12. What purpose does the application of statistical methods to individuals commonly serve?

13. In what respects do statistical conclusions differ from empirical generalisations?

14. Describe the particular method of observation employed by field botany, natural history and descriptive geology.

15. What are the characteristics of perception, and in what relation does perception stand to intelligence?

16. In the light of your answer to the previous question, what view must be taken of the logical function of perception?

17. In what respects does scientific observation differ from ordinary perception?

18. What do you understand by experimental observation?

19. What are the limits of experimental observation?

20. Explain the nature of theoretical observation.

21. Illustrate by reference to the relation of the scientist to his apparatus the place of purpose in experimental observation.

22. 'Experimental observation involves a purposive interference with the production of phenomena.' Explain.

23. State what a scientist may and may not do in interfering with the phenomenon he wishes to observe.

EXERCISES

1. Give at least six examples of empirical generalisation.

2. Give six illustrations of imperfect induction, and show how each may be used as the basis of an inference.

3. Illustrate from each of the sciences you have studied the hypothetical character of inductive inference.

4. Show, by a carefully worked out example, the nature and method of statistical observation.

5. Give one example of experimental observation.

6. Illustrate what is meant by theoretical observation.

CHAPTER XV

SOME EXPLANATORY METHODS OF INDUCTION

The Nature of Scientific Explanation. The methods that were examined in the last chapter may be classified roughly as methods of observation, and those that are to be examined in the present chapter may be classified approximately as methods of explanation. It will, perhaps, help us to understand these latter methods if in this section we inquire into the meaning of the term explanation. This is the more necessary because some confusion on this subject has been occasioned by the way in which scientists have sometimes expressed themselves with respect to the aims of science. For example, one declares that science consists of a complete description of the phenomena that are brought under observation, while another declares as emphatically that description is only a preliminary step in the work of the scientist, and that the goal of all science is explanation. If we were to take such statements absolutely, we should be led to suppose that there is between the scientists an irreconcilable difference of opinion as to the nature of the work in which they are engaged, and we might presume that, until they arrived at a settlement of these differences, it were useless for us to discuss the matter further. This, however, would be a false view to take; for not only must logic examine the

aims and methods of the sciences, but the differences already referred to are verbal rather than real, and are due in a large measure to the ways in which what is after all a substantial agreement has happened to get itself expressed.

Let us first get before ourselves what is meant ordinarily by a scientific explanation, and then, in the light of this information, we may consider the distinction between it and scientific observation. All scientific explanation conforms to a very simple type; it consists in stating what other things occur when the particular thing we are observing occurs. If, for example, I hold a book in my hand and, releasing my grasp upon it, it falls to the ground, we should ordinarily explain the falling of the book to the ground by saying that I had released my hold

upon it. The book fell because I released my hold.
If, now, experimenting with other objects than
books, I find that pencils, stones, silverware, china-
ware, etc., fall to the ground when the hand that
held them releases its grasp, I may put the results
of these observations into the statement that 'all
objects fall to the ground when their support is re-
moved/ If, further, the fall not only of the book
but of all objects whatsoever is connected with the
force of gravity, the process of explanation has been
carried a step farther. But however far such a
process is carried, it consists essentially in describ-
ing events that occur along with the event which, at
the beginning, was the object of our observation.
This occurs when that occurs' is the universal for-

mula which reveals the nature of scientific explan-
ation.

The same view is sometimes expressed more pre-
cisely in the statement that scientific explanation
is concerned with the discovery of the conditions of
the occurrence of any object of observation. Let
P be the phenomenon or object observed, then the
question of explanation relates to the conditions, C,
under which it occurs. When these conditions have
been discovered and recorded, we are said to have
explained the phenomenon. Out of the innumerable
circumstances that accompany an event, the prob-
lem of scientific explanation is to select those which
must be present whenever the event is present, and
which when they are absent the event itself does not
occur. The factors of explanation are always
found among the concomitant circumstances of the
phenomenon which comes before us for explanation.
An examination and description of these is what is
meant by a scientific explanation.

With these statements in mind, we may now
make clearer the distinction between scientific ob-
servation and explanation. It is obvious, in the
first place, that the phenomena which we include
under each of these terms are continuous with each
other. For instance, the falling of an object is con-
tinuous with the release of the hand's grasp upon it.
Stated generally, a phenomenon and its conditions
form an inter-connected series of events, no one of
which is unnecessary to the series, and each of which
is important if the series is to maintain its essential

character. From this point of view, the distinction
between a phenomenon and its conditions is more
or less accidental and artificial ; and if we take such
series as scientific units, regarding the objects
which are the starting points of our observations
as fragments which through scientific methods we

are to supplement by their necessary concomitants,
we shall see that the whole aim of science has been
fulfilled when such a series has received a full and
complete description. If, in the second place, we
do not regard the object which provides us with
the starting point of our observation as a fragment,
but as a phenomenon which has a quasi-independent
existence, we shall be inclined to consider the search
for conditions as a distinct step in scientific investi-
gation, and, laying emphasis upon this, the problem
of explanation will assume larger proportions than
it did in the other view. But whichever of these
two ways of looking at the scientific problem we
may take, the factors of each are the same, and be-
tween these views there is only a verbal difference.
On either view, we have to supplement what is
given the phenomenon, with what is not given
the conditions; and to determine the conditions of
a phenomenon is what we understand as the prob-
lem of scientific explanation.

The Meaning of Analogy. The word analogy is
used in different senses, and these we shall proceed
to distinguish. It is used, in the first place, to indi-
cate an identity of relation. This is the meaning
that it had for Aristotle with whom it corresponded

to mathematical proportion. In this sense, it as-
sumes the form of 2 : 4 : : 3 : 6, where the relation
between 2 : 4 is identical with the relation between
3 : 6, and the factors between which the relation
obtains are homogenous. We may state the charac-
teristics of this first meaning of analogy generally
by saying that whenever a is related to b in the same
way that c is related to d, then whatever follows
from a : b follows also from c : d, if the inference
is based upon nothing but the identity of the rela-
tion between the two pairs of factors or terms.

The word analogy is used, in the second place,
to indicate a similarity of relation. The difference
between this and the preceding use of the term is
not due to the absence of proportion, but to the dif-
ference in the character of the terms between which
the proportion obtains. Although the relation be-
tween two pairs of terms is similar, the terms be-
tween which the relation holds may be heterogene-
ous. For example, the number of vibrations per sec-
ond of the sound which is recognised by our musical
sense as middle C (c') is 261, that of its octave (c")
is 522 (2x261). The similarity of relations in-
volved in these facts is expressed in the proportion
261 : 522 : : c' : c". But since the octave of any
musical note always has twice as many vibrations
as the note itself, we may express the law of octaves
in the proportion : x vibrations of air : 2 x vibra-
tions of air : : a note : its octave. The analogy may
be interpreted to mean that the relation between
the series of physical stimuli is connected in our

knowledge with their corresponding impressions
in such a way that given the former we can infer
the latter.

The word analogy is used, in the third place, to
indicate any resemblance between things. Here the
idea of proportion which was present in the preced-
ing uses has dropped out, and resemblance of any
kind between objects is made the basis of analogical
inference. For example, certain resemblances were
early known to exist between sound light : that both
were capable of being reflected, that the direction
of reflection of each obeyed the same law, that the
angle of reflection is equal, in each case, to the angle
of incidence. It was further known that sound
travelled in waves. From these data it was inferred
analogically that light also travelled in waves. If
it had been known that the equality of the angles
of reflection and incidence in the case of sound were
due to its traveling in waves, the inference to a like
mode of propagation in the case of light would have
been more certain. The more important the re-
semblances, that is to say, the more certain the in-
ference. From the example just used, the analogy
between things may be expressed generally in the
following manner: If a resembles b in certain re-
spects, x, and a exhibits the character y, it is in-
ferred that b will resemble a in possessing the char-
acter y also.

The Logical Character of Analogy. We have
shown that analogy is a method of inferring cer-
tain possible events on the ground of a resemblance

between certain ascertained events. "In the syllo-
gism of Analogy," says Hegel, "we conclude from
the fact that some things of a certain kind possess
a certain quality, that the same quality is possessed
by other things of the same kind." In every argu-
ment from analogy an identity of some sort is as-
sumed, and it is upon the character of the assumed
identity that the validity of the inference is in every
case said to depend. Let us look at the soundness
of such arguments in the light of this statement.

In the first place, it is obvious that not any kind
or degree of resemblance is a safe principle of in-
ference. In common life, we meet with analogical
arguments that are very superficial. For instance,
the loyalty of college students to the university from
which they were graduated may often lead to a
mistaken estimate of a man who is a graduate of
the same university. "It would be a very bad anal-
ogy," as Hegel remarks, "to argue that since the
man Caius is a scholar, and Titus also is a man,
Titus will probably be a scholar too; and it would

be bad because a man's learning is not an uncondi-
tional consequence of his manhood." In public ad-
dresses on political and social questions we may
often detect arguments of this sort. In the period
of the Commonwealth in England, the demand for
annual Parliaments is said to have been urged on
the ground that the serpent which is the wisest
of beasts sheds his skin every year. We also find
analogical reasoning in the works of men of science,
and sometimes the conclusion which these argu-

ments are intended to support rest upon a very
weak and even false resemblance. Take, for in-
stance, the conception of the human body as a
machine. "When we desire to set machinery in
operation," as Chittenden, commenting on this view,
says, "we must get up steam, and so a fire is started
under the boiler and steam is generated in propor-
tion as fuel is burned. The source of the energy
made use of in moving the machinery is the extra-
neous combustible material introduced into the fire-
box, but the energy of muscular contraction, for
example, comes not from the oxidizable food mate-
rial in the stomach, but from the material of the
muscle itself. In other words, in the animal body it
is part of the tissue framework, or material that is
closely incorporated with the framework, that is
burned up, and the ability to endure continued mus-
cular strain depends upon the nutritive condition of
the muscles involved, and not upon the amount of
food contained in, or introduced into, the stomach."
In the second place, the resemblances upon which
analogical arguments are made to rest must be im-
portant resemblances. Accidental resemblances and
superficial likenesses are at the basis of all falla-
cious reasoning by analogy. With this class of anal-
ogies in mind Heine was led to exclaim, "Heaven
defend us from the Evil One and from metaphors."
But if the resemblance is essential and important,
there is no need to avoid the use of this method of
reasoning. Now when we speak of a resemblance
being essential, we mean that the characteristics

with respect to which objects are compared must be
essential either to the existence of the objects or to
the purpose which these objects realise. If, to illus-
trate the former case, we infer that certain things
are true of diamonds because they are true of
graphite, we, no doubt, do so with the thought in
mind that these substances are different forms of
carbon. To illustrate the latter, we may argue from
the similarity in shape of certain flints found in the
ground and those used by certain savage tribes of
the present day that the former were used as
weapons since this is the use that the latter are
known to have.

In the third place, analogical arguments must
take into account not only the importance of the
resemblances but the non-importance of the differ-
ences between the objects compared. An interest-
ing example is the following, borrowed from Gib-
son. He says, "we might enumerate many points
of external resemblance between the Whale and the
Shark, and found upon them an analogical argu-
ment to the effect that the respiration-processes in
the two animals must be similar. The whale, we
might say, resembles the shark not only in all the
common characters of Vertebrates, but also in its
submarine habitat and in being (as regard species)
one of the very largest of marine animals. Like the
shark, it is fish-like in external form, its fusiform
body being well fitted for cleaving the water. An-
teriorly its body passes into the head without any
distinct neck, and posteriorly it is furnished with a

swimming-tail into which the body gradually tapers.
It has no hairy covering. Like the shark, again,
it has a wide mouth, and it is of predaceous habit,
feeding only on living animal nutriment. There-
fore we may with great probability conclude that
its method of respiration is like that of the shark
i. e., that it breathes the oxygen dissolved in the
water, and has no need to be supplied with atmos-
pheric air.

"But this argument would be unsound. The points
that we ought to have observed are the characters
connected with the function of respiration. The
presence of gill-slits in the shark and their absence
in the whale is a difference so essential to the in-
quiry that its observation would at once have been
sufficient to make our analogy fall to the ground.
And among the still more obvious external differ-
ences there is a single character which also should
alone outweigh all the above mentioned resem-
blances. The extremity of the shark's tail is ex-
panded vertically ; in the whale the flukes of the tail
are placed horizontally. From many points of view
this difference might be regarded as unimportant;
but from the point of view of our analogical argu-
ment it is very important indeed, for it is intimately
connected with the problematic point of resemblance
that we are endeavouring to establish. For sea-
creatures which, like the whale and the shark, spend
their life in swimming freely through the water,
the direction of movement is chiefly determined by
the presence or absence of the air-breathing habit.

Those creatures that have no need of atmospheric
air move usually in straight-forward and lateral
directions, and for effecting such movements a ver-

tically expanded caudal fin is admirably fitted. But
creatures that need to rise frequently to the surface
of the water for the purpose of respiration are con-
stantly moving upward and downward. To move-
ments of this kind a tail with horizontally expanded
fluxes is precisely adapted. Thus the whale's hori-
zontally expanded tail affords a strong presumption
in favour of the presence of the air-breathing habit ;
and this apparently trifling difference between the
two creatures must be regarded as fatal to the
cogency of the analogical argument."

The Function of Analogy in Induction. We have
been considering analogy as a special kind of argu-
ment, the way in which Aristotle understood it. We
proceed now to discuss the value that analogies have
for advancing our knowledge of the world about us,
the assistance they may give in the problem of ex-
planation. Analogy, as our exposition has shown,
is an argument from similar instances. It is, to
quote Mellone, "any resemblance between things
which enables us to believe of one what we know
of the other." We advance from one instance to
another on the basis of a perceived or imagined sim-
ilarity between the instances. The necessity of ad-
vancing in an analogical argument from particular
to particular, has led to the saying that analogy
"sticks in the particular instances." Although this
is true, it is not on that account worthless as an in-

strument or means of arriving at the law of the
connection between resembling instances. For if
there is a resemblance, or a group of resemblances,
between P and P', such that we feel warranted in
affirming of P' what we know positively only of P,
we may look upon the similarity, not merely as a
bridge from the one instance (P) to the other (P')>
but as a suggestion of a specific connection between
the two instances which is not brought out ex-
plicitly by the analogy. It is this characteristic of
suggesting more than it can possibly make clear,
that renders analogy of service in an inductive proc-
ess. The following remarks are intended to make
this point clear.

Two things are characteristic of analogy. In the
first place, the comparison of instances, as we have
seen, rests upon what are called their essential
attributes, but, in the second, the degree of the
resemblance always remains more or less undeter-
mined. When we have assured ourselves that the
resemblance depends upon essential features of the
compared phenomena, we are, however, still in
doubt about the precise factor or factors in the re-
semblance upon which the inferred characteristic
really depends. Thus any two phenomena, P and
P', may resemble each other in possessing the
attribute x, a resemblance which seems to warrant
us in expecting that if P also shows the character-
istic y, P' will likewise show the same characteristic.

To take a concrete example. The chemist classifies

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a number of elements together under the head of
alkaline metals because all these elements potas-
sium, sodium, caesium, rubidium, and lithium, -
possess certain characteristics in common; for in-
stance, their active combination with oxygen to de-
compose water at all temperatures; their forming
strongly basic oxides, highly soluble in water, yield-
ing powerful caustic and alkaline hydrates from
which water can not be expelled by heat; the solu-
bility of their carbonates in water; and the forma-
tion by each metal of only one chloride. Now, if in
the progress of the chemistry of any one of these
metals a new property is discovered, it is natural
to infer by analogy that the other members of the
group will display under appropriate conditions the
same property. But beyond the suggestion of a
connection of the new property with the character-
istics of the alkaline group analogy cannot go; it
cannot point out on which attribute, or combination
of essential attributes, the new property really de-
pends. Thus an argument by analogy presumes a
connection between x and y, but it cannot show that
y depends on x rather than on some other property
in P which may not belong to what we have called
its essential attributes. However strong the pre-
sumption may be that x and y are causally related,
there always remains the possibility that y is condi-
tioned in some other way. Analogical arguments
for this reason are never conclusive, and in an in-
ductive process they are valuable only because they
suggest lines of further observation which may

either verify or discredit the analogical inference.
Mill, therefore, is right when he regards an analogy
as "a mere guide post, pointing out the direction
in which more vigorous investigations should be
prosecuted. It is in this last respect," says Mill,
"that considerations of analogy have the highest
scientific value. The cases in which analogical evi-
dence affords in itself any very high degree of prob-
ability are, as we have observed, only those in
which the resemblance is very close and extensive;
but there is no analogy, however faint, which may
not be of the utmost value in suggesting experi-
ments or observations that may lead to more posi-
tive conclusions." With this view, to which Mill
does not consistently adhere, Jevons is in agree-
ment, and he has made it the foundation of his chap-
ter on analogy in the Principles of Science.

Nature of Hypothesis. An hypothesis is an at-
tempted explanation of an occurrence, a supposition

about the connection of particular phenomena. To
get the meaning of this general statement before us,
let us consider a particular case. Malaria is a dis-
ease which has a set of characteristic symptoms,
the chief of which are chills and fever occurring at
more or less definite intervals of time. When the
physician has become familiar with the character-
istic symptom complex of the disease, he is able to
diagnose the new cases that come under his obser-
vation by means of the similarity that they bear to
this complex ; all the cases that show the diagnostic
marks of the disease he calls malaria. The logical

procedure in this instance is analogical. If, how-
ever, instead of taking the physician's attitude which
requires him to diagnose only for the purpose of
selecting the proper remedies, we approach the dis-
ease from the standpoint of the scientist who wants
to know what malaria is, we shall have to go beyond
the similarities which figure in the physician's diag-
nosis, and, by a series of suppositions or hypotheses,
work our way among the antecedents and concomi-
tants of the cases of the disease for some clue to the
agent which is responsible for the production of the
disease. It is not enough to say that similar symp-
toms mean the same disease, the question we are now
asking is what produces the similar symptoms in all
the cases that occur. We are looking for something
more than similarity, we are searching for an iden-
tity among the conditions under which the disease
is contracted. Thus, for example, night air, damp
places, exhalations from marshy ground have been
proposed as the antecedent condition which is
capable of producing malarial fever. It is only
within comparatively recent times that, for these
hypotheses, another has been substituted which con-
nects the disease with the bite of the Anopheles
mosquito, and this is the view that is held at the
present day. The bite of the Anopheles mosquito*
is our hypothesis for the occurrence of malaria.

In the light of this illustration, we may observe
that not any supposition about phenomena is an
hypothesis. It is only when the supposition points
us to phenomena of the same order as the event

that we are trying to explain that it satisfies the
conditions of a tenable hypothesis. In medicine,
for example, we no longer entertain theological ex-
planations of disease, and for devils we are substi-
tuting bacteria and their toxins, and in those dis-
eases which cannot be shown to be of bacterial
origin, as for example many of the occupational
diseases, we assign either a chemical cause, as in
lead poisoning, or a mechanical one, as in the dis-
ease characteristic of the Sheffield steel grinders.

When made with regard to the requirement we are
now considering, namely, that the supposition
should be stated in terms of the same order as the
phenomenon to be explained, hypotheses differ from
one another only in the degree of their probability;
and it seems to us to be quite misleading to speak of
them as guesses, as is done by some logicians, as if
they were altogether uncontrolled by the nature of
the phenomena for which an explanation is being
sought. The truth of this statement is apparent
when we recognise that the demand for an hypoth-
esis is only a particular form of the demand for a
careful analysis of the phenomena under observa-
tion. Our acquaintance with objects becomes more
minute as well as more accurate under the stimulus
that comes from the call for explanation ; and if one
step in the process of explanation is hypothetical,
that step must still be controlled by the nature of
the observed material if we are to safeguard the in-
ductive process against useless and irresponsible
guesses. The satisfaction of this requirement by

science may be briefly illustrated. To account for
the phenomena of sound, the physicist, starting with
the sound experience, connects this with the undu-
lations of the air which occasion it, and these undu-
lations, again, he connects with a vibrating body,
a stretched string, the vocal cords, an organ pipe.
When the scientist asks what is the source of the
phenomena of light which occasion the sensation of
vision, although he cannot point definitely to the
material bodies which produce the undulations in
the ether, he forms his hypothesis in terms of the
same order as the phenomena that he has under in-
vestigation; and he does so because the "scientific
imagination," to quote Tyndall, "demands, as the
origin and cause of a series of ether-waves, a par-
ticular vibrating matter quite as definite, though it
may be excessively minute, as that which gives
origin to a musical sound. Such a particle we name
an atom or a molecule. I think the intellect, when
focussed so as to give definition without penumbral
haze, is sure to realize this image at last."

Objections to the Use of Hypothesis. Although
the history of modern science furnishes so many
illustrations of the value of hypotheses, and al-
though the methods in use at the present day for
the advancement of scientific knowledge depend
also upon their employment, there is, nevertheless,
among scientific men either only a half-hearted
recognition of their services, or a misleading rejec-
tion of their claims to a place in scientific procedure.
This interesting fact is not difficult to understand,

and we refer to it here because it enables us to

explain some aspects of the formation of hypoth-
eses which as yet have not been mentioned. The
hesitancy of men of science to recognise that the
advancement of scientific knowledge is, in any re-
spect, dependent upon hypotheses, may be attrib-
uted to their effort to exclude from all parts of their
work influences and additions that are derived from
the nature of the mental processes through which
that work is carried on. The aim of science is
throughout objective in the sense that its task is to
describe and explain the facts of observation, to
arrive at judgments about these facts that are inde-
pendent of the idiosyncrasies of the individual mind.
"The scientific man," as Karl Pearson says, "has
above all things to strive at self-elimination in his
judgments, to provide an argument which is as true
for each individual mind as for his own." The
life of science depends upon loyalty to this aim.
The intellectual integrity of every scientific man is
involved in his efforts to maintain this aim. All
this may be granted; it may even be admired and
praised. And yet we cannot avoid the impression
that if the spirit of loyalty to professional ideals
which is displayed by workers in the fields of the
particular sciences were supplemented by an ac-
quaintance with the history of scientific achieve-
ments, the objections to hypothesis would be miti-
gated, and in time might entirely disappear. For
the admission of hypothesis in no way interferes
with keeping the work of science objective, and

their practical rejection may often render impos-
sible of realisation the aims which stimulate scien-
tific effort.

The situation that has just been described may
be made more explicit by saying that without an
active and fertile imagination, it is impossible to
formulate a satisfactory hypothesis. It is, in part,
because the scientist does not take the pains to
ascertain what are the nature, conditions, and limits
of the imagination that he looks askance upon the
formation of hypotheses. This is not the place to
state and develop a doctrine of the imagination; it
is enough for our purpose to call attention to the
fact that many of the leading men of science have
borne eloquent testimony to the value of the imagi-
nation in advancing the interests of scientific truth.
In his address on 'Scientific Use of the Imagination/
Tyndall writes: "Bounded and conditioned by co-
operant reason, imagination becomes the mightiest
instrument of the physical discoverer. Newton's
passage from a falling apple to a falling moon was,
at the outset, a leap of the imagination." Tyndall
prefixed to his essay the following passage from an
address to the Royal Society by Sir Benjamin Brodie.
"Lastly, physical investigation, more than anything
besides, helps to teach us the actual value and right
use of the Imagination of that wonderful faculty
which, left to ramble uncontrolled leads us astray

into a wilderness of perplexities and errors, a land of
mists and shadows; but which, properly controlled

by experience and reflection, becomes the noblest
attribute of man; the source of poetic genius, the
instrument of discovery in Science, without the aid
of which Newton would never have invented flux-
ions, nor Davy have decomposed the earths and
alkalies, nor would Columbus have found another
continent." In his Methods and Results, Huxley
writes : "It is a favourite popular delusion that the
scientific inquirer is under a sort of moral obliga-
tion to abstain from going beyond that generalisa-
tion of observed facts which is absurdly called
'Baconian' induction. But any one who is practically
acquainted with scientific work is aware that those
who refuse to go beyond fact rarely gets as far as
fact; and any one who has studied the history of
science knows that almost every great step therein
has been made by 'anticipation of nature/ that is,
by the invention of hypotheses which, though veri-
fiable, often had little foundation to start with, and
not infrequently, in spite of a long career of useful-
ness, turned out to be wholly erroneous in the long
run."

These quotations are sufficient to illustrate the
importance of the imagination in the construction
of scientific hypotheses, and to indicate the reason
why many men of science look with suspicion upon
the use of hypotheses. "Scientific men fight shy of
the word (imagination) because of its ultra-scien-
tific connotations," because its use is often uncon-
trolled, and because under the best conditions it
sometimes leads us astray. But to reject an instru-

ment of research because of its limitations is no
more reasonable than would be a physician's refusal
to employ strychnine in the cure of a patient, be-
cause that drug is on the commercial market in the
form of 'Rough on Rats.' We are not advocating an
indiscriminate exercise of the imagination, nor the
substitution of it for the careful and painstaking
observation of phenomena. What we are pointing
out is that there are conditions of physical investi-
gation which render all known instruments of pre-
cision inadequate and clumsy tools, and that if
observation is not to be hindered its range must be
extended as far beyond that of our instrumental
world as this is beyond the world made known by
our natural organs of perception. We cannot, for
example, bring under observation by the most
powerful microscope the particles of matter which
are the media in our atmosphere of reflected light.
By what means has the existence of such particles
scattered throughout our space come to be believed

in? Tyndall cites this example as an illustration
of the use that science may make of the imagina-
tion, as he does also Darwin's hypothesis of a pri-
mordial germ as the source of all the variety of
organisms now upon the earth's surface. These in-
stances, and many others that are among the most
brilliant achievements of science, lead us to look
upon the imagination as itself an instrument of
observation, and in the form of carefully stated
hypothesis, it leads to an explanation of many ob-

served facts which without its aid would postpone
indefinitely important lines of research.

Verification of Hypotheses. If we are to carry
our explanations of events to a successful termina-
tion, the hypotheses by means of which the rela-
tions of particular phenomena are brought under an
intelligible view need to be tested and not merely
stated, to be verified, not merely formulated. There
are two steps in the process of verification to which
we may give attention. "To prove or disprove (an)
induction we must have resort," says Tyndall, "to
deduction and experiment." Mill's definition of an
hypothesis, that it is "any supposition which we
make (either without actual evidence, or on evidence
avowedly insufficient) in order to endeavour to
deduce from it conclusions in accordance with facts
known to be real," points to the same two require-
ments. An hypothesis which is not capable of be-
ing verified would serve no immediate purpose, and
whether it serves any purpose at all need not con-
cern us. We are now studying living hypotheses,
those which answer questions, and render intelli-
gible the particular facts of observation. And it is
about these that we are warned that it is not their
intelligibility merely, and not the fact that they
answer questions, which recommends them finally to
our acceptance. It is only if our hypotheses are
true, if they make us acquainted with the actual
relations which objects sustain to one another, that
they are received as part of our scientific knowledge.
The formation of hypotheses takes us beyond what

is actually known and observed, and for this reason
there is in every hypothesis an element of risk ; but
they must at the same time make it possible for us
to return to fact and the observation of fact, and it
is this that renders them useful in the advancement
of human knowledge. The return to fact is made
in the two steps of deduction and experiment.

Let us take as an illustration of these two stages
in the process of verification the well-known fact
that water rises to a certain height in a pump, and
the explanation of this fact on the ground that

"Nature abhors a vacuum." The story goes that in
trying to raise water to a great elevation, some
Florentine gardeners found that the column of
water ceased at the height of thirty-two feet. The
matter was referred to Galileo who, embittered by
the reception that had been accorded to his science,
said that he supposed that Nature abhorred a
vacuum only at the height of thirty-two feet. It
was left for Toricelli, Galileo's pupil, to provide an
answer to the inquiry. He supposed that water
might be forced into a tube by pressure on the sur-
face of the liquid outside. After much thought, it
occurred to Toricelli that the atmosphere might
exert such pressure, and that the column of water
thirty-two feet in height might be the exact weight
necessary to equalise this atmospheric pressure.
This supposition was Toricelli's hypothesis. Was it
true? This was the next question that the physicist
confronted, and it is exceedingly instructive to ob-
serve the way he went to work to verify his hypoth-

esis. He deduced certain consequences from the
hypothesis. He argued that if thirty-two feet of
water will hold the atmospheric pressure in equili-
brium, a shorter column of a heavier liquid should do
the same. According to his calculations, mercury,
which is thirteen times heavier than water, should
be able to balance the pressure of the atmosphere
at thirty inches. The next step in the process of
verifying the original hypothesis was an experi-
ment. Toricelli filled a glass tube a yard or so in
length, open at one end and closed at the other,
with mercury. Placing his thumb over the open
end, he inverted it in a bath filled with the same
metal. When he removed his thumb, the mercury
began to sink, and continued to sink until the height
of thirty inches had been reached. The proof of the
hypothesis was complete.

Hypothesis and Theory. The difference between
an hypothesis and a theory is a relative one merely.
To bring out this feature of the terms' meanings,
we may say that a theory is a completely verified
hypothesis, and that an hypothesis is an incom-
pletely verified theory. This statement will have
served its purpose if it remind us that hypothesis and
theory both spring out of the demand for explana-
tion, that they both involve the use of the creative
imagination for their formation, and call for verifi-
cation in the way that has been described. It is these
similarities which justifies the popular use of the
terms as synonymous. It will be useful for us, how-
ever, to look at the matter a little more closely. We

may observe, for instance, that we advance from
hypothesis to theory, not by leaving our hypothesis

behind, but by developing it in the light of further experiences so as to make it accord with facts hitherto not known or not understood. In this sense, the hypothesis becomes a theory. To illustrate, when ice-cold water is poured into a glass on a hot summer day, little drops of water collect and trickle down on the outside of the glass. How do we account for this phenomenon ? The sudden cooling of the glass takes place by radiation of its heat, and the water-vapour of the atmosphere condenses on the cooled surface of the glass. The same hypothesis may be extended to account for the formation of dew, and a number of other phenomena. An hypothesis that can be used to explain a variety of facts which were not thought of when the hypothesis was formulated, can justly be regarded with greater confidence than one which explains only a single phenomenon. Every new fact which fits into an hypothesis strengthens it. At first, an hypothesis has an explanatory value only for the particular phenomenon with respect to which it is framed. But if an hypothesis is capable of growth, both in respect to the number and variety of the facts which it is capable of explaining, and in the simplicity of the form which it assumes, the conditions are present for the development of the hypothesis into what is known as a theory. We speak, for example, of the Darwinian hypothesis, because the supposition it states is still in a condition of growth, and because the modifications which are being introduced into Darwin's

statement are intended to make his view harmonise more fully with progressive experience and recent discovery. When, however, we regard the idea of growth throughout the known world as a confirmed doctrine of science, we no longer speak of the Darwinian hypothesis, but of the theory of evolution. In the same way, and for similar reasons, we speak of the theory of gravitation, the Copernican theory, the theory of the conservation of energy. What we mean by such designations is that the evidence for the particular hypotheses which lies back of them is ample and varied, that the exceptions within the fields of their application are either insignficant or are absent altogether, that newer experiences and discoveries tend to confirm these views. When lines of evidence tend to converge and to be f ocussed on an hypothesis, that hypothesis has no longer the tentative position of a supposition, but the firmer and surer foundation of a confirmed belief. The formulation of such a confirmed belief is called a theory.

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QUESTIONS

1. Is there necessarily any irreconcilable opposition be-
tween the view that the aim of science is complete ob-
servation, and that it is explanation? Explain.

2. To what simple type does all scientific explanation con-
form? Illustrate.

3. What is meant by saying that explanation consists in
discovering the conditions of the occurrence of phe-
nomena?

4. Are all the circumstances attending the occurrence of
an event conditions of its occurrence?

5. What is meant by saying that the phenomena of ob-
servation and those of explanation are continuous with
each other?

6. What bearing, if any, do the facts included in your answer to the previous question have upon the distinction between a phenomenon and its conditions?

7. In what sense can it be said that scientific explanation is a process by which what is given in observation is supplemented by what is not so given?

8. Can you connect the conception of scientific explanation implied in the previous question with the conception of knowledge stated in Chapter I?

9. State and illustrate three senses in which the word analogy is used.

10. Why is not any kind or degree of resemblance a safe principle of inference?

11. What is meant when it is said that analogical reasoning depends upon important resemblances? .

12. In what way does the validity of reasoning by analogy depend upon the attitude one takes toward differences?

13. What light does the saying that analogy 'sticks in the particular instances' throw upon the character of analogical argument?

14. In what sense can analogy be regarded as a method of explanation ?

15. What are the limits of analogical argument?

16. What does Mill mean by calling analogy 'a mere sign post'?

17. State and illustrate what you understand by an hypothesis.

18. Why must hypotheses be stated in terms of the same order as the phenomena they attempt to explain?

19. Is there any objection against calling hypotheses 'guesses,' and, if so, what is the ground on which it rests?

20. What reason may be given for the scientists' objection to the use of hypotheses?

21. What is the relation of imagination to the task of formulating scientific hypotheses?

22. What are some of the 'facts' which we owe to the exercise of imagination in the field of the natural sciences?

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23. State and explain the two steps involved in the veri-
fication of hypotheses?

24. Illustrate by the use of concrete example the process
of verifying an hypothesis.

25. How do hypothesis and theory agree with and differ
from each other? Illustrate.

EXERCISES

1. Examine the explanations of three simple events with
which you are acquainted, and state whether they con-
form or not to the fundamental form of explanation
as stated in the text.

2. Give three instances in which explanation consists in the
statement of the conditions of a phenomenon's occur-
rence.

3. Give two llustrations, one from literature and one from
science, of analogy. Examine each with a view to show-
ing to which meaning of the word it conforms, and
whether it satisfies the conditions of a valid inference.

4. Upon what logical principle does each of the following
statements depend, and what can you say as to their
validity as arguments:

(1) It is said that a general resemblance of the hills
near Ballarat in Australia to the California hills

where gold had been found suggested the idea of
digging for gold at Ballarat.

(2) There are no great nations of antiquity but have
fallen to the hand of time; and England must join
them to complete the analogy of the ages. Like
them she has grown from a birth-time of weakness
tutelage to a day of manhood and supremacy, but
she has to face her setting. Everything that
grows must also decay.

5. Construct an hypothesis to explain some fact of your
experience, and explain how it may be verified or over-
thrown.

CHAPTER XVI

CAUSATION

General Statement of the Problem. The fact that
underlies the problem of causation is the observed
regularity in the order of the particular phenomena
which occur in the course of our ordinary expe-
rience, and in the fields of the several sciences.
That our ordinary and scientific experience is char-
acterised, within ascertainable limits, by some kinds
and degrees of regularity is a fact about which

there is universal agreement. Indeed, this is a fea-
ture of experience so generally recognised that it
constitutes the starting point not only of the theo-
retical interest which leads us to the more accurate
forms of human knowledge, but also of the practical
interests which lie at the foundation of the political,
commercial, and social relations by which human
individuals are held together in a community. A
world from which all order were absent would be a
world in which all thought and action would be im-
possible, and to which all thinking and active agents
would ultimately succumb. The institutions of
society and the organisation of the sciences pre-
supposes that some sort of unity and order belong
to the world ; and it is the business of all our sciences
to study the regularities of the phenomena and
events of the world for the purpose of endowing
our notion of such regularities with greater pre-

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cision. The problem, then, that confronts us in view
of this regularity of the world's order is : How shall
we conceive this regularity so as to make intelligible
to ourselves the principles or laws by which it is
maintained and upon which it depends?

The Practical Aspect of the Question. There is
no doubt that this is not a theoretical question
merely, a question only of the sciences, and unim-
portant or superfluous in the absence of theoretical
interests. The way in which the world in which
we live may be expected to behave is a broadly
practical interest; and the man who in the morning
starts off to his office, as well as the one who goes to
his laboratory, begins the day's work with the ex-
pectation that the uniformities upon which he has
relied in the past will be maintained in the present.
Indeed, we may say that, in the history of the indi-
vidual and of the race, interest in the regularity
of the course of observed events was practical before
it was theoretical; and it would not be difficult to
show that the practical motive has never been
divorced from the theoretical when, in the progress
of the sciences, these uniformities have become
the subject of very specialised study. No one,
for instance, who has the least knowledge of
primitive peoples can fail to be impressed with the
fact that the origin and development of their insti-
tutions is closely interwoven with their struggle
with the forces of nature. Upon his understanding
of the physical world has depended the primitive
man's ability to maintain himself in existence. We

see the relationship thus indicated between the
growth of intelligence and the economic struggle

illustrated in a broad way if we contrast, for ex-
ample, the peoples of the northern and southern
latitudes. Whenever, as in the latter case, the food
supply is plentiful and relatively independent of the
cultivation of the domestic arts, intelligence is com-
paratively low ; but when, as in the former case, the
food supply is scanty or precarious, it becomes
increasingly important to understand the physical
environment from which has to be won the means
of physical support, and, if the community is to
perpetuate itself, to socialise this knowledge in the
domestic arts.

There are many concrete illustrations of the
way in which, at the present time, observation
of natural occurrences, and inferences drawn from
such observation, are allowed to affect our prac-
tical life. From the character of the sunset
we infer that it will be a fair or stormy day to-
morrow, and, therefore, that it will, or will not, be
possible to take a day's outing in the country. What
the farmer calls 'good growing weather' is an infer-
ence, based upon observed connections in the past,
of the same practical sort. Now about the facts that
underlie such practical inferences as these, we may
observe that they are selected, often by the cooper-
ative labours of many generations of observant men,
from a very complex mass of details, and that no
effort is made, as a rule, either to determine the pre-
cise nature and connection of the facts themselves,

or to enumerate exhaustively the other factors with
which, in our experience, they are associated. For
example, what constitutes 'good growing weather'
may be for one man a matter of temperature, for
another a matter of humidity, and for a third a
matter of both ; but neither of these factors, nor both
together, can be regarded as a sufficient explanation
of the term, and many other elements of the situ-
ation in which it is relevant to talk about growing
weather must be taken account of such, for in-
stance, as the nature of the particular crop, the
particular stage of its growth, its condition at that
stage, the nature of the soil, the location of the field
in which the crop is growing, etc. if the phrase
is to have for us any practical significance. When,
therefore, we examine the character of those uni-
formities which our practical interests lead us to
observe, we find that they are made up of certain
striking or important features of a complex situ-
ation, which are connected together in such a way
that, on their recurrence in our experience, we are
led to expect the recurrence of other features of the
situation with which they have been associated in
our past experience. In other words, one part of
an experience is taken as a sign of the recurrence
of another part with which it is usually connected.
Beyond such empirical connections as are found in
experience, the practical view of causation does not
enable us to advance.

The Theoretical Aspect of the Question. If we
compare the theoretical with the practical way of

dealing with the observed regularities in the occur-
rence of natural events, we shall see that it differs
from the latter in two respects. In the first place,
the theoretical view, in Venn's suggestive phrase,
'screws up' the antecedent or cause and the conse-
quent or effect of an event into close juxtaposition,
so that they come to be regarded as nearly as pos-
sible concurrent. The possibility of doing this, it is
obvious, depends upon our ability to eliminate from
the phenomenon we are examining all the disturb-
ing or irrelevant elements. If, therefore, it is re-
membered that no two natural events are exactly
alike in all their details, that some of the attendant
circumstances are peculiar to the instance of the
phenomenon we are examining, and form no part of
the phenomenon itself, it is evident that the omission
of these, by whatever means it is brought about,
can serve only to give greater precision to the fac-
tors that are involved in the orderly sequence, and
to make it possible to determine with greater accu-
racy the details which are involved in the causal
relation. We pass from the practical to the more
theoretical view of causation, that is to say, when
we devise means of eliminating from our observa-
tion of natural events what is irrelevant to our.
search for the conditions of the occurrence of such
events.

In the second place, the theoretical view insists
upon the importance of a careful analysis of the
antecedents of an event as a condition of establish-
ing a causal relation. Mill insisted on this point

with some emphasis, and he criticised the practical
view for the unregulated way in which it picks out
some one event or circumstance, and calls it the
cause. There is just ground for Mill's contention,
if our study of the observed regularities in the
occurrences of natural phenomena is made from
the point of view of the requirements of accu-
rate knowledge; but if we admit the legitimacy of
the practical point of view, if, that is, the order of
nature's changes are taken as a clue to the kinds of
conduct that are likely to be efficient, we may say
that the more refined analysis that Mill had in mind,
and which is required by science, would in large
measure defeat this latter purpose. It is because
the interests of science are so intimately bound up
with a detailed knowledge of the conditions of phe-
nominal occurrences that, in contrast with those of
the practical life, its requirements are satisfied only
by the minute analysis of the phenomena with which

it is particularly concerned. In emphasising this
point Mill has directed attention to an important
difference between the practical and theoretical
views of the causal relation.

The Genetic Relation of the Practical and Theo-
retical Views. While the theoretical view of caus-
ation differs, as we have said, from the practical in
important respects, we should be departing from
the truth if we supposed that the differences between
these views expressed the whole truth about them.
There is between the two views no such opposition
in fact as an examination of their differences alone

would lead one to think. We must regard them,
rather, as earlier and later stages in the progressive
efforts of the race to make clear to itself the rela-
tion in which it stands to the changing environment
under which its life has to be lived. It was doubt-
less useful for the theoretical view that practical
interests had led to the observation of large numbers
of uniformity in the occurrence of natural events.
In this way, material was already prepared for it,
and to this material it could apply the stricter
methods which a change in interests was the means
of defining. But in developing and applying these
methods the sciences have not freed themselves alto-
gether from practical considerations and, moreover,
have themselves contributed very largely toward a
new and broader conception of the practical itself.
By this statement we do not merely mean that, in its
history, scientific progress frequently has been
determined by difficulties encountered in a narrowly
practical way, nor merely that scientific truth has
so often been found capable of a like practical
application; the more important fact is that, as
scientific aims and methods have become established,
our conception of what is practical has been broad-
ened to include any kind of activity that is directed
toward the attainment of an end. In the sense in
which nowadays we use the word, any regulated or
consciously controlled process is practical, and it
would seem that science has not only contributed to
this conception but is itself, in this meaning of the
term, preeminently a practical affair. And just be-

cause the scientific man approaches his problems
with definite questions in his mind, because, as
Bacon said, he interrogates nature, there is a limit
set, by the nature of the questions themselves, to
the amount of analysis that is necessary in arriving
at the solution of particular problems. It is not,
therefore, in the amount of analysis performed that
we can find the distinguishing mark of a theoretical
view of the causal question. For if we insist that
our analysis in any field whatever must be relevant,

in kind and amount, to the purpose for which it is
undertaken, it becomes at once obvious that the
practical and theoretical views are brought together
under a single view, and that the differences enu-
merated above must be understood, not as placing
the views in question in different classes, but as indi-
cating different species of activity which belong to a
single class.

The Origin and Nature of the Causal Problem.
In view of the foregoing considerations, two facts
may be said to be fairly well established. In the
first place, there is good reason for believing that
the causal problem arises from the importance that
the presence of order in human experience has for
the practical no less than for the theoretical life.
The problem of causation is of such general interest,
as we have seen, not because the world in which
we live is unregulated and disordered, but because,
being regulated and- ordered, we can adjust our-
selves to it better if we know the principles and
laws according to which, in the future as in the

past, things and events may be expected to happen.
It is well to be perfectly clear on this point, because
frequently its neglect has led to a somewhat one-
sided, if not misleading, view of the problem itself.
We have called attention to the impossibility of
considering the causal problem as in any essential
respect different for the scientist than for the prac-
tical man. For both, it is the fact that experience
presents us with certain regularities in the order
of our experience that directs attention to the prob-
lem, and that leads to a study of these regularities.
We do not study the causal problem, that is to say,
to escape from a world of chaos to a world of order,
but, starting with the world of order, we seek to
understand its laws, and to ascertain how far these
laws are capable of being extended to new and
larger areas of life.

In the second place, it is clear that the problem
of causation has nothing whatever to do with the
question why things happen as they do, if by that
question is meant an inquiry into the reasons why
our experience has the distinctive characteristics
that it is known to have. Science, and the same
thing is equally true of philosophy, starts with the
acceptance of the world as it is known in human
experience, a world, as we have seen, that has a cer-
tain determinate character. Now about such a world,
it would be futile to ask ourselves why it has this
rather than some other character, since the very
problems which confront us in our everyday life, and
in our sciences and philosophy as well, arise out

of the world's character as made known by human observation. The facts about the world in which we live, as these are observed and reported in increasing numbers and with improving accuracy, constitute the material of all human knowledge, and if there are any further questions that arise, these must concern the way in which such facts are connected in the unity of an ordered system. Instead, therefore, of conceiving the causal problem as an inquiry into the reason why facts are what they are, we must view it rather as demanding of us an exposition of the nature of the connection that binds the various parts of human experience together. Put simply, the causal problem is concerned, not with the question why things are what they are, but with the question how things happen as they do.

The Course of Our Further Discussion. Our further study of the causal problem will bring before us particularly three closely related questions. We shall examine, in the first place, the time relations of causal events; in the second place, the complex character of such events will demand attention; and in the third place, we must try to make clear what is meant by the necessity that is always recognised as belonging to such events. In our discussion of each of these topics, we shall make Mill's 'treatment, in Book III., Chapter V., of the Logic, our point of departure. It will be advantageous, therefore, for the student to read the whole of Mill's

chapter in connection with the following paragraphs.

The Time Relations of Causal Events. The first characteristic of a causal relation that Mill enumerates is the 'invariable antecedence' of certain of the factors involved in the causal relation. He says that "invariability of succession is found by observation to obtain between every fact in nature and some other fact which preceded it. ... The invariable antecedent is termed the cause; the invariable consequent, the effect. And the universal law of causation consists in this, that every consequent is connected in this manner with some antecedent or set of antecedents. . . . For every event there exists some combination of objects or events, some given concurrence of circumstances, positive and negative, the occurrence of which is always followed by that phenomenon." He points out that we may not have discovered what the particular concurrence of circumstances may be in a given case, "but," he adds, "we never doubt that there is such a one, and that it never occurs without having the phenomenon in question as its effect or consequence."

In this passage, Mill definitely raises the question of the time relations of causal events. In lay-

ing emphasis on the antecedence of the cause, Mill
takes the view that for any event to be considered
as a cause at all, it must exist in time before the
event which is, or may be regarded as, its effect.
This, doubtless, is the conception of the time rela-

tions of cause and effect that prevails generally at
the present day, and it may be worth while to ask
how far it is an accurate description of the facts
that are involved in causal events. There are,
without question, many examples of the causal rela-
tion that lend themselves quite naturally and easily
to this interpretation, examples, that is to say, in
which the fact that we call the cause and the fact
that we call the effect appear to be temporally dis-
tinct events. A blow on the head, for instance, may
be followed by the loss of consciousness, and
may be said to be the cause of the loss of con-
sciousness. The explosion of a powder magazine
may follow the application of a lighted match or
fuse to the powder. Diphtheria makes its appear-
ance ten days after the ingestion of the Klebs-
Loeffler bacillus which, the physicians tell us, is the
cause of the disease. In all these cases we have, or
seem to have, undoubted examples of the necessary
temporal priority of the cause, and the necessary
posteriority of the effect, in causally related phe-
nomena. It may be doubted, however, whether all
causally related events can be made to fall so easily
and naturally within this scheme or view. It would
be difficult, for example, to detect in the explanation
offered by the chemist of the formation of rust the
temporal discontinuity of cause and effect which is
an essential part of Mill's doctrine of causation.
Rust formation, so we are told, is due to the combi-
nation of iron with the free oxygen of the air; but,
if that is so, it is quite obvious that the chemical

combination of oxygen and iron does not precede,
but is contemporaneous with, the formation of rust
itself. There are innumerable instances of a similar
character, and we may even say that the example
chosen is typical of most of the chemical processes
with which we are at all familiar. The case is im-
portant because of the large field of application of
chemical laws, not only in the inorganic, but in the
organic world as well. To take only one such
example, we now know that bacterial action is
largely, if not wholly, due to the toxins generated
by microscopic organisms; and, if that is true, the
final explanation of their action and results is, as
is coming to be seen, a highly specialised branch of
the science of chemistry. If, as seems probable, the
results of bacterial action are not separable in time
from the production of their toxins, an overwhelm-
ing list of examples can be appealed to to throw

doubt on the necessary temporal antecedence and consequence of the events involved in the causal relation.

It is owing to some such considerations as these that the position has sometimes been taken that there is no distinction whatever between the cause and the effect of a phenomenon, in other words, that the cause and effect are identical. There seems no sufficient reason in the nature of causal phenomena why we should adopt so paradoxical a view. Cause and effect do stand for distinct things in our experience of causal events, and if, as we have said, this distinction is not necessarily one of temporal

discontinuity, we need to inquire further what the distinction is.

When we say that the relation of cause and effect is not necessarily one of antecedence and consequence in time, we must not be understood to affirm that causal phenomena have no relation at all to time. That would be not only a paradox, but exceedingly difficult to maintain. It is no doubt true that all causal phenomena are events in time, that they are constituted by a number of facts which come before and after one another in a series. That the whole number of facts in a causal phenomenon have a definite sequence and order in time there is no need to deny, and that the order and sequence can be determined is the permanent expectation and belief of science. From this fact, however, it does not follow that, within the series, the cause and effect are separated by a necessary temporal interval. What rather we seem warranted in saying with respect to the causal series is that their factors are continuous, temporal continuity, not temporal discontinuity, seems to be the characteristic of all such events. But whether within the causal series the cause antedates the effect, or is contemporaneous, at least in part, with it, as it must be, for example, in the circular reactions of chemistry, is a fact to be determined in the particular instance. But whatever may be true of any particular instance, temporal discontinunity cannot be regarded as an essential feature of the causal relation. The utmost that we can say, from the

standpoint of their temporal relations, is that the cause and effect are continuous with one another.

The Complex Character of Causal Events. It is seldom, if ever, according to Mill, that an invariable sequence subsists between a consequent and a single antecedent. Usually, the causal relation exists between "a consequent and the sum of several ante-

cedents ; the concurrence of all of them being requisite to produce, that is, to be certain of being followed by, the consequent." If, for example, "a person eats of a particular dish and dies in consequence, that is, would not have died if he had not eaten of it," the death is usually attributed to eating of the dish although, as Mill points out, there were other factors contributing to the result, such as the bodily constitution of the individual, the particular state of his health, and, perhaps, a certain state of the atmosphere. These taken in conjunction with eating of the dish are, according to Mill's view, the 'invariable antecedent/ When we select one among the antecedents of a phenomenon and call this the cause, our selection, Mill says, falls generally on the one which came last into existence. But, he also points out, there is hardly any one among the number of antecedents that may not serve in this special sense as the cause "according to the purpose of our immediate discourse." This tendency "to associate the idea of causation with the proximate antecedent event, rather than with any of the antecedent states, or permanent facts, which may happen also

to be conditions of the phenomenon," Mill regards as not at all necessary to the common notion of cause. The conclusion, then, at which he arrives is that by a cause is meant "the sum total of the conditions, positive and negative, taken together; the whole of the contingencies of every description which being realised, the consequent invariably follows. The negative conditions . . . may be all summed up under one head, namely, the absence of preventing or counteracting causes."

The essential contentions of Mill in this passage are, first, that the antecedent of any fact is a complex group of facts, and, second, that the cause, popularly considered, is taken to be some one fact among the antecedents selected arbitrarily or for some special purpose. With regard to the first point we may quote Jevons. He says : "By an antecedent we mean any thing, condition, or circumstance which exists before or, it may be, at the same time with an event or phenomenon. By a consequent we mean any thing, circumstance, event, or phenomenon, which is different from any of the antecedents and follows after their conjunction or putting together. It does not follow that an antecedent is a cause, for the effect might have happened without it. Thus the sun's light may be an antecedent to the burning of a house, but not the cause, because the house would burn equally well in the night; but a necessary or indispensable antecedent is identical with a cause, being that without

which the event would not take place. . . . There

are usually many different things, conditions, or
circumstances necessary to the production of an
effect, and all of them must be considered causes
or necessary parts of the cause. Thus the cause
of the loud explosion in a gun is not simply the
pulling of the trigger, which is only the last appar-
ent cause or occasion of the explosion ; the qualities
of the powder, the proper form of the barrel, the
proper arrangement of the percussion-cap and pow-
der, the existence of the surrounding atmosphere,
are among the circumstances necessary to the loud
report of a gun ; any of them being absent it would
not have occurred." In this passage it may be
observed that what is popularly regarded as the
cause, the second point mentioned by Mill, Jevons
calls the occasion of the event, that is, that which,
in connection with the other necessary antecedent
or coexisting conditions, is effective in bringing
these latter into active operation. What Jevons
here speaks of as the occasion is sometimes called
the immediate cause, the other necessary attendant
circumstances being referred to as the conditions
or causal conditions of the event in question.

That the cause of any event is some complex
group of facts or circumstances is undoubtedly true.
Indeed, this seems to follow as a matter of necessity
from the general character of human experience.
As we have pointed out frequently, objects and
events are experienced by us, not as separate and
individual things, but as subsisting with other ob-
jects and events with which they are connected in

a variety of ways. It is this feature of experience
that was said above to be the starting point of the
casual problem. Now it is no doubt true that within
any experienced complex we can, and in fact do,
isolate, by an act of discriminative attention, a
given fact or event which we regard, for reasons
special to the case, as the effect or result of other
perceived or discoverable facts, and that, in this
way, a certain uniqueness, a certain independence,
comes to be regarded as the distinguishing mark of
all effects whatever. But while no objection can be
brought against thus isolating an effect, since in this
way it is rendered more capable of exact descrip-
tion, and the particular causal relation that has to
be determined is made more capable of exact defi-
nition, a similar line of remark does not apply to
what we understand as a cause. For, in the first
place, it is only because what we call the effect
has a definite character that the search for a cause
becomes a problem at all. Unless the fact or event
of which we wished an explanation were made

definite, there would be no point of starting for the
establishment of a causal relation. It is owing to
the fact that some part of the experience of which
the effect is only a fragment remains indefinite that
the cause is characterised at first by an indeter-
minateness that would be quite fatal if it attached
to the effect.

But, not to press this point, we cannot be
sure, in the second place, that, in any particular
case, all the conditions which will make the oc-

currence of an effect intelligible fall within our
experience of that case. As we have seen above,
experimental and theoretical observation are val-
uable chiefly because they bring within experience
factors, material to our understanding of a phe-
nomenon, that are not included in our ordinary
perception of it. An example, usually cited, is the
discovery of the planet Neptune by Galileo in 1846.
The observed fact which led to its discovery was the
deviation of the planet Uranus from the course
determined for it by the attractive forces of the
sun, Jupiter, and Saturn. It was suggested, first
by Adams and later by LeVerrier, that this devia-
tion could be accounted for if we supposed that
some hitherto unknown body, situated external to
it in a particular position and at a given distance,
were affecting the movement of the planet. Such
a body, situated where Adams and LeVerrier had
suggested, was later discovered by Galileo, and
exists in our solar system as the planet Neptune.
In the third place, we may observe that, whether
all the factors necessary to a causal relation are or
are not parts of our ordinary perception of it, as
indeed the illustration just used is sufficient to show,
the effectiveness of any given fact, the planet
Neptune, for example, seems to depend as much
on its relations to other facts, the sun, Jupiter
and Saturn, as it does on its own existence. It
is no doubt true that if the fact, the planet Nep-
tune, did not exist, it could be neither a cause
nor any part of a cause ; but if it is a cause or part

of a cause at all, it owes this character, not merely
to its existence, but also to the way it acts and is
acted upon by other facts in the system of facts in
which the effect, the course of Uranus, is in-
cluded as an important, and, indeed, a necessary ele-
ment. To take another illustration, we cannot re-
gard death as the result of a gun shot, poison, or
any other single fact, but as the result of a net-
work of facts which includes the gun shot or what

not in a system which extends to and embraces the
stated effect. From this point of view, it is evident
that the problem of causation is one in which, start-
ing with some fact or event, we endeavour to build
up by observation and experiment a system of facts
within which the fact or event with which we
started is necessarily included. Causes, conse-
quently, must always be complex, and the difficulty
of determining causes is the difficulty of including
within the system only those factors that are mate-
rial to it.

Few words are necessary to make our position
clear on the second point raised by Mill, namely, the
importance usually given to one of the conditions
of an event and naming this the cause. Prac-
tically, as Mill pointed out, the fact selected is
usually the one which is nearest in time to the effect.
But, as we have seen, the immediate temporal ante-
cedence of the cause is not necessarily an essential
feature of the causal relation. What rather, even for
the practical view, is needed is the selection of an
agent on which reliance can be placed to bring about

the desired result. Certainty as to the cause seems
to be the desideratum, whether the causal factor is
the immediate temporal antecedent of the effect or
not. When, for example, we wish to rid the prem-
ises of rats, to borrow an illustration, we may
choose either traps, strychnine, phosphorus, or ter-
riers, and doubtless the one selected will be the one
that, under the circumstances, is regarded as most
efficient. And by efficient, in this connection, we
mean the one that, with due regard to the circum-
stances of the case, realises best the purpose for
which it is chosen. Now when the purposes, for
the satisfaction of which causal relations are sought,
become specialised as they do in science, when,
that is, they are directed toward the attainment of
knowledge, and not toward the improvement of the
material conditions of life, the situation, so far as
the causal relation is concerned, is not greatly dif-
ferent, for in science the search for a cause is
determined by a purpose which the ascertainment
of the cause itself is expected to satisfy. In the
field of science, as was pointed out before, the pur-
pose that directs an inquiry does not lie outside of,
but is one with, the attainment of scientific truth.
In this the chief difference between the theoretical
and practical life is to be found. But when we have
said that, it remains true that the conditions of
knowledge are more rigid than those of practice,
and the goal of inquiry requires more strict defini-
tion. Hence we find that what passes for a cause in
practical life may seem, from the scientific point of

view, altogether inadequate, if not false, and, con-
sequently, that a more thorough analysis of the
antecedent and concurrent circumstances has to be
undertaken if the end of scientific truth is to be
reached. Now, whether or not, for the purpose of
science, all or only part of the circumstances and
conditions of an event are included in its cause will
depend on the particular and immediate purpose it
is intended to satisfy. No doubt, the ultimate goal
of science is to discover laws of connection which
are capable of extension to other than the observed
phenomena, but, at the same time, we should observe
that it can reach this end only by the determination
of the particular connections of one empirical event
with another in human experience. But even in
this more restricted field of scientific effort, a cer-
tain rigid demand is usually made and observed,
namely, that all and only those factors which can
be regarded as essential conditions of a fact or
event should be enumerated as its cause. It is only
when there is a lapse from strict scientific precision
that any thing less is possible ; and even when such
lapse takes place, the scientist feels himself obliged
to fill out, on demand, the scantier statement by
restoring all the enumerated elements that are of
material importance to our understanding of the
case.

The Necessity of Causal Events. The two fac-
tors of Mill's view of Causation that we have con-
sidered are, first, that causes are invariable ante-
cedents of the facts or events we call effects, ani

second, that causes are always complex groups of
fact, the sum total of conditions, as Mill says,
requisite to bring the effect into existence. There
is still a third factor to which we may now give
attention, a factor, it would seem, that occupies, in
Mill's total view, a place which gives it a peculiarly
special prominence. For, according to Mill, you
may have a sequence displaying the features of com-
plexity and invariability and not have one that is
definitely causal. That is to say, B may have fol-
lowed A invariably in our experience, and yet the
ground or cause of the sequence A-B may really
not be in A at all. The illustration, borrowed from
Reid, that Mill uses is the sequence of night and
day, in neither of which can the cause of the other
be found, although there is no doubt that the em-
pirical connection extends throughout human expe-
rience. Some other factor, therefore, is required
to complete the idea of cause, for, as Mill says, "it
is necessary to our using the word cause that we
should believe not only that the antecedent always
has been followed by the consequent, but that as
long as the present constitution of things endures
it always will be so." Unless the sequence can also
be regarded as 'unconditional,' we are not war-
ranted, by Mill's view, in considering it to be caus-
ally determined. "This is what writers mean when

they say that the notion of cause involves the idea
of necessity. . . . That which is necessary, that
which must be, means that which will be, whatever
supposition we may make in regard to all other

things. . . . That which will be followed by a
given consequence when, and only when, some third
circumstance also exists, is not the cause, even
though no case should ever have occurred in which
the phenomenon took place without it. Invariable
sequence, therefore, is not synonymous with caus-
ation, unless the sequence besides being invariable,
is unconditional."

It will be seen, at once, that in this statement,
and only here, do we come, in Mill's view, face to
face with the question, crucial for our comprehen-
sion of causal relations, of what we must mean
when we say that one event is necessarily connected
with another. Now it should be remarked that this
statement of Mill's raises questions which for their
adequate discussion would require us to go outside
the limits of inductive logic into the field of general
metaphysics ; and this is true, not only for a student
of the theory Mill proposes, but it is admitted as
necessarily so by Mill himself. For, as he says, it is
only so long as we can believe that the "present
constitution of things endures," only so long, that
is, as "the ultimate laws of nature (whatever they
may be) as distinguished from the derivative laws
and the collocations" remain unchanged, that what
happens in experience can become a clue to what
is true outside experience. In other words, it is
only so long as the nature of reality is and remains
what it is that we can argue from what has been
to what will be in human experience. But the
determination of the nature of reality, and of the

relation that we as thinking and active individuals
sustain toward it, is the definite problem of meta-
physics, and only indirectly does this problem come
into view in the discussion of logical questions. But
even incidentally it is worth while to remark that
the relation of logic to metaphysics that the position
of Mill raises is such that, unless we can presuppose
an ordered system of reality of some sort, our con-
fidence in human knowledge is ultimately shaken,
and the distinction between truth and error to a
large extent is obliterated. For, as we have seen
throughout, the nerve of human knowledge is to be
found in the confidence we have that in all science
and philosophy, and, we should say, in all art and
religion as well, we are interpreting, not the empty
shadows of a merely temporal experience, but the
real nature of the world which is not only the sub-
stance of all our knowing, but the very centre and

core of the being which we as individuals possess.

Turning, now, from these rather abstruce con-
siderations, we must try to interpret Mill's position
with respect to its logical implications. In order
that we may understand exactly what Mill had in
mind to say, it will be necessary to gain and secure
a correct notion of the term in which he translates
the necessity that belongs, as he and Hume before
him admit, to our notion of cause. According to Mill,
the necessity that we ascribe to a causal sequence
has its foundation in the unconditional character
of the causal sequence. What, then, does Mill mean
by unconditional? The meaning that Mill attaches,

in a general way, to this word is perhaps not diffi-
cult to detect, although he does not state definitely
the sense in which it is understood. Most of his
statements about it are negative. He says, for in-
stance, that "that which will be followed by a given
consequent when, and only when, some third cir-
cumstance exists, is not the cause," the meaning
evidently being that it is a cause only when the
consequent follows without such mediation. And,
again, he says that "if we adopt the convenient
modification of the meaning of the word cause which
confines it to the assemblage of positive conditions
without the negative, then instead of "uncondition-
ally," we must say, "subject to no other than neg-
ative conditions," where, again, the absence of some
third circumstance is necessary for determining an
unconditional sequence. The point that Mill seems
to make is that a sequence is unconditional when the
consequent is seen to follow from the totality of
conditions which constitute its cause, without any
aid from any other circumstance which falls outside
its cause as thus determined.

Two remarks may help to make the meaning of
this statement clearer. In the first place, Mill's
view leaves out of account, as indeed it has a right
to, such metaphysical considerations as were re-
ferred to a little while ago. However impossible
such a procedure would be if Mill were discussing
the causal problem from the standpoint of the phil-
osophy of knowledge, it is quite possible and even
necessary when he is concerned merely with the

invariable connections that are built up in the course
of human experience. The denial, therefore, that
any "third circumstance" operates in an uncondi-
tional sequence cannot be meant, by Mill, to refer
to the "constitution of things" which, as we saw,
is in some sort the foundation on which all human
knowledge in the long run depends. In the second
place, we may remark that the "third circumstance,"

on the absence of which from any sequence the
unconditionality of the cause is determined, must be
interpreted to mean some third phenomenal circum-
stance, some further fact or event of human expe-
rience the same in kind as those that enter into the
causal relation. What this statement amounts to
is the declaration that whenever any causal se-
quence has been determined, it will be found to
include all those positive factors on which the occur-
rence of the phenomenon depends, and that it is
only when all such factors are present that the
sequence is necessary, or, in Mill's term, uncondi-
tional. It may help to bring out the significance of
such a statement if we say that when the stated
conditions are satisfied in any given case, we can
argue not only from the occurrence of the cause to
the occurrence of the effect, but also from the occur-
rence of the effect to the occurrence of the cause.
The presence of either the cause or effect necssarily
implies the presence also of the effect or the cause.
The Plurality of Causes. In view of the fact that
the aim of science is to point out a connection be-
tween a particular event and the totality of condi-

tions on the presence of which the event takes place,
and on the absence of which it does not take place,
we may ask how this conception of the aim of
science is affected by the fact that the same event
may occur for very different reasons. Now about
such a fact there is no qusetion. It was fully recog-
nised, for instance, by Mill who tersely remarks
that "it is not true that the same phenomenon is
always produced by the same cause." The fact,
then, is that an event M may be caused now by A,
and, again, by B or C or D. This fact is known, in
the terminology of Mill, as the plurality of causes.
What effect, we may ask, does the recognition of
such a plurality of causes have upon our view of
the nature of causation as expounded in the pre-
ceding paragraphs?

If we consider this question strictly from the
point of view of what we have seen the relations
between cause and effect in a causal sequence must
be, it is obvious that we can not regard those events
whose occurrence depends on a possible plurality of
antecedents as causally related events at all. It
was said just now that in a causal sequence we must
be able, not only to argue from the occurrence of
the antecedent to that of the consequent, but also
to argue from the occurrence of the consequent to
that of the antecedent. Now the significance of
such a connection between antecedent and conse-
quent in a causal sequence is that it goes far beyond
what, in an earlier chapter, we saw was formally
possible when we were considering merely hypo-

thetical statements of fact. The rule concerning
hypothetical statements, 'If A then B' for example,
made it clear that from the occurrence of B we
could say nothing with respect to the occurrence
of A, and the reason assigned was that B might
have occurred for some other reason than A. In
other words, we had to recognise the possibility of
what Mill calls the plurality of causes. Now the
necessity for such a rule for dealing with the facts
of our general experience is quite obvious when we
consider that, with the development of science, there
has come to be recognised a marked difference be-
tween empirically connected events and causally
related events, and, consequently that until the
causal character of a particular sequence has been
established, we cannot be certain that one rather
than another group of possible antecedent condi-
tions, as a matter of fact, has been the occasion of
any given consequent.

We may also point out that the recognition of a
plurality of causes, if we emphasise the word cause
in Mill's phrase, would necessarily throw our whole
conception of cause into confusion, and there would
remain for us no means of distinguishing between
those events which were really connected 'as cause
and effect, and those whose connections depended,
in MilPs words, on some "third circumstance,"
events, that is to say, which are connected merely
after the manner of an empirical juxtaposition.
The distinction between causal sequences and em-
pirical ones is important, it marks one of the gains

that have been acquired as the result of much
labour, and it serves the distinctive purpose of map-
ping out the fields with respect to which we may
claim to have different degrees of knowledge. It
is certainly true, for instance, that the inferences
drawn from our ordinary experience are enter-
tained much less confidently than are those that
rest on the foundation of a scientific induction. In
the latter case alone do we have certainty; in the
former, we reach only a higher or lower degree of
probability. And the difference between certainty
and probability rests, in part at least, on the fact
that in the case of certain knowledge all the factors
material to it are known, and in the case of prob-
ability we have no reason for believing that this
requirement has been satisfied. And this statement
enables us to see why it is that analysis plays so
large a part in the method not only of the sciences
but of philosophy as well, and why it is that, from
the times of the Greeks, the distinction, based on the
application of a method of analysis to the facts of
experience, between opinion and knowledge, be-
tween the popular beliefs of an age on the one hand,
and carefully established truths on the other, has
been regarded as a condition of intellectual culture
and progress. We cannot, therefore, entertain any

suggestion of treating the two classes of connection,
the causal and the empirical, as if no distinction had
been made between them, and we cannot do so be-
cause all scientific advancement depends on it, and

because it would leave us without any adequate
conception of what we should mean by a cause.

The result of our consideration of the conception
of a plurality of causes amounts to this, that when
we look at the conception from the standpoint of a
carefully stated view of what causation implies, it
seems to be a quite misleading, if not mischievous,
conception. But, it may be objected, this result can
be reached and maintained only if we allow a some-
what strict interpretation of the causal relation to
determine the view we take as to the possibility of a
plurality of causes. That is exactly true. But the
recognition of its truth does not require us to alter
our notion of the causal relation, but to indicate the
field within which the operation of more than a
single set of antecedents as a condition of the occur-
,rence of a given fact or event may be said to occur.
What we have seen is that the field of causally estab-
lished relations is not such a field. For science in the
strict sense of that term there is only one group of
conditions that can be inferred from the occurrence
of any given event. But when we remark that, as
compared with the broad extent of our ordinary
experience, the causal field is only a very small
area, we see at once that, when we go outside this
field, there must be possible some other than a
causal interpretation of the sequences that occur.
It follows, therefore, that we must go outside the
field of the natural sciences if, looking at our expe-
riences from the standpoint of their temporal rela-

tions, we wish to emphasise and illustrate the possi-
bility and nature of a plurality of causes. Nowhere,
except in the sciences, can we argue from conse-
quent to antecedent. The relations of antecedent
and consequent, therefore, that occur in our ordi-
nary experience, are not, in the strict sense, causal
relations at all. And because they are not, it seems
altogether misleading to speak of these relations as
involving a plurality of causes. What a discussion
of the possibility of a plurality of causes forces on
us is, then, the recognition of a type of experience
which implies no more than a plurality of ante-
cedent or concurrent conditions. To call these con-
ditions, in their relation to the event with which
they are connected in our experience, causal is to
go beyond what we know about them; for, as we
have said, the test of a causal relation is that we
can argue, not only from a given set of conditions
to the conditioned, but also from the conditioned

to a particular set of conditions. It is exactly the
impossibility of doing this latter that led Mill, in
the class of cases we are now considering, to speak
of a pluarlity of causes, and which leads us to speak
of a plurality of conditions. If, by our terminology,
we can keep clearly before ourselves the fact that
the relations which we are now considering are not
causal, in the strict sense of that word, but that they
are connected empirically merely in our experience,
it will be passible to set over against each other the
two types of experience, and to entertain the prob-
lem, which the non-causal relations certainly sug-

gest, whether these latter can all be reduced to a
single causal type. Although it takes us outside the
limits of our present inquiry, we may hazard the
remark that perhaps human life and experience are
too rich and complex to be capable of interpretation
throughout in terms of any single class of relations.

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H. W. B. Joseph, An Introduction of Logic, Chs. XIX., XX.,

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F. C. S. Schiller, Formal Logic, Chs. XX., XXI.
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QUESTIONS

1. In what general fact of observation does the problem of
causation originate?

2. How, in view of this fact, may the causal problem be
stated?

3. Explain what is meant by saying that the causal prob-
lem is practical before it is theoretical. Illustrate.

4. In what way does the practical aspect of the problem of
causation tend to develop human intelligence?

5. Describe as accurately as you can the precise nature of
the regularities in experience which we are led to ob-
serve from the practical point of view.

6. In what two respects does the theoretical differ from the
practical view of causation, and what advantages are
thereby secured?

7. State and illustrate Mill's criticism of the practical and
theoretical conceptions of cause.

8. Show, by means of illustrations, that the practical and
theoretical conceptions of cause are genetically related.

9. In what way has the theoretical notion of cause reacted
upon the practical to give it a more definite and extended
meaning?

10. What is meant by saying that the causal problem arises
from the importance of order in human experience?

11. 'The causal problem is concerned with the question of
how things happen as they do.' Explain.

12. What, according to Mill, is the first characteristic of a
causal relation?

13. What is meant by the time relations of causal events?

14. How far do you agree with Mill that the cause of an
event is its invariable antecedent?

15. What can you say with respect to the view that there
is no essential difference between a cause and an effect.

16. Explain what is meant by the temporal continuity of causal events.

17. What, according to Mill, is the second characteristic of causal relations, and to what two facts of importance does it direct attention?

18. What does Jevons mean by the occasion of an event as contrasted with its cause? What other term is sometimes used for Jevons' 'occasion'?

19. Give three reasons for emphasising the complex character of causes.

20. What can be said for and against selecting one of the conditions of an event and calling that the cause?

21. In what way would your answer to the previous question be affected by the consideration that one's interest in the causal relation is practical and not theoretical?

22. What, according to Mill, is the third characteristic of causal relations?

23. Does Mill recognise the 'necessity' of causal relations, and, if so, what does he mean by necessity?

24. Does Mill's view of causation imply an appeal to metaphysics, and, if so, in what respect?

25. Explain what Mill means by unconditional.

26. Is it possible, on Mill's view of causation, to argue from the occurrence of an effect to that of the cause?

27. What is meant by the plurality of causes?

28. If in any particular instance we admit a possible plurality of causes, how does that admission affect our conception of its strictly causal character?

29. What is the difference between causally and hypothetically connected series of events?

80. Why would it be preferable to speak of a plurality of eonditions instead of a plurality of causes?

EXERCISES

1. Enumerate six instances of regularity in the order of particular events which are of importance for the practical life.

2. Develop, from the theoretical point of view, the instances mentioned in your answer to the previous question in order to show to what question of scientific interest each may lead.

3. Examine six instances of scientific causation for the purpose of showing how each satisfies the three conditions of a cause mentioned in the text.

4. Examine the following and show in what respects they are, and in what respects they are not, statements of strictly causal relations.

(1) In myexperience A has been invariably preceded by B, and we may therefore conclude that B is the cause of A.

(2) Scarlet poppies, scarlet verbenas, the scarlet hawthorne and honeysuckle are all odourless, therefore we may conclude that all scarlet flowers are destitute of odour.

6. Mention six instances which illustrate, what Mill calls, a plurality of causes. State for each instance the possible causes.

CHAPTER XVII

MILL'S EXPERIMENTAL METHODS

Their Historical Position. The publication of Mill's System of Logic in 1843 gave, no doubt, a great impetus to the study of what is commonly known as inductive logic, and especially to the consideration of the principles that underlie the methods by which, in the several sciences, causal relations are determined. Prior to Mill, however, interest in the inductive inquiry had had a somewhat long history, and the reader will find in Minto's Logic (pp. 243-272) an account of the course that this interest took from the time of the Franciscan monk, Roger Bacon (1214-1292), to the modern era which was ushered in, and whose development was determined by the progress of experimental science. That the advancement of learning, of which Francis Bacon (1561-1626) may be taken as the modern herald, should have maintained itself successfully for over two centuries, and that during that period natural science should have extended its scope as well as secured its position, could not be without its influence upon the conception that was held of the nature and value of logical inquiries. In the presence of such a solid body of achievement as came rapidly to the credit of the natural sciences, it was inevitable that interest should be aroused in the methods by which such results were gained. Con-

sequently, we find that men of learning in this period gave considerable attention to the study of scientific methods, and in the first half of the nine-

teenth century HerscheFs discourse On the Study
of Natural Philosophy, (1831), and Whewell's two
large volumes on the History of the Inductive Sci-
ences, (1837), and his Philosophy of the Inductive
Sciences, (1840), stand out prominently as contri-
butions of capital importance to our understanding
of the inductive procedure. Based as they are upon
the facts of experimental science, and containing a
description and analysis of the methods by which
conclusions had been reached in the sciences, they
constitute a repository of great value for any one
who would study the theory of inductive science.
With these books before him, Mill set out in his
Logic, as he says, to "generalise the modes of inves-
tigating truth and estimating evidence, by which so
many important and recondite laws of nature have,
in the various sciences, been aggregated to the
stock of human knowledge." In the chapter on The
Four Methods of Experimental Inquiry/ Mill gives
an account of the various ways in which causal
relations are or may be determined. In what fol-
lows, we propose to describe these methods briefly,
and shall limit ourselves chiefly to the task of stating
and illustrating them. To determine the view that
Mill took of them as a whole, or to estimate their
value in detail, falls outside the scope of an elemen-
tary study of logical problems.

The Nature of the Problem to which these Methods
Apply. In the foregoing chapter, we have seen that
the causal relation, strictly interpreted, is reciprocal,
that is, it is a relation between phenomena of such
a kind that from the presence or absence of either
term of the relation we can argue to the presence
or absence of the other. The rise and fall of the
mercury in a thermometer, for example, are recip-
rocally related to the varying degrees of tempera-
ture. To the establishment of such relations the
sciences doubtless aspire in their investigation of
the processes of nature. And that a considerable
degree of success in this particular has been achieved
in those sciences, such as physics and astronomy,
which rest upon a mathematical foundation is suffi-
cient to suggest, to those who are interested in the
logic of the sciences, an inquiry to which the meth-
ods of Mill are the direct answer. Mill's methods, in
other words, are a statement of the processes which
have been found useful in the establishment of those
causal relations in which the antecedent and conse-
quent reciprocally imply each other. But since recip-
rocal relations have not been established between
the antecedent and the consequent of all known
phenomena, we should be putting an unnecessary
strain upon these methods if we did not regard them
as applying, in the strict sense, only to those special
cases in which a relation of the kind in question
had been determined. We may also remark that
these methods are not offered by Mill as a substitute
for the specialised modes of investigation which are

developed by each special science according to its
needs. Indeed, the methods are quite general in
nature, and could not have been formulated had not
relations of the kind they imply been already suc-
cessfully established. They must be understood,
therefore, as revealing the logic of causal inquiries,
when these inquiries have led to the determination
of reciprocal relations between causes and effects.

Elimination as a Method of Causal Inquiry. We
have just seen that Mill's methods aim to state the
general modes of procedure in those instances in
which reciprocal causal relations have been estab-
lished. In the light of this statement, it might seem
superfluous to ask whether the causal inquiry rests
upon the process of eliminating from the cause, or
effect, those data whose presence or absence from a
phenomenon makes no difference either to its occur-
rence or non-occurrence. This is, indeed, the posi-
tion that we should be inclined to adopt were it not
for the fact that a difference of opinion exists as to
whether, and in what sense, the methods, as Mill
expounds them, depend upon such process of
elimination.

Joseph, for example, takes the view that "the
causal circumstances are indicated by a process of
exhaustive elimination." His position, more fully
stated, is that, in view of the nature of causal rela-
tions, certain particular requirements must be satis-
fied by any instance which claims to involve a causal
relation, and that the failure to satisfy any one of
these requirements disproves that relation between
two given phenomena. These requirements he enu-

merates as grounds of elimination, and are as fol-
lows:

1. Nothing is the cause of a phenomenon in the
absence of which it nevertheless occurs.

2. Nothing is the cause of a phenomenon in the
presence of which it nevertheless fails to occur.

3. Nothing is the cause of a phenomenon which
varies when it is constant, or is constant when it
varies, or varies in no proportionate manner with it.

4. Nothing is the cause of a phenomenon which
is known to be the cause of a different phenomenon.

These grounds of elimination are said by Joseph
to be the foundations of Mill's inductive methods.
The first is the foundation of the Method of Agree-
ment ; the second, of the Method of Difference ; the
first and second combined, of the Joint Method of

Agreement and difference; the third, of the Method
of Concomitant Variations; and the fourth, of the
Method of Residues. It thus comes about, according
to Joseph, that "Mill has not formulated four (or
five) but one "Method of Experimental Inquiry"
... of which the essence is that you establish
a particular hypothesis about the cause of a phe-
nomenon by showing that, consitently with the
nature of the relation of cause and effect, the facts
do not permit you to regard it as the effect of any-
thing else (and mutatis mutandis if you are inquir-
ing into the effect of anything) ." Thus if I know
that S must be caused by L or M or P or Q, because
these are the instances in which the phenomenon
occurs, then by testing each instance by the canons

of elimination I am able to discover the one rela-
tion in which S stands that is reciprocally causal.

Against this position Gibson argues that there
is in Joseph's account a confusion between physical
and logical elimination, and that when Mill speaks
of the Methods of Agreement and Difference as
methods of elimination he must be understood to
mean the former and not the latter kind of elimina-
tion. The meaning of this contention is quite clear
if by physical elimination is understood the method
of excluding from a phenomenon certain elements
which are found not to have an effect upon the occur-
rence or non-occurrence of the phenomenon. By
logical elimination, on the other hand, is meant the
rejection of certain hypotheses as, for example,
some of the alternatives in a disjunctive proposi-
tion with respect to the causal connection. In
this case, we are rejecting the non-causes as a
means of discovering the true causes. There is a
certain presumption in favour of Gibson's conten-
tion, for Mill himself says that elimination is a term
"well suited to express the operation . . . which
has been understood since the time of Bacon to be
the foundation of experimental inquiry namely,
the successive exclusion of the various circumstances
which are found to accompany a phenomenon in a
given instance, in order to ascertain what are those
among them which can be absent consistently with
the existence of the phenomenon." But whether
any or all of Mill's Methods are based upon a single
type of elimination can be decided only by exam-

ining the methods themselves. For the present, it is
enough to have stated the nature of the difference
between the views that are held of the relation of
elimination to the Methods that we are about to
study.

The Method of Agreement. Mill states the prin-

ciple upon which this Method rests as follows:
If two or more instances of the phenomenon under
investigation have only one circumstance in common,
the circumstance in which alone all the instances agree
is the cause (or effect) of the given phenomenon.
The requirement that the instances in question
shall have only one circumstance in common can not
be satisfied unless all the other circumstances that
are relevant to the phenomenon are different. Not
any enumeration of instances, therefore, would sat-
isfy the conditions of this Method, but only one in
which all the instances, however much they may
differ from one another, are alike in only a single
particular. When, then, two or more instances of a
phenomenon are shown to have only one circum-
stance in common, that circumstance, according to
Mill, is the cause or the effect of the phenomenon. For
this reason, the Method has been called the Method
of Single Agreement, and is formulated by Jevons
as follows : The sole invariable antecedent of a phe-
nomenon is probably its cause. An illustration bor-
rowed from Bain, may be given. "The North-East
wind," Bain writes, "is generally detested in this
country ; as long as it blows, few people are at their
best. Occasional well known causes of a wind being

injurious are violence, excessive heat or cold, ex-
cessive dryness or moisture, electrical condition, the
being laden with dust or exhalations. Let the hypo-
thesis be that the last is the cause of the North-
East wind's unwholesome quality; since we know
it is a ground current setting from the pole toward
the equator and bent westward by the rotation of
the earth; so that, reaching us over thousands of
miles of land, it may well be fraught with dust,
effluvia, and microbes. Now, examining many
cases of North-East wind, we find that this is the
only circumstance in which all the instances agree;
for it is sometimes cold, sometimes hot; generally
dry ; but sometimes wet ; sometimes light, sometimes
violent; and of all electrical conditions. Each of
the other circumstances, then, can be omitted with-
out the North-East wind ceasing to be noxious ; but
one circumstance is never absent namely, that it
is a ground current. That circumstance, therefore,
is probably the cause of its injuriousness."

It will be observed from this illustration that the
Method is essentially a method of elimination; its
use depends upon the possibility of analysing the
phenomenon into its constituent parts, and of select-
ing from among them the one that is causal. It is
evident, therefore, that the method cannot begin to
be put into operation until we have before us at
least two instances of the phenomenon, and that
the reliability of the Method is much increased with
an increase in the number and variety of the in-
staces that are examined. In view of such facts

as these, Mellone has formulated the method as
follows: When observation shows that two events
accompany one another (either simultaneously or in
succession), it is probable that they are causally con-
nected; and the probability increases with the number
and variety of the instances.

When this Method speaks of causes as single
antecedents, it is evident that it presupposes that
the phenomenon under investigation has been sub-
jected to analysis, and that in this way its elements
have been distinguished. Now, with respect to the
supposition that causes are to be discovered among
the elements into which the phenomenon is anal-
ysed, there are two question to be asked. The first
is, are we certain, in view of the inter-connection
of all parts of the known universe, that single events
ever do act in isolation from all the rest? But not
to press the point in that form, are we certain that
within particular universes, that is, with reference
to particular groups of events, we can analyse a
point for point concomitance between causes and
effects? For instance, is the "ground current" of
the illustration used above, on any supposition, a
single antecedent? Is it not merely another name
for "dust, effluvia, and microbes"? If, however, it
be replied that the object of science is to establish
causal connections between single antecedents and
consequents, we may ask, in the second place,
whether there exists any means of assuring our-
selves that the analysis of a particular phenomenon,
however complete it may seem, has succeeded in

detecting all of the factors present in the event that
we call its cause? For a long time, for example,
air was regarded as an element; and even since its
analysis into oxygen, nitrogen, hydrogen, carbon
dioxide, etc., modern chemistry has discovered still
other elements in certain quantities. It may very
well happen, therefore, that any supposed single
antecedent is really complex. In most cases, it is
only a relative simplicity that can be attained, a
simplicity that is met with at the point where our
methods of analysis are unable to carry us any
further. We conclude, therefore, that the Method
states an ideal that, in practice, is difficult to attain,
and, when attained, to definitely certify.

What degree of confidence, we may ask, may be
reposed in the results that are attained by the use
of this Method ? In other words, what are the limits
of its usefulness? To be more specific still, is it
distinctively a method by which we are able to ex-
plain the occurrence of phenomena? This question
we must answer in the negative. The Method of
Agreement is, as one has said, "a mode of recon-
noitering," a method for delimiting the area. within

which causal relations may, with some degree of
confidence, be expected to exist. But for the estab-
lishment of such relations we should have to pass
beyond the method itself. Let us suppose, for
example, that three instances of a phenomenon may
be analysed in the following schematic way:

[ABC x / z]

Antecedents 1 A E' C x/wj- Consequents

Are we certain, in such a case, that A, the circum-
stance in which all the antecedents agree, is the
cause of the phenomenon ? Starting with the obser-
vation of x, does it follow, because our analysis of
all the instances of x shows A to be the one element
that is common to these instances, that A is, there-
fore, the cause of x ? Mill has pointed out in answer
to such questions that their affirmative answer
would take us beyond the limits of this Method,
when and so long as we are obliged to consider, in
our interpretation of the instances, the possibility
of a plurality of causes, the possibility, that is, that
x may be produced by more than one cause. If the
instances of the phenomenon were known to be
reciprocal, or if we were certain that we had all
the instances before us, the situation would be
different; but so long as neither condition is guar-
anteed, it only remains probable, as Jevons' and
Mellone's formulations of the Method indicate, that
the "one circumstance in common" is the cause of
the phenomenon in question. It thus appears, to
quote Mill, that the Method of Agreement "leads
only ... to unifomities, which either are not laws
of causation, or in which the question of causation
must for the present remain undecided. The Method
of Agreement is chiefly to be resorted to as a means
of suggesting applications of the Method of Differ-

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ence, ... or as an inferior resource in case the
Method of Difference is impracticable; which . . .
generally arises from the impossibility of artificially
producing the phenomena/' that is, when experi-
mentation is not possible.

The Method of Difference. The Method of Agree-
ment, as we saw, is a method of systematic obser-
vation, and its object, negatively stated, is to elim-
inate from the occurrences of a particular phenom-
enon those elements which, because they are not

constant in all the instances, cannot be regarded as
being the cause, or part of the cause of the phenom-
enon, and thus, affirmatively stated, to map out the
area within which the cause may probably be found.
Turning now to the Method of Difference, we find
that it is a method of scientific experiment, and
the formulation given it by Mill is as follows: If
an instance in which the phenomenon under inves-
tigation occurs, and an instance in which it does not
occur, have every circumstance in common save one,
that one occurring only in the former, the circum-
stance in which alone the two instances differ is the
effect, or the cause, or an indispensable part of the
cause, of the phenomenon. Let us suppose, for ex-
ample, that two instances of a phenomenon can be
analysed schematically as follows :

f A B C x y zl

Antecedents } I Consequents

B C y z

then we may say, according to this Method, that A
is the cause of x. Thus, let us suppose that in two
glasses equal quantities of lemon juice and water
are mixed, and that in one of them a given quantity
of sugar is dissolved. The taste of the liquid which
contains the sugar, we shall say, is pleasant, and
the taste of the liquid which does not contain sugar
is unpleasant. What is the cause of the pleasant
taste? The circumstance, says Mill, in which alone
the two instances differ, namely, the sugar.

In calling the Method of Difference a method of
scientific experiment, we may observe that scientific
experimentation, as this was defined above, involves
a definite control of the conditions under which a
phenomenon occurs, and a definite inquiry to which
the experiment is expected to give an affirmative or
negative answer. Scientific experiment is like a
shafted arrow, it is aimed at a mark, and its course
toward that mark is controlled, as is the arrow
which is sped from the bow. To illustrate, let us
suppose that we wished to know why a feather,
dropped simultaneously from the same height as a
coin, reaches the ground after the coin. Our ques-
tion will be, Is the greater resistance offered by the
air to the feather the cause of the observed phe-
nomenon? To answer this question, we must insti-
tute an experiment, and to do this, as we said, it is
necessary to bring the phenomenon under controlled
conditions. Thus, we first drop the two objects
from the same level and at the same time in, let us
say, the receiver of an air-pump. The feather is

observed to flutter to the base of the pump after
the coin. We perform the same experiment again,
with the exception that we take care to remove all
the air from the receiver. Under these conditions,
the coin and the feather reach the base of the re-
ceiver at the same time. The conclusion is that the
only circumstance in which the two instances differ,
namely, the presence of air in the former, is the
cause of the phenomenon. Because, as in this ex-
ample, the Method proceeds systematically by
changing one condition at a time, it is known as
the Method of Single Difference, and the following
formulation has been given by Mellone: When
the addition of an agent is followed by the ap-
pearance, or its subtraction by the disappearance, of
a certain event, other circumstances remaining the
same, that agent is causally connected with the event.
Or, to state the principle on which any formulation
of the Method relies, we may say that the circum-
stance in the absence of which a phenomenon fails to
occur is the cause, or part of the cause, of the phe-
nomenon.

It will add to the clearness of our apprehension
of the meaning of this Method, if we distinguish
the instances of the phenomenon that are success-
ively observed. For this purpose, let us call the
instance in which the suspected cause occurs the
positive instance, and the one in which it does not
occur the negative instance. By this terminology
is meant that, in what is called the positive in-
stance, we have the occurrence of the observed phe-

nomenon along with the occurrence of its supposed
cause, and, in the negative instance, the absence of
the phenomenon together with the absence of the
supposed cause.

In view of this distinction, it will be seen that
the Method depends, for its validity, on the negative
instances through which a suspected cause is either
proved or disproved. And, for this reason, it rightly
insists on the importance of varying only one condi-
tion of the phenomenon at a time. For if we were to
vary simultaneously two of a phenomenon's condi-
tions, and found that some change resulted, we
should be unable to tell whether this change was due
to one of the altered conditions, or to the other, or
to the joint action of both. And if no change en-
sued, we could not safely conclude that neither con-
dition was affective, for the action of the one may
have been neutralised by that of the other. And
even when only a single condition is varied at any
one time, it is important, as Mill pointed out, that
the experiment should be conducted with dispatch,
and its entire process brought as rapidly as possible
to an end. The reason for this caution is that if the
experiment is to serve the purpose for which it was
instituted, the effect must be the effect solely of the
one altered condition. If, on the contrary, during

the course of an unusually prolonged experiment,
the original conditions of the experiment were mod-
ified by the development of changes which deter-
mined in part the character of the observed effect we
should have, what Mill called, an inter-mixture of

effects ; and this would be as destructive of the value
of the Method as any unsystematic variation in the
conditions themselves.

It is a well known fact that not all problems are
capable of experimental handling, and that those
that are, are liable to have their results affected by
the operation of conditions which we can in no
wise eliminate. In the former case, the Method of
Difference cannot be used. In the latter, the condi-
tions referred to are those that belong to the struc-
ture of the universe to which the particular phenom-
enon belongs. Such conditions Mill called perma-
nent causes. "The pendulum, for example, has its
oscillations disturbed by the vicinity of a mountain."
What, in such a case, can be done to make the
Method applicable? It is evident that we cannot
remove the mountain, but, as Mill points out, we
can take the pendulum to a locality where the
mountain's intereference is reduced to a minimum.
In this way, it ceases to be an "influencing agent,"
and becomes merely a "co-existing fact." When an
experiment cannot be removed outside the sphere of
the operation of such permanent causes, recourse
may be had to the Method of Concomitant Variations
which is discussed below.

The Joint Method of Agreement and Difference.
There is, no doubt, something ideal in the require-
ments that are laid down as conditions of the use of
the Methods of Agreement and of Difference. It is
rarely that in the course of common life or scientific
investigation a number of instances are given which

agree or differ in only a single instance. There
seems to be, therefore, a breach between experience,
on the one hand, and these modes of establishing
causal relations, on the other. Either, then, we
shall have to say that the Methods of Agreement
and of Difference are of only limited application,
and that causal connections cannot be established
in a great deal of our experience, or that, with re-
spect to that part of experience which does not come
directly within the scope of these Methods, some
other means of determining causal connections must
be used. It is to meet the latter of these alternatives
that the Joint Method of Agreement and Difference
is particularly useful. The formulation of this
Method by Mill was made necessary in view of the
fact, as he says, that there are "many cases in which,

though our power of producing the phenomenon is
complete, the Method of Difference either cannot be
made available at all, or not without a previous em-
ployment of the Method of Agreement. This occurs,"
says Mill, "when the agency by which we can pro-
duce the phenomenon is not that of one single ante-
cedent, but a combination of antecedents, which we
have no power of separating from each other and ex-
hibiting apart." Besides those cases in the natural
sciences which Mill had in mind, the Joint Method
will be found applicable, as Creighton has pointed
out, when we try "to reach generalizations regard-
ing the behaviour of human individuals or human
societies in looking for moral, or social or eco-
nomic laws."

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The Joint Method is formulated by Mill as fol-
lows: If two or more instances in which the phe-
nomenon occurs have only one circumstance in com-
mon, while two or more instances in which it does
not occur have nothing in common save the absence
of that circumstance, the circumstance in which alone
the two sets of instances differ is the effect, or the
cause, or an indispensable part of the cause, of the
phenomenon. Thus, we are concerned, in this
Method, with two sets of instances, one set of posi-
tive instances, in which thei phenomenon with its
suspected cause is present, and one of negative
instances, in which the phenomenon with its sus-
pected cause is absent. When these conditions are
satisfied, the Method affirms that the circumstances
in which the two sets of instances differ is causally
connected with the phenomenon. Let us suppose,
for example, that two sets of instances, positive and
negative, can be, schematically, analysed as follows :

Antecedents

POSITIVE INSTANCES

ABCD xyzw

x y v u

A B E F
A C F G

X Z U t

Consequents

Antecedents

NEGATIVE INSTANCES

B C D E y z

C F G H z

E H J K v

z w vl
u t s L
s r qj

Consequents

A comparison of these instances shows that when
x is present A is present,' and that when x is absent

A is absent, and this suggests that A and x are
causally connected. But we cannot prove this by
the Method of Agreement, because there are no two
instances which agree in having only a single cir-
cumstance is common; and we cannot prove it by
the Method of Difference, because there are no two
instances which differ in no respect except in the
presence of A and x in the positive instances, and
their absence in the negative ones. Moreover, it
will be observed that the instances supposed do not
conform strictly to the requirements of Mill's state-
ment, and that it is exactly this divergence that sets
the problem which this Method is intended to solve.
In other words, the agreements and differences are
greater in the instances we have supposed than they
have any right to be on a strict interpretation of
Mill's statement. The reason for this divergence is
that Mill's statement of the Method, as Mellone
remarks, "is vague, and it is incorrect in more than
one point; two positive instances would never be
enough, still less could two negative instances ; and it
is not necessary that the negative instances should
have 'nothing in common'," and, as our illustration
shows, it is not necessary that the positive instances

should agree in only a single circumstance. With
these amendments in view, we may quote Mellone's
proposed formulation of the Method : Whatever is
present in numerous observed instances of the pres-
ence of the phenomenon, and absent in observed
instances of its absence, is probably connected caus-
ally with the phenomenon.

How, now, can we proceed to apply the Method?
If we examine the positive instances, employing for
that purpose the general principle of the Method
of Agreement, we shall see that in the first two
cases A or B or AB is the cause of the phenomenon
x, since A and B are the only conditions present in
both. For a similar reason, we see that A or C or
AC is the probable cause of the phenomenon in the
first and third cases; and that the cause in the
second and third cases is probably A. Now if the
probable cause in all these instances is the same, that
cause must be A, since that is the only particular in
which they all agree. If, now, we examine the neg-
ative instances, employing for that purpose the gen-
eral principle of the Method of Difference, we note
that they all agree in the absence of A and x, and
that this is the only relevant circumstance in which
they do agree. The absence in the negative instances
of the supposed cause of x along with the absence of
x, when taken in connection with the relative
unimportance of the other circumstances, greatly
strengthens the supposition that was reached as the
result of examining the positive instance, namely,
that A is the cause of x. Such a Method as the one
here outlined has been called by various names. Mill
spoke of it sometimes as "a double employment of the
Method of Agreement," whence it is often called the
Method of Double Agreement. Mill also spoke of it
as the Indirect Method of Difference. But the name
by which it is commonly known is the Joint Method

of Agreement and Difference, a name which Mill
also used in referring to the method.

The following application of the Joint Method
to a social problem illustrates so well, not only its
usefulness in this class of problem, but the nature
of the Method itself, that we shall quote it entire.
"We may suppose," Creighton writes, "that in a
certain part of the country it was noticed that a
considerable difference existed in the number of
criminal offenses committed, in proportion to the
number of inhabitants, in the various towns. In
several towns the percentage was high, while in
others it was relatively small. This being so, a
question naturally arose as to the cause of the high
percentage. Now there were among the people
various opinions concerning the matter. . . . Not

being able to agree about the matter, it was decided
to appoint a committee to investigate the circum-
stances existing in various towns where the same
general conditions prevailed, and upon the basis of
this comparison to decide. The towns with a high
criminal percentage were examined first. The re-
port of conditions there was as follows :

Town A: Small police force efficient schools severe pen-
alties inactive churches licensed saloon.

Town B: Small police force efficient schools light penal-
ties active churches licensed saloons.

Town C : Large police force inefficient schools severe pen-
alties active churches licensed saloons.

Town D: Large police force inefficient schools light pen-
alties inactive churches licensed saloons.

"This report revealed the fact that in each of
these towns having a high criminal percentage there
was one circumstance, and only one, invariably
present, the licensed saloon. This rendered it
probable that the saloon was the cause of the high
percentage of crime. Still, before finally deciding,
it was thought well to investigate negative instances
as well ; that is, towns in which the high percentage
of crime did not occur. The report of conditions
there was as follows:

/

Town E: Large police force efficient schools light penal-
ties active churches no licensed saloons.

Town F: Large police force inefficient schools light pen-
alties active churches no licensed saloons.

Town G: Small police force efficient schools light penal-
ties inactive churches no licensed saloons.

Town H : Small police force inefficient schools severe pen-
alties active churches no licensed saloons.

"This table showed that in the absence of the
phenomenon (high criminal percentage) one and
only one of the conditions concerned was invariably
absent ; namely, the licensed saloon. This confirmed
the previous report and established to the satisfac-
tion of all that the saloon was, at least, the main
cause of the high criminal percentage in the cities
concerned."

The Method of Concomitant Variations. Mill
states this Method as follows : Whatever phenom-
enon varies in any manner whenever another phe-
nomenon varies in some particular manner, is either

a cause or an effect of that phenomenon, or is con-
nected with it through some fact of causation. The
Method presupposes two classes of cases. Whenever,
for example, any variation in one phenomenon ac-
companies a variation in another, these phenomena
may either be related directly as cause and effect,
or they may be "two different effects of a common
cause." The Method itself, however, does not enable
us to decide, in any particular instance, which of
these alternative possibilities is realised. In order
to decide that point, as Mill says, we should have to
determine whether one set of the variations in ques-
tion were capable of being produced by means of the
other. In that case, the relation is one of cause and
effect. If, on the other hand, the variations in ques-
tion were not capable of being produced in the man-
ner indicated, we should have to regard them as
effects of a cause that is common to both. In both
cases the principle on which the Method rests is
that "anything on whose modifications, modifica-
tions of an effect are invariably consequent, must
be the cause (or connected with the cause) of that
effect," As an example, "let us suppose," to quote
Gibson, "that an electric bell is placed ringing under
the receiver of an air-pump. The air is now grad-
ually exhausted, and it is noticed that, parri passu
with the exhaustion of the air, the sound of the
bell grows fainter and fainter, until a point is
reached at which it is no longer heard at all. The
air is now allowed to pass back gradually into the
receiver, and, as it does so, the sound of the bell is
heard, at first faintly, then more and more loudly,

until the clearness of the original note is repro-
duced."

The Method of Concomitant Variations, as Mill
himself indicated, is applicable particularly to those
cases in which the Method of Difference, on account
of the impossibility of removing the phenomenon
under observation from the influence of permanent
causes, entirely fails. Let us suppose, to take one
of Mill's illustrations, that we wished to know what
influence the moon exerts on the surface of the
earth. "We cannot try an experiment in the absence
of the moon, so as to observe what terrestrial phe-
nomena her annihilation would put an end to; but
when we find that all the variations in the position
of the moon are followed by corresponding varia-
tions in the time and place of high water, the place
being always either the part of the earth which is
nearest to, or that which is most remote from, the
moon, we have ample evidence that the moon is,
wholly or partially, the cause which determines the
tides."

Sometimes it is not the mere concomitance

of varying phenomena, but the varying quantities
of the associated phenomena, that leads to the deter-
mination of a causal relation between these phenom-
ena. If, for example, a connection between heat and
expansion is suspected, we can increase or diminish
the amount of heat, and observe whether, under
the varying conditions, any corresponding varia-
tions occur in the expansions of a heated body. That
increase of heat is followed by increased expansion,
and decreased heat is followed by decreased expan-

sion, is all the evidence we need that there is a
causal connection between the two occurrences. It
is by the use of a method such as this in cases like
the last that precise quantitative variations between
phenomena may often be made out. We may, that
is to say, measure the increases and decreases in
amounts of accompanying phenomena, and deter-
mine the exact correlation between them. Some-
times only one of the quantities can be measured,
as, for instance, the correlation between the inten-
sity of a stimulus and the resulting sensation which
is formulated in what is known as Weber's law.
Whenever we experiment with variations of quantity
in accompanying phenomena, it should be observed,
in general, that the greater the number and variety
of the instances in which the correlation is known
to hold, the greater the certainty that attaches to a
given conclusion. The desirability of extending our
observation of accompanying variable phenomena
over a considerable range of instances is further
emphasised by the fact that only in this way can
we determine the limits within which their correla-
tion holds good. In this way, for example, the upper
and lower limits of the correlation between intensity
of stimulus and sensation in each of the sense fields
has been ascertained. Beyond these limits, the cor-
relation no longer holds good either because the phe-
nomenon changes its character or ceases altogether.
Notwithstanding the necessity for exercising care
in the use of this Method, it is particularly service-
able in those cases in which the amounts of varia-

tion can be measured. "Although," as Mill re-
marks, "the most striking applications of the
Method of Concomitant Variations takes place in
the cases in which the Method of Difference, strictly
so called, is impossible, its use is not confined to
those cases; it may often usefully follow after the
Method of Difference, to give additional precision
to a solution which that has found. When by the
Method of Difference it has first been ascertained
that a certain object produces a certain effect, the
Method of Concomitant Variations may be usefully
called in to determine according to what law the
quantity or the different relations of the effect fol-

low those of the cause."

The Method of Residues. Most of the phenomena
with which the sciences have to deal are complex.
The experimental methods, as they have been for-
mulated by Mill, are, as we have seen, statements
of ways that have been devised for the purpose of
analysing various kinds and degrees of complexity
in the material facts that constitute the subject-
matter of the particular sciences. We have seen
that when particular phenomena do not conform to
the requirements of either of the fundamental
Methods of Agreement or of Difference, the joint use
of these Methods is then often necessary if we are
to determine whether and, if so, in what respects,
phenomena are causally connected. Sometimes our
analysis of phenomena by this Method enables us
merely to show that complexes are probably con-

nected together in a causal way. We may find, for
example, in the series of instances:

POSITIVE INSTANCES

fA B C D x y z wl

Antecedents J i Consequents

[A B E F x y v uj

NEGATIVE INSTANCES

{BCDE yzwu]

) Consequents
CFGH zutsj

that the negative instances confirm what the positive
instances suggest, namely, that AB and xy are, in all
probability, causally related. But the Method itself
does not, in this case, enable us to analyse the phe-
nomenon further to determine whether A is causally
connected with x or not. If, however, we supple-
ment the Joint Method by the Method of Concom-
itant Variations, we may be able, by varying A
or x, to ascertain whether the two phenomena
are related as cause and effect. It is obvious,
further, that we may employ the same Method
for the purpose of ascertaining whether, in the
above instances, B is causally connected with y,
and C with z. Now, if experiment should show
that A and x, B and y, C and z are causally connected
then, the Method of Residues, which we have to
discuss, assures us that the remaining phenomena,
namely D and w, are also causally connected. Thus,

the Method virtually says that any remainder which is left over after other portions of a complex phenomenon have been explained, are themselves causally connected. Mill's statement is as follows: Subduct from any phenomenon such part as is known by previous inductions to be the effect of certain antecedents, and the residue of the phenomenon is the effect if the remaining antecedents.

The Method of Residues, as it has just been stated, is constantly employed in the sciences. To take one illustration only, as this is given by Jevons. "In chemical analysis," he writes, "this method is constantly employed to determine the proportional weight of substances which combine together. Thus the composition of water is ascertained by taking a known weight of oxide of copper, passing hydrogen over it in a heated tube, and condensing the water produced in a tube containing sulphuric acid. If we subtract the original weight of the condensing tube from its final weight, we learn how much water is produced; the quantity of oxygen in it is found by subtracting the final weight of the oxide of copper from its original weight. If we then subtract the weight of the oxygen from that of the water, we learn the weight of the hydrogen which we have combined with the oxygen. When the experiment is carefully performed ... we find that 88.9 parts by weight of oxygen unite with 11.11 parts of hydrogen to form 100 parts of water."

Mill calls our attention to the fact that the Method of Residues is specially serviceable in those

cases where several causes acting together produce an effect which is the joint result of all the causes taken together. In such cases, we have, what Mill calls, an "intermixture of effects." What is meant by an intermixture of effect has been explained by Jevons as follows: "If in one experiment friction, combustion, compression, and electric action are all going on at once, each of these causes will produce quantities of heat which will be added together, and it will be difficult or impossible to say how much is due to each cause separately. We may call this a case of the homogeneous intermixture of effects, the name indicating that the joint effect is of the same kind as the separate effects. There are several causes, each producing a part of the effect, and we want to know how much is due each." What is here called by Jevons a homogeneous intermixture of effects, Mill also called a Composition of Causes. He writes : "I shall give the name of the Composition of Causes to the principle which is exemplified in

all cases in which the joint effect of several causes
is identical with the sum of their separate effects."
In contradistinction to the case just mentioned, the
intermixture of effects may also be heterogeneous
when, as Mill says, "the agencies which are brought
together cease entirely, and a different set of phe-
nomena arise: as in the experiment of two liquids
which, when mixed in certain proportions, instantly
become, not a larger amount of liquid, but a solid

We may remark, further, that the Method of
Residues is significant because it operates in the
interests of thoroughness in scientific observation.
It sets a barrier against carrying over into science
the popular attitude towards what is small and
insignficant, and its use has taught the scientist
that what appears small and insignficant if often
the hinge upon which scientific discoveries of the
first important turn. "Almost all the greatest dis-
coveries in astronomy," says Herschel, "have re-
sulted from the consideration of residual phenomena
of a quantitative or numerical kind. . . It was thus
that the grand discovery of the Procession of the
Equinoxes resulted as a residual phenomenon, from
the imperfect explanation of the return of the sea-
sons by the return of the sun to the same apparent
place among the fixed stars." The discovery of the
planet Uranus, to which we have referred in an-
other connection, and the invention of the steam
engine, are other instances of the importance of
paying attention to residual phenomena. What one
calls 'luck' in ordinary life, what one calls 'genius'
in scientific life, and what one calls 'success* in
commercial life are all of them very often merely
the result of giving heed to details that the average
person passes lightly by. In this regard, the fol-
lowing quotation from Darwin's 'Life and Letters'
has its value. "A point apparently slight and un-
connected with his present work is passed over by
many a man almost unconsciously, with some half-
considered explanation, which is really no explana-

tion. It was just these things that he (Darwin)
seized upon to make a start."

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QUESTIONS

1. State briefly the relation of Mill's 'Logic' to the history
of inductive logic in the modern era.

2. With what problem does Mill's chapter on 'The Four
Methods of Experimental Inquiry' deal?

3. What is meant by calling causal relations reciprocal?

4. Are all causal relations reciprocal? Explain.

5. What relation have Mill's Methods to the special modes
of inquiry developed by each science to meet its own
problems?

6. Explain as well as you can exactly what Mill's Methods
undertake to do.

7. In what sense can it be said that Mill's Methods rest
upon a process of elimination?

8. What is Joseph's view of elimination as applied to
causal problems?

9. What view, according to Gibson, does Mill take of the
nature of elimination?

10. What is the characteristic feature of the Method of
Agreement?

11. What is Jevons' formulation of Mill's Method of Agree-
ment?

12. What criticisms may be passed on this Method for de-
manding a point of single agreement among the phe-

nomena which it examines?

13. Is the Method of Agreement one of observation or explanation? Give reasons for your answer.

14. What degree of certinty attaches to the conclusions reached by the Method of Agreement?

15. What are the chief features of the Method of Difference as formulated by Mill?

16. What is meant by calling the Method of Difference a method of scientific experiment?

17. How does Mellone formulate the Method of Difference?

18. What two kinds of instances are presupposed by the Method of Difference, and by what names are they called?

19. Why is it necessary to vary only one condition at a time in a series of scieintific experiments?

20. What does Mill mean by a permanent cause?

21. How does the operation of permanent causes affect the applicability of the Method of Difference?

22. Under what conditions does the Joint Method of Agreement and Difference become effective?

23. To what two classes of problems is the Joint Method applicable?

24. What are the chief features of the Joint Method as formulated by Mills?

25. Show, by the enumeration of supposed instances to which the Methods of Agreement and of Difference do not apply, the conditions which call for the use of the Joint Method.

26. What criticism can be made of the way in which Mill formulates the Joint Method?

27. What statement has been given by Mellone of this Method so as to avoid such criticism?

28. Explain carefully and in detail how you would apply the Joint Method.

29. Verify each step of your answer to the previous question by using the analysis of the social example given in the text.

30. What is the Method of Concomitant Variations?

31. What two classes of cases are presupposed by Mill's statement of the Method of Concomitant Variations?

32. How can you determine which of these two cases is present in any particular instance?

33. On what general principle does the Method of Concomitant Variations rest?

34. What is the relation of this Method to that of Difference? How is it affected by the operation of permanent causes?

35. In what way does the Method of Concomitant Variations enable us to determine causal relations between quantitative phenomena?

37. Illustrate how the measurements of quantitative phenomena enable us to determine causal relations, first, in instances where both antecedent and consequent can be measured, and, second, where only antecedent can be.

38. What, according to Mill, are the chief uses of the Method of Concomitant Variations?

39. State briefly the relations of the Methods of Agreement and Differences, the Joint Method, and the Method of Concomitant Variations to one another with a view to shrow what Mill means by the Method of Residues.

40. Illustrate the Method of Residues.

41. What does Mill mean by the intermixture of effects?

42. Why should the Method of Residues be specially applicable to cases which involve an intermixture of effects?

43. In what way does the Method of Residues operate in the interests of thoroughness in scientific observation?

EXERCISES

1. Examine each of the examples of inductive reasoning given below, and state by what method or combination of methods the conclusion in each case is reached.

(1) It is found that sun-lit air has been the means of eliminating some diseases, and of diminishing the severity of a number of others; whence it seems to follow that for maintaining a high degree of health sun-light air is essential.

(2) Other conditions remaining the same, children who are taught in classes which average from twenty to twenty-five in number attain in the same amount of time a higher degree of proficiency than those taught in classes which average from forty to fifty, or attain the same degree of proficiency in a shorter amount of time.

(3) Sachs maintained, in 1862, that starch is formed by the decomposition in chlorophyl of carbon-dioxide gas under the influence of light. He found

that when all other conditions were constant, and
light was excluded from a plant, no starch was
formed; the single circumstance of readmitting
light was accompanied by renewed formation of
starch. Further, he found that if certain portions

of the leaves of an illuminated plant were covered
with black paper, no starch was found in these
portions.

(4) Tyndall found that of twenty-seven sterilised flasks
containing infusion of organic matter, and opened
in pure Alpine air, not one showed putrefaction;
while of twenty-three similar flasks, opened in a
hay loft, only two remained free from putrefaction
in three days. He concluded that putrefaction is
due to floating particles in the air.

(5) In 1675 Leeuwenhoek discovered infusoria, or ani-
malculae under the microscope, and it was thought
that such minute organisms as these might be
spontaneously generated, even if the larger were
not. About 1745 Needham performed a number
of experiment to test this conclusion. He extracted
the juices of meat by boiling, enclosed them in
bottles, which were carefully corked and sealed
with mastic, then subjected the closed bottles to
heat and set them away to cool. In due course of
time, the fluids thus treated became infected with
microscopic life, and inasmuch as he believed that
he had killed all living germs by repeated heating,
he concluded that the living forms had been pro-
duced by spontaneous generation.

(6) Spellanzi, however, thought that Needham 's ex-
periments had not been conducted with sufficient
care. He, therefore, made a great number of sim-
ilar experiments, using different kinds of infusions.
But he placed them in thin flasks with slender
necks, which were then hermetically sealed in
flame, after which he immersed the flasks in boil-
ing water for three-quarters of an hour, in order
to destroy all germs that might be contained in
them. Under these conditions no infusoria ap-

peared in them. Needham was not satisfied with
these results, however, and objected that such pro-
longed boiling would destroy not only germs, but
the generative force of the infusion itself. Spell-
anzi easily disposed of this objection by showing
that when the infusions were again exposed to the
air, no matter how severe or prolonged the boiling
to which they had been subjected, the infusoria re-
appeared.

(7) Goldschn eider proved that muscular sensations

play no considerable part in our consciousness of
the movement of our limbs, by having his arm sus-
pended in a frame and moved by an attendant.
Under these circumstances, where no work de-
volved on his muscles, he found that he could dis-
tinguish as small an angular movement of the arm
as when he moved and supported it himself.

(8) The case has been supposed of a man who, having
a taste for cucumber, attributes his chronic indi-
gestion now to the salmon, now to the cheese, now
to the pastry no one of which is an invariable
feature of his evening meal but never to the
cucumber, which he takes every evening. However,
after having dined without cucumber on several
consecutive evenings, whilst taking salmon one
evening, pastry the next, and so on through the
whole list of suspicious dishes, he cannot but notice
that on no one of these evenings did any indiges-
tion occur, and is thus brought to confess that the
cucumber, after all, must have been the offending
cause.

(9) Frri, in his Criminal Sociology, writes: I have
shown that in France there is a manifest corre-
spondence of increase and decrease between the
number of homicides, assaults and malicious

wounding, and the more or less aboundant vintage,
especially in the years of extraordinary variations,
whether of failure of vintage (1853-5, 1859, 1867,
1873, 1878-80), attended by a remarkable diminu-
tion of crime (assault and woundings), or of abun-
dant vintages (1850, 1856-8, 1862-3, 1865, 1874-5),
attended by an increase of crime.

CHAPTER XVIII

FALLACIES

Fallacy Defined. The earliest systematic account
of fallicies was given by Aristotle in his treatise

Was On sophistical arguments (-n-epl O-O^HO-TIKWJ/ eAeyx^)-

The aim of this treatise was to name and examine
the various tricks that were relied on by many of
the sophists to win the applause of their audience.
We may say, therefore, that it contains an exami-
nation of the various forms of 'sophistry' current
among the Greeks of the fourth century B. C. To
this practical employment of the term corresponds,
in a general way, the meaning that must be assigned
to it when, at the present day, it is used in a popular
sense. From this point of view, a fallacy may be
said to be any error of statement or belief. If, for
example, any one should believe that the sun revolves
around the earth, such a belief would be called fal-

lacious, and the statement of that belief would
be called a fallacy. This meaning of the word,
however, is too indefinite for the purposes of logic,
and it covers too miscellaneous a group of cases to
be of much service in directing its inquiries. It
is customary, therefore, to narrow the interpreta-
tion of the term by confining its application to any
breach of the principles and rules of logical pro-
cedure. In the foregoing pages, we have become
acquainted with a number of the principles and

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rules to which we must submit our thought and our
speech if what we assert and what we express are
to carry logical conviction. And, doubtless, our
study of these principles and rules, and our effort
to put them into practice, have convinced us both
of the necessity and of the difficulty of conforming
our thought and speech to their requirements. Now
whenever our thinking fails to conform to such
principles and rules, we are said, in the strict sense
in which the term is used in logic, to be guilty of a
fallacy. A fallacy, therefore, may be defined as any
breach of a logical principle or rule.

This statement of what we understand in logic
by a fallacy needs to be safeguarded in one par-
ticular. As it stands, and especially if one does
not regard strictly the context in which it occurs,
it will seem capable of including, not only those
breaches of logical procedure to which the definition
is intended to confine it, but also those errors which
arise from other than logical sources, and to which
the term fallacy can be applied only in a popular
and conventional sense. There are, no doubt, nat-
ural limitations of mind which prevent all of us
at some time from attaining, in the character of our
intellectual life, anything that can be called with
propriety logical exactness. Indeed, the ordinary
course of life, as we have so often said, does not
depend for the attainment of its objects on the
strictness with which logical requirements are met
in the field of the interests by which that life is
controlled. And, doubtless, mistakes occur here

which have their roots in the mental process by
means of which that life is carried on. We have
pointed out, for instance, that perception does not
provide a secure foundation of knowledge, and if
we were to add that the organisation of our ordi-
nary experience proceeds very largely upon prin-
ciples of association, it would be evident, in the
light of our previous studies, that association cannot
guarantee against logical error the conclusions to
which it is the means of conducting us. In so far,

then, as we have regard to the mistakes that arise
in this field, it would be quite misleading to apply
the term fallacy to these mistakes, and they must
be considered as falling outside the scope of our
definition. We may point out also that lapses into
this more usual method of procedure are likely to
occur in the course of our efforts to reach more
strictly scientific results. The exclusion of these
cases from the field of the fallacies is made on the
principle that such cases do not involve ignorance
of the methods of logical procedure, but carelessness
in their application; just as, for example, ignorance
of a mathematical rule would not be attributed to
one whose mistake was obviously due to haste or
inattention in its application to a given case. We
must regard as logical fallacies, therefore, only
those instances of erroneous conclusions which rest
upon grounds which are demonstrably false. It is
in this sense, then, that a fallacy was defined above
as any breach of a logical principle or rule.

Classification of Fallacies. Although Aristotle
was limited in his treatment of fallacies by the
practical purpose to which reference has been made,
and although he had before him chiefly those errors
to which the Sophists were exposed by their desire
for popular favour, his classification of fallacies
has remained the basis of what may be regarded in
logic as the traditional position on this subject. In
the work referred to, Aristotle divided fallacies into
two main classes, a division which corresponds, in a
general way, to the distinction on which we have in-
sisted in our discussions of logical doctrine, the dis-
tinction, namely, between truth in the form of judg-
ments, and truth expressed in the form of proposi-
tions. According to this distinction, fallacies may
arise from the way in which we express or interpret
propositions, or, as Aristotle said, they may be due
directly to language (napa T^V Ae'&v; in dictione) ; or
they may exist in the thoughts or judgments that
we assert, or, as Aristotle expressed it negatively,
they may not be due to the language we employ
(ew IT/? Ae'^ews; extra dictionem). Under the first
class Aristotle enumerates six kinds of fallacy, some
of which are trifling and dependent wholly on the
syntax of the Greek language ; and under the second
class, he enumerates seven. Beyond the distinction
of these two main classes we are not directly inter-
ested in Aristotle's classification.

There is, perhaps, no entirely satisfactory class-
ification of fallacies, and the most that can be
attempted here is to bring under some practical and

intelligible scheme the various errors to which log-
ical thinking is exposed. It will help us to do this

if we recall, in the first place, that the proposition
was said to be an expression in words of the truth
asserted in a judgment. We saw that, for the per-
son speaking, the problem was to find words which
express adequately the thought that he desires to
convey, and, for the person spoken to, it was to
interpret the words in which a judgment is ex-
pressed in the sense that they had for the person
who first used them as the embodiment of an idea.
In either case, the logical value of a proposition
depends to a large extent on language, on the fitness
of the verbal forms which are chosen as the medium
of ideas. If one realises the great difficulty, which
the masters of literature alone have at all adequately
overcome, of choosing words that reveal the mean-
ing their employment is intended to convey, he will
understand why logicians, since Aristotle, have con-
tinued to regard language as one main source of
logical fallacy. The study of the fallacies which
beset our interpretation of propositions through
the ambiguous use of language will form for us the
first group of fallacies.

Our second main group of fallacies will comprise
those mistakes which threaten our comprehension
of the full meaning of propositions. It will be
remembered that we pointed out that our relation
to propositions is two fold. In the first place, prop-
ositions need interpreting, and, as we have just now
intimated, the difficulties in the way of interpreting

propositions constitutes the first main class of fal-
lacies. But, in the second place, it was pointed out
that propositions contain implications which limit
in certain determinate directions what we can think
about the subject-matter of their assertion. For
instance, we said that if we admit the truth or
falsity of a given proposition we are thereby com-
mitted to the truth or falsity of a number of other
propositions. An examination of the possible
sources of error in this region, the region of logical
implication, will enable us to avoid one of the most
frequent pitfalls in the way of that accuracy and
precision that is the desideratum of the intellectual
life.

The fallacies that are included under the two
heads just mentioned refer to the meaning of prop-
ositions taken singly, they are the fallacies which
arise in the field of simple, unmediated assertion.
When, however, we go beyond this region, and our
assertions take the more complex forms that we
have studied in the syllogism and induction, a
special group of fallacies has to be recognised, be-
cause here thought is guided in its efforts to reach
logically sound conclusions by special principles and
rules. The mistakes that occur in connection with
the control of thought by these principles and rules
will constitute a third main group of fallacies.

A fourth group of fallacies may be recognised
if we recall that no logical assertion, whether simple
or complex, is ever a wholly detached unit, and

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that, if such assertions are to be interpreted cor-
rectly, they must be brought into relation to the
contexts out of which their original meaning was
forged. Every assertion, we have said, implies a
certain universe of discourse. Now we often find
that the plausibility of statements and arguments
depends on suggestions derived from their contexts
which are not directly related to the truth char-
acter of the statements and arguments themselves,
and for these extrinsic reasons are frequently,
though fallaciously, accepted as true. They are
cases of this kind that we shall classify under the
present head.

For the sake of convenience, we shall refer to
the four main classes of fallacy that have just been
distinguished, in the order in which we have con-
sidered them, as fallacies of interpretation, of im-
plication, of inference, and of the context. A cer-
tain latitude must be allowed in the use o*f this
classification, as indeed it must of any classification,
of fallacies. The only justification that any scheme
can receive is that it brings together, in a way that
connects with the development of logical doctrine,
the errors to which we are exposed in our efforts
to think accurately and convincingly. If, in addi-
tion, it groups the fallacies in a way that is easily
remembered, it has a still further advantage.

Fallacies of Interpretation. These are due, as we
have said, to the deceptiveness of the language in
which propositions are expressed. They all, there-
fore, fall under the defect of ambiguity. But since

ambiguity may attach either to the words or to the
structure of our statements, we may distinguish
two classes of error to which our interpretation of
propositions is exposed. Among the fallacies due to
verbal ambiguity we may include equivocation,
accent, composition, division, accident, and converse
fallacy of accident; and among those due to struc-
tural ambiguity, amphibole and false parenthesis.

Verbal Ambiguity. In discussing the fallacies
that are due to verbal ambiguity, we may remind
ourselves that ambiguity is not identical with mere
indefiniteness in the meaning of words, and that,
in view of a certain unavoidable indefiniteness in
the meanings of the words we employ, propositions
can attain only a non-ambiguous signification. The

principle of non-ambiguity, we said, controlled all
our efforts after logical exactness both with respect
to terms and propositions. We cannot, therefore,
convict of any of the verbal fallacies a proposition
whose terms are indefinite, if this indefiniteness
does not spread to the meaning of the proposition
taken as a whole. When, however, the indefiniteness
of the parts affects the meaning of the whole prop-
osition, we have a case that falls under the class
of fallacies that we are now considering. With this
reminder, we take up seriatim the several fallacies
that originate in verbal ambiguity.

Equivocation, or indefiniteness in the denotation
or connotation of a term, gives rise to a fallacy
when either term of a proposition is interpreted in
a different sense by the speaker and by the person

spoken to, and this affects the meaning of the prop-
osition as a whole ; or when, for the same individual,
any term which appears in a continuous discourse
fails to retain the same meaning in the various
propositions in which it occurs, and this affects
the conclusion to which one is led. The latter is,
perhaps, the more usual, as it is, certainly, the more
insidious, form of the fallacy of equivocation. Any
form of continuous address, and especially of public
address, exposes one to the danger of equivocation,
and the most careful writers sometimes fall into it.
A familiar example is the following taken from
Mill's argument in support of the position that hap-
piness is the chief aim or good of life. He says,
"The only proof capable of being given that an
object is visible is that people actually see it. The
only proof that a sound is audible is that people
hear it. And so of the other sources of our expe-
rience. In like manner, I apprehend, the sole evi-
dence it is possible to produce that anything is
desirable is that people do actually desire it." For
the purpose of his argument, the word desirable
must have the meaning 'worthy to be desired/ but
this is a meaning that is not analogous to visible
and audible in the context. Visible and audible
mean able to be seen or heard, and/ therefore, all
that Mill has a right to argue is that desirable
means 'able to be desired/ But from this meaning
he could not argue that happiness is the summum
bonum or chief good of life, for the fact that a
person desires an object is no proof that it is, in the

sense Mill uses the word, the most desirable.
Against committing or being imposed on by the
fallacy of equivocation we may submit the meanings
of our terms to the methods of translation and defi-
nition, as these terms have been explained above.

Accent. The fallacy of accent is any misconcep-
tion due to the emhasis placed on a word or group
of words in a sentence. It was for Aristotle the
mistaken accentuation of a word in writing Greek.
"A ludicrous instance of this fallacy," to quote
Jevons, "is likely to occur in reading Chapter XIII
of the First Book of Kings, verse 27, where it is
said of the prophet, 'And he spake to his sons, say-
ing, Saddle me the ass. And they saddled him.'
The italics indicate that the word him was supplied
by the translators of the authorised version, but it
may suggest another meaning. The commandment,
Thou shalt not bear false witness against thy
neighbour/ may be made by a slight emphasis of the
voice on the last word to imply that we are at liberty
to bear false witness against other persons." We
may, however, give certain words or groups of words
a prominence that does not really belong to them in
another way. For example, in quoting an author
we may separate a word from its context, italicise
a word which was not italicised in the original, or,
by leaving out qualifying words and phrases, we
may give certain ideas a prominence which they did
not have for the author himself. Connected with
this latter interpretation, the fallacy, as Creighton

observes, "appears in connected arguments of any
kind in which, while the facts are not actually mis-
stated, certain aspects of them are so disproportion-
ately dwelt upon and emphasised, at the expense of
the rest, that a false idea of the subject in its en-
tirety is the result. In this wider form, this fallacy
is one that may be described as the particular vice
of special pleading; and the caution that may be
suggested against it is, in the language of the
astronomer, to make allowances for the 'personal
equation' both in one's own thinking and in that of
others."

Composition. The fallacy of composition, like
its converse, the fallacy of division, turns on the
distinction between the distributive and collective
use of terms. This distinction, it will be remem-
bered, is based on the fact that we may predicate
qualities and relations of a class without at the
same time predicating those qualities or relations
of the individuals that constitute the class; and,
conversely, we may predicate qualities and relations
of the individuals that constitute a class without at
the same time predicating those qualities or rela-
tions of the class. Now, we are guilty of the fal-
lacy of composition when, having predicated some-
thing of a' term used distributively, that is, of each
of the individuals that fall under the term, we sup-
pose that the predicate belongs to the term in its
collective sense, that is, of the individuals taken as
a group. "We must not argue," to use Jevons' illus-

trations, "that because every member of a jury is
very likely to judge erroneously, the jury as a whole
is also very likely to judge erroneously; nor that be-
cause each of the witnesses in a law case is liable to
give false or mistaken evidence, no confidence can
be reposed in the concurrent testimony of a number
of witnesses. It is by a fallacy of Composition that
protective duties are still sometimes upheld. Be-
cause any one or any few trades which enjoy pro-
tective duties are benefited thereby, it is supposed
that all trades at once might be benefited similarly;
but this is impossible, because the protection of one
trade by raising prices injures others."

Division. The fallacy of division is, as was said,
the converse of the fallacy of composition. It was
so considered by Aristotle. It occurs when we sup-
pose that a statement that is true of a group is true
of the individuals of the group. If, for example,
it is true that a particular class of college students
are bright, it does not follow that this is true of
each or any particular one of the members of the
class, any more than it follows that because a jury
can be relied on to reach a just verdict that a sim-
ilar confidence can be placed in any one of the jury-
men. Gibson has called attention to an interesting
illustration of this fallacy to be found in Thomas a
Kempis' Imitatio Christi. In the paragraph refer-
red to, the writer is exhorting the 'good monk' not
to seek any earthly delight, but to remain alone in
his cell. The argument by which this advice is sup-
ported reads: "What canst thou see elsewhere

which here thou seest not? Behold the sky and the
earth, and all the elements, for of these are all
things made." Expressing this argument syllogis-
tically, Gibson detects the fallacy of division in the
middle term. Thus:

The elementary substances (in organised combination)

are the whole material world.
The objects included in the prospect from your cell are

the elementary substances (not so combined).
Therefore, the objects included in the prospect from your

cell are the whole material world.

As this ilustration suggests, the fallacy of division,
in common with many others, is most liable to occur
in continuous discourse, and the value of putting
the subject-matter of such discourse into the logical
forms suitable to them is that we may the more
easily detect any fallacy lurking in our thought, or
in the forms in which that thought is expressed.

Accident. The fallacy of accident occurs when

we suppose that what is true of a term used in a
relatively indeterminate or unconditioned sense, is
true of the term when used in a relatively deter-
minate or conditioned sense. The Latin name of
the fallacy is, Argumentum a dicto simpliciter ad
dictum secundum quid. It is, that is to say, a tran-
sition from what is true of an indeterminate state-
ment to what is true of the same statement 'with a
modification/ In other words, it consists in secur-
ing assent to a statement in a general form, and
then proceeding as if it held under some special

circumstance. If we supposed, for example, that
because it is right for a man to inculcate his own
opinions, it is, therefore, right for a magistrate to
use his position to enforce his own political views,
we should be guilty of this fallacy. For, as Mellone,
from whom this illustration is taken, remarks, "we
cannot infer of his special powers as a magistrate
what is only true of his general rights as a man."
We may often detect the fallacy in our thoughts
about moral questions. Thus, in discussing such
questions, "one may insist that all men by nature
seeks after the good, meaning that each man acts
sub specie boni, and is therefore seeking after some
kind of good, even when he is pursuing his own
pleasure. But, in continuing the argument, he may
use the term 'good' in a differentiated sense e. g.,
in the sense of the common good, or the good of
humanity and come thereby, through a fallacy of
accident, to the conclusion that all men by nature
seek the general good."

The Converse Fallacy of Accident occurs when
we suppose that what is true of a term used in a
determinate or conditioned sense is true of the term
when used in an indeterminate or unconditioned
sense. The Latin name of the fallacy is, Argumen-
tum a dicto secundum quid ad dictum simpliciter.
The following illustrations will be sufficient to make
the nature of this fallacy obvious. For example,
let us suppose that it can be shown that the syllo-
gism is of no use in the discovery of new truth, are
we warranted in supposing, as the early modern

critics of the syllogism seem to have done, that it
is, therefore, of no use whatever ? Or, if philosophy
'bakes no bread/ is it, therefore, useless? The
affirmative answer to both these questions involves
the converse fallacy of accident.

Structural Ambiguity. In the chapter on the
proposition, it was pointed out that particular
statements are often ambiguous, not because the
terms in which they are expressed are ambiguous,
but because the structure of the sentences in which

ideas are expressed are so. It is to the grammatical
structure of sentences, for example, that we must
attribute, in part, the difficulty sometimes expe-
rienced in determining the subject and predicate
terms of given propositions. Whenever syntactical
relations obscure the meaning of sentences or para-
graphs, there is presented a hindrance to the correct
interpretation of propositions. Difficulties of the
kind in question are more possible in the classical
languages where the word order in sentences is
more variable, and where oblique constructions are
more common, than in English; but something of
the same sort is seen in English poetry in which a
departure from the relative simplicity of the ordi-
nary prose sentence is often made necessary by the
demands of metrical composition.

Amphibole. Now, whenever the structure of the
sentences in which ideas are expressed, in prose
or in poetry, leads to opposed interpretations of
such sentences, we have the typical fallacy of amphi-
bole. Sometimes sentences whose structure renders

their interpretation difficult, although not neces-
sarily ambiguous, are spoken of as amphibolic.
This is a view similar to that sometimes taken of
words, when any degree of indefiniteness is thought
sufficient to render them equivocal. This seems to
us too loose an interpretation of these fallacies. As
we have pointed out in regard to words, there is
also a certain freedom in the use of syntactical
relations that is allowable and necessary if partic-
ular shades of meaning are to get expressed in the
sentences we employ. The object that the transla-
tion of sentences into propositions keeps in view
is, not to give all statements an equal clearness, but
to bring out the exact degree of clearness that be-
longs to each of our statements. A certain indefi-
niteness of meaning may be characteristic of propo-
sitions, therefore, without involving them in the
fallacy of amphibole. Before we can convict any
statement of being amphibolic, we must have ex-
hausted all the means at our disposal to interpret
the statement, and to give it an expression which
truly represents its meaning. If it then remains
ambiguous, if, that is, our attempt to give the state-
ment a prepositional form is defeated on account of
its equivocal syntax, we may properly regard it as
an example of the fallacy of amphibole. An illus-
tration of this statement may be found in the often
quoted lines of Shakespeare, The Duke yet lives
that Henry shall depose.' We are baffled in any
attempt to put this sentence into the form of a
proposition, because its structure does not enable

us to determine whether it means, The Duke yet

lives who shall depose Henry/ or, The Duke yet
lives who shall be deposed by Henry/ Such a
statement, therefore, is essentially amphibolic. The
student will recall, in further illustration, many of
the utterances of the oracles, for instance, 'If
Croesus should wage war against the Persians, he
would destroy a mighty empire/ As further ex-
amples we may cite, 'It is possible for thee the
enemy to overcome/ The lion David slew/

False Parenthesis. Closely connected with the
foregoing, is the fallacy of false parenthesis. It
consists essentially in an uncertainty with regard
to the relations of the main and subordinate clauses
of a sentence. For example, 'I ruined the cause
and injured my own prospects which I deeply re-
gret/ a statement that may mean either, 'I ruined
the cause, and injured my own prospects which I
deeply regret/ or, 'I ruined the cause and injured
my own prospects, which I deeply regret/ A sim-
ilar fallacious statement is 'I will begin and finish
the task tomorrow/ The advertising columns of
our newspapers are sometimes said to provide us
with humorous illustrations of the fallacy of paren-
thesis. For instance:

LOST A valuable silk umbrella belonging to a gentle-
man with a curiously carved head.

WANTED A groom to look after two horses of a pious
frame of mind.

FOR SALE A Newfoundland dog ; will eat anything,
particularly fond of children.

We introduce these instances, not in order to
subscribe to the view that they are amphibolic in
character, but to point out that if these are to be
admitted as examples of amphiboly, then any badly
constructed sentence would have to be included
whether or not their meaning was involved in am-
biguity. This is a view to which, as we said above,
we cannot subscribe.

Fallacies of Implication. The second main class
of fallacies which we have now to consider com-
prises those that occur when for any reasons we
mistake the implications of prepositional state-
ments. The difficulties that confront our efforts to
give to any statement a prepositional form have
been considered already, and in contrast to these,
the ones with which we are now concerned presup-
pose that those difficulties have been overcome, and
that we know unequivocally the significance that
particular statements have. Until we are sure what
the asserted meaning of a proposition is, tre cannot
raise the question whether, and if so what, further
or implied meaning it can have.

It will be remembered that by implication is

meant the unexpressed signification of a logical
proposition, and that implications may assume one
or the other of two forms. In the first form, the
unexpressed or implied propositions may be related
to the given proposition in the way of opposition,
in the second form, they may be related to the
given proposition in the way of eduction. These

distinctions will provide us a natural and easy
method of classifying the fallacies of implication.

Fallacies of Opposition occur when, from state-
ments accepted as true or false, other statements
dealing with the same subject-matter are derived,
the truth or falsity of which is, mistakenly, sup-
posed to rest upon the principles that determine the
relations of opposed propositions. It has been
shown above that there are four kinds of relation
between propositions in opposition, contrariety,
subcontrariety, subalternation, and contradiction.
These relations have been studied, and the propo-
sitions between which each obtains have been indi-
cated. ' In view, therefore, of what we have learned
with respect to this class of implication, it is readily
seen that, in respect to this class, our thought be-
comes fallacious when we suppose that the prin-
ciples of opposition justify a statement which, as
a matter of logic, they are incapable of support-
ing. Or, to put it another way, any statement
which avowedly rests upon the principles of opposi-
tion is fallacious if it can be shown that those prin-
ciples fail to give it the necessary support.

In general, it is quite obvious that there are as
many fallacies of opposition as there are pairs of
propositions between which relations of opposition
may hold. Some of these relations are in themselves
so obvious, the relation of contradiction, for in-
stance; and others lose so readily whatever obscur-
ity they may have when they occur between certain
pairs of propositions, that it is not necessary to

consider all the possible fallacies of opposition. All,
therefore, that we shall attempt is to point out
some of the difficulties that may be experienced in
the effort to conform our thinking to the principles
of opposition.

And, in the first place, we may consider the
fallacy of contrariety which occurs when we sup-
pose that the falsity of one universal proposition,
A or E, involves the truth or falsity of the other,
E or A. It may be false, for example, that 'None
of the members of the team are bona fide students/
but it does not , therefore, follow that 'All the
members of the team are bona fide students,*

and it does not follow because, it might still be true that 'Some of the members of the team are not bona fide students.' It is certainly very easy for the untrained mind to proceed from the falsity of a universal to the truth of its logical contrary, and one is particularly exposed to this error when the latter statement is separated in our discourse from the former by an appreciable lapse of time. But, as we saw above, the statement of what is false in a universal form does not enable us to say anything with respect either to the truth or falsity of its contrary. In such cases the contrary is always involved in doubt.

In the second place, we are exposed to a fallacy of sub contrariety when we attempt to argue from the truth of a particular proposition, I or O, to the falsity of another particular proposition, or I. We run into this error when we forget

that two particular propositions dealing with the same subject-matter, one of which is affirmative and the other negative, may both be true. From the statement, for example, that 'Some of those who have given their word are keeping it faithfully/ it does not follow that 'Some of those who have given their word are not keeping it faithfully' is false, since this latter statement might be true of any of those not included in the original statement.

In the third place, fallacies of sub alternation may arise when we argue either from the falsity of a universal propostion, or from the truth of a particular proposition. The falsity of a universal proposition, 'All that I have done for you has gone for nought/ might very well seem to involve the falsity of the particular subaltern, 'Some of the things I have done for you have gone for nought;' but this would not necessarily be the case, because the truth or falsity of the subaltern proposition depends in this case upon the degree of falsity of the original proposition, and it is exactly this that we cannot determine from that proposition itself. Unless it were so common, one would hardly think it necessary to call 1 attention to the other fallacy of subalternation, the fallacy, namely, that is involved in proceeding from the truth of a particular statement to the truth of its corresponding universal. It may, for example, be quite clear that from the statement that 'Some books are dull/ we cannot proceed to the statement that 'All books are dull/ but we dare say, it is not equally obvious that we cannot proceed from the

statement, 'Some planets move in their own orbits', to, 'All planets move in their own orbits.' The reason why we cannot argue from the truth of a part-

ticular statement to either the truth or falsity of
the universal of the same quality seems to be that
we have no means of determining, by an examina-
tion of the original statement, the precise' amount
of truth that is claimed by it, that is, whether it
states the whole truth about its subject, or only
part of it.

Fallacies of Eduction. Eductions were defined
above as those relations which propositions dealing
with the same subject-matter have to one another
when they express what is true about this subject-
matter from different points of view. There are,
as we said, two fundamental methods for deter-
mining these relations, obversion and conversion,
and it is with respect to these methods, therefore,
that fallacies are likely to occur. An eductive fal-
lacy may, consequently, be defined as an error of
implication due to a misunderstanding of obversion,
of conversion, or of both.

The fallacy of obversion is most likely to occur
when for the contradictory of the predicate of an
original proposition we substitute its contrary in
the obverse proposition. Now by contrary terms
we mean those which, although opposed to one an-
other, do not exhaust between them the particular
universe of discourse to which they both belong.
Black and white are, in this sense, contrary, but
they are not contradictory, terms. By a contra-

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dictory term we mean one that, together with the
original term, does exhaust the universe of discourse
to which both terms belong. Thus, black and not-
black are contradictory, but they are not contrary,
terms. It is, then, a confusion of contrary with
contradictory terms, in the sense in which these
have been defined, that gives rise to the fallacy of
obversion. Thus, it would be quite fallacious, for
the reason already assigned, if we supposed that
we were warranted in saying of a particular indi-
vidual that he was bad, if all we knew was that he
is not good; good and bad are contrary, they are
not contradictory, terms. Again, if we supposed
that the obverse of the proposition 'He is not happy,
was 'He is unhappy/ there would be as complete
misunderstanding of what was implied in the first
statement as if we supposed that because a certain
object was not red that it was, therefore, green.

Fallacies of Conversion are most likely to occur
in the case of the universal affirmative, and the
particular negative propositions. In the latter case,
the fallacy occurs when we suppose that from a
particular negative proposition anything can be
asserted merely by converting it. It is quite true,
for example, that 'Some elements are not liquid/
and also that 'Some liquids are not elements/ but

the one statement does not follow from the other
by simple conversion. Again, a fallacy of conver-
sion occurs when we suppose that the universal
affirmative proposition can be simply converted, a
supposition that is based on the false assumption

that both terms of the proposition are distributed.
In universal affirmative propositions, as we have
seen, the predicate terms are undistributed; and,
consequently, when, through conversion, these terms
become the subjects of new propositions, these prop-
ositions must be particular in quantity. The neg-
lect of this consideration leads directly to a fallacy
of conversion.

Fallacies of Inference. The class of fallacies to
which we now direct attention includes the errors
to which our thinking is exposed when it is con-
fronted by the difficulties that are involved in the
more complex logical processes known as argu-
ments. The two classes of fallacy already con-
sidered, the fallacies of interpretation and implica-
tion, are concerned with the errors to which thought
is liable when it deals with single statements; but
it is not until these simpler errors have been avoided,
not until single statements have been given a strictly
logical form and content, that there comes into view
the class of fallacy that is connected with our at-
tempt to put into their logical relations such logically
determined propositions. For, in an argument, not
only must the constituent propositions be free from
ambiguity, but the relations between these proposi-
tions must be precisely determined. It is perfectly
obvious, therefore, that the avoidance of the fal-
lacies of interpretation and implication is essential,
if we are to meet and overcome the difficulties that
are occasioned by the more complex character of
our thinking in the process of argument. We may,

therefore, say that just as the avoidance of the fal-
lacies of interpretation are presupposed by any
attempt to avoid the fallacies of implication, so the
avoidance of both these classes of fallacy is presup-
posed by any attempt to overcome the fallacies of
inference.

Arguments, from the time of Aristotle, have
been recognised to be of two kinds: those, namely,
that start with the recognition of some general
principle, and those that start with the collection
of a number of particular facts. In the former, the
aim is to bring, through the mediation of a middle
term, some particular fact under the principle which
constitutes what is called the major premise of the
argument; in the latter, it is, through an analysis
of particular facts, to state a principle that shall

exhibit what is common to all the facts examined,
and, if possible, to extend that principle to other
facts which either have not been examined, or which
are not known to exist. It is usual to call the
former kind of argument deductive, and the latter,
inductive; and, although there is a danger of sup-
posing, falsely, that they constitute quite separate
logical processes, we may use these names, deductive
and inductive, for the purpose of classifying the
fallacies of inference. The deductive fallacies will
include those errors that arise in connection with
the syllogism, and the inductive fallacies will include
those that arise in connection with the various steps
through which it is necessary to pass in our efforts
to establish causal connections.

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The Deductive Fallacies. Whenever an argument
starts from the conscious acceptance of a general
truth about its subject-matter, and proceeds to show
that some particular fact is a special instance of that
truth, it is said to be a deductive argument. Now,
since we accept such general truths as are the
starting points of deductive arguments in either
one or the other of three forms, in the forms,
namely, of categorical, hypothetical, or disjunctive
propositions, these arguments, as we have seen,
assume a form and character which corresponds to
the difference in the method and principle by which
thought, in each case, proceeds to its conclusion.
In consequence of this fact, we found it necessary
to consider categorical arguments, hypothetical
arguments, and disjunctive arguments separately,
and to give special attention to the rules by which
thought, in each type of argument, is controlled.
It follows, from this statement with respect to the
various forms of deductive arguments, that the
deductive fallacies can be classified most conve-
niently by following the line of cleavage between
the arguments in connection with which they are
likely to occur. In the following sections, therefore,
we shall pass in review what we may call the cate-
gorical, hypothetical, and disjunctive fallacies, the
fallacies which occur, or are liable to occur, in those
types of argument to which similar descriptive
names have been given.

Categorical Fallacies may be defined as those mis-
takes in reasoning which render the conclusions of

categorical arguments erroneous. These fallacies
fall conveniently into two groups, according as the
error lies in the terms, or in the character of the
proposition of the syllogism. To the former group
we may assign the fallacies of four terms, and to

the latter, the fallacies of insufficient premises.

Fallacies of Four Terms occur as a breach of
the rule which states that a syllogism must contain
three, and only three, terms. Their occurrence is
due to a failure to rid the terms of a syllogism of
ambiguity. Now, since ambiguity may occur either
in the connotation or in the denotation of a term,
and may attach to any one of the terms of a syllo-
gism, it is evident that the fallacies of four terms
are of two kinds ; those, namely, which occur when
the meaning of any of the terms of a syllogism is
ambiguous, and those which are due to a mistaken
distribution of any of the terms of a syllogism.
Among the former, it is usual to call special atten-
tion to the case of the middle term, but it should
be remembered that the ambiguity of the major or
of the minor term may also invalidate an argu-
ment by giving rise to the fallacy of four terms.
When the fallacy of four terms invalidates a syllo-
gism on account of the connotative ambiguity of the
middle term, it takes the special name of ambiguous
middle; when an argument is invalid on account of
a similar ambiguity of the major term, the fallacy is
called ambiguous major; and when ambiguity in the
meaning of the minor term destroys the validity of
an argument, the fallacy is called ambiguous minor.

It is not necessary to give illustrations of all these
fallacies. The following will serve to show the form
in which they are likely to occur. If, as Jevons
remarks, we argue "that 'all metals are elements and
brass is a metal, therefore it is an element/ we
should be using the middle term 'metal' in two dif-
ferent senses, in one of which it means the pure sim-
ple substances known to chemists as metals, and in
the other a mixture of metals commonly called metal
in the arts, but known to chemists by the name
alloy." Or, if we argued "that 'what is right should
be enforced by law, and that charity is right and
should be enforced by law' . . . it is evident that
'right' is applied in one case to what the conscience
approves, and in another use to what public opinion
holds to be necessary for the good of society."

The other type of fallacy which results in break-
ing an argument under the weight of four terms,
is due to a disregard of the denotation or distribu-
tion of the terms of a syllogism. In these cases, the
erroneous conclusion results from a neglect of the
extent of a term's meaning, rather than to a dis-
regard of the meaning itself. In other words, it is
a fallacy of the division, not a fallacy of the defi-
nition, of a term. Now, as we have seen, the dis-
tribution of the terms of a syllogism is subject
to special rules. In respect of the middle term, the
rule states that this term must be distributed in one,
at least, of the premises ; and in respect of the major
and minor terms, the rule states that if either of
these terms is distributed in the conclusion, it must

have been distributed in the corresponding premise.
When the rule relating to the middle term is dis-
regarded, the resulting fallacy is known as undis-
tributed middle; and when the rule relating to the
terms of the conclusion is disregarded, the resulting
fallacy, in the case of the major term, is known as
illicit process of the major, and, in the case of the
minor, as illicit process of the minor. The fol-
lowing illustrations will throw light on these state-
ments. If we should argue, for example, that be-
cause "all rash men are confident, and all brave men
are confident," therefore, "all rash men are brave,"
we should be guilty of the fallacy of undistributed
middle. Again, if we argued "that 'because many
nations are capable of self-gvoernment, and and
that nations capable of self-government should not
receive laws from a despotic government, therefore
no nation should receive laws from a despotic gov-
ernment/ we should be clearly exceeding the con-
tents of our premises. The minor term, many
nations, was undistributed in the minor premise,"
and must not, consequently, be used in a distributed
sense in the conclusion. While it is comparatively
easy to detect an illicit process of the minor, it is
much more difficult as a rule to detect an illicit
process of the major. The following from Creighton
is an example of the latter fallacy. "All rational
beings are responsible for their actions ; brutes are
not rational beings; therefore, brutes are not re-
sponsible for their actions."

Fallacies of Insufficient Premises. These consti-
tute the second class of categorical fallacies, and
they may be described as breaches of those rules of
the syllogism that were considered and illustrated
above as rules of quality and rules of quantity. The
rules of quality refer to the grounds on which affir-
mative and negative conclusions can be based, and
the rules of quantity to the grounds on which uni-
versal and particular conclusions can be based. In
the main, we apprehend that these rules have caused
the student no great difficulty, and that he will have
become familiar with their application. But because
limiting instances are liable to cause more or less
confusion, because, that is, we find it difficult to keep
strictly within the boundaries within which any set
of rules applies, we direct attention again to the fact
that there are conditions which preclude certain
prepositional statements from rendering valid con-
clusions. It is a general fact that conclusions do
not follow from any combination of propositions.
If we wish to support a conclusion by premises or
grounds, those premises must have a character from
which the conclusion can be shown to follow, and
that means that a certain other character is strictly

forbidden. Now, if this is true of particular con-
clusions, we may go further and ask whether there
are any combinations of propositions which support
no conclusion whatever, that is, whether there are
any limits of strictly categorical argumentation.
Now such limits to all categorical inference we find
in the two cases that are included here for con-

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sideration, the cases, namely, of negative and par-
ticular premises. We have shown above that any
attempted reasoning on the grounds of particular or
negative premises involves us in one or other of the
fallacies of distribution; but what is more impor-
tant to remark now is that the study of these two
cases enables us to insist upon certain character-
istics of syllogistic reasoning which are fundamental
to our understanding and employment of this type
of argument. The syllogism, it should be observed,
rests upon the possibility of making with respect
to the subject-matter of the argument an affirmative
and universal statement. The universal statement
need not be affirmative, and the affirmative state-
ment need not be universal ; but unless the premises
contain the statement of universal affirmative rela-
tions, no conclusion whatever can be drawn. Con-
versely, if we wish to ground a belief on premises
from which it can be shown to follow, these prem-
ises, considered as a combination of propositions,
must be universal and affirmative. Indeed, this is
only to say that any categorical argument must con-
form to the character of syllogistic reasoning. For,
to speak of syllogistic reasoning at all, is to imply
that conclusions are inferred from, or rest upon,
statements about a given subject-matter which are
affirmative and universal in the sense in which those
terms have been explained. Now, if this is the true
character of the syllogism, it follows that particular
premises, whether they be both negative, or both
affirmative, or one negative and the other affirm-

ative, cannot express the structure of a syllogistic
argument, because they do not contain the note of
universality; and that negative premises also fail
to do so, whether both premises are universal or
only one is, since they fail to express the note of
affirmation. To ground a conclusion upon premises
which fulfil only one of the conditions of a cate-
gorical -argument, that is, upon propositions which
are affirmative without being universal, or upon
propositions which, although universal, are not
affirmative, is to fall into one or the other of the
fallacies of insufficient premises. In the former
case, we have the fallacy of particular premises,
and in the latter, the fallacy of negative premises.

Hypothetical Fallacies may be defined as those
mistakes in reasoning which render the conclusions
of hypothetical arguments erroneous. Hypothetical
arguments, as we have seen, derive their character
from the relation of antecedence and consequence
which is expressed in their major premise. Two
observations only need to be made to remind our-
selves of the nature and limits of hypothetical
arguments. The first is that the major premises of
such arguments are always hypothetical proposi-
tions, that is, propositions which state a relation
between two possibilities. From the fact that a
relation of antecedence and consequence is always
affirmed between these two possibilities in hypothet-
ical propositions, it follows that the acceptance of a
hypothetical statement commits us to the belief that
the possibility which is expressed as the consequent

can be regarded as an actual fact, only when the
possibility expressed as the antecedent states a con-
dition which is known to be fulfilled. We cannot
argue in the reverse order, that is, from the known
existence of the consequent to the existence of the
antecedent. The second remark is that the major
premise affords no guarantee that the condition it
states is anywhere fulfilled, and, consequently, no
guarantee that the fact stated in the consequent is
any where to be met with. Whether the antecedent
or consequent is a fact that the minor premise can
affirm or deny, depends upon whether either has
been observed. Thus, the possibility of a hypothet-
ical argument rests upon our ability to affirm or
deny, for some other reason than the major premise
itself affords, one or other of the possibilities be-
tween which the major premise postulates a rela-
tion; but within these limits the validity of such
arguments depends upon a proper interpretation of
the relation between antecedent and consequent as-
serted by the major premise. It is, consequently, to
a misunderstanding of this relation that we must
look for the source of the fallacies which render the
conclusions of hypothetical arguments erroneous.

The hypothetical fallacies are due, as we said
just now, to a wrong interpretation of the relation
between antecedent and consequent asserted in a
hypothetical proposition. Now, since there are two
terms in a hypothetical proposition each of which
we may affirm or deny, the relation between ante-
cedent and consequent may be interpreted, theo-

retically, in any one of four possible ways. It might
be interpreted to mean that (1) if the antecedent
is affirmed, the consequent may also be affirmed;
(2) if the antecedent is denied, the consequent may

also be denied; (3) if the consequent is affirmed, the antecedent may also be affirmed; (4) if the consequent is denied, the antecedent may also be denied Now, as we pointed out before, it is only when the minor premise either affirms the antecedent or denies the consequent that the relation asserted in the major premise is interpreted correctly; only two, therefore, of the alternatives enumerated above represent truly the relations involved in a hypothetical proposition. When either of the other relations is asserted in the minor premise of an argument, that is, when the minor either affirms the consequent or denies the antecedent, ; the argument must be rejected as fallacious. The fallacy of denying the antecedent leads to an eroneous denial of the consequent, and the fallacy of affirming the consequent leads to an erroneous affirmation of the antecedent. Both fallacies, as we shall see, arise from the neglect of an underlying material fact of considerable importance for a correct understanding of the hypothetical syllogism.

In general, it may be remarked that the hypothetical fallacies are due, on the material side, to a failure to recognize the complexity and interconnection of natural events. It is true that the object of our study of nature is to determine, in the strict sense, causal connections, that is, relations between

phenomena of such a nature that, not only does the consequent follow from the antecedent, but the stated antecedent is implied in the occurrence of the consequent. Our knowledge of natural events, however, frequently falls below this standard, and we have to be satisfied with the affirmation of a one-sided relation, that is, with the statement of a relation between antecedent and consequent of such a nature that while the former is always followed by the latter, it does not always and necessarily precede the latter. There are large areas of knowledge, in other words, in which the relations involved fail to display the characteristics of causal connections, and in reference to them we are bound to recognise what Mill called a plurality of causes. Now it seems to be the neglect of this consideration that is really at the foundation of the fallacies which befall hypothetical arguments. For, as Mellone states, "if we deny the antecedent, we cannot, therefore, deny the consequent, for the latter may be true for other reasons, and if we affirm the consequent, we cannot affirm the antecedent, for the consequent may result from other reasons." In either case, that is to say, we must recognise the possible existence of more connections between antecedent and consequent than the one which is made the subject of statement by the major premise, and this possibility places limitations upon the interpretation which we can give to hypothetical statements. It is true that, if the major premise states a causal connection between the

antecedent and consequent, we may argue from
the affirmation or denial of the former to the affir-
mation or denial of the latter, and vice versa. In
any other case, the possible operation of a plurality
of causes must be allowed to determine the limits
which we place upon hypothetical arguments. From
this point of view, it seems quite clear that when
we argue, "If a man's character is avaracious, he
will refuse to give money for useful purposes; this
man refuses to give money for useful purposes,
therefore, this man's character is avaracious," the
conclusion is erroneous, not merely because the
minor premise affirms the consequent, but because,
as we all know, there are other reasons, not at all
connected with a man's character, which may make
a refusal of the kind in question the necessary and
right course for him to pursue, And it seems
equally obvious that when we argue, 'If some agree-
ment is not speedily arrived at between employers
and workmen, the trade of the country will be
ruined, an agreement will not be arrived at and
therefore the trade of the country will be ruined/
the conclusion is erroneous, not merely because the
antecedent is denied, but because the prosperity of
a country depends upon other conditions than the
one specified in the antecedent of the major premise.
In both these instances we see that the breach of the
formal rule of hypothetical arguments is tanta-
mount, on the material side, to the neglect of the
plurality of causes, that is, to the failure to recog-

nise the complexity and interconnection of natural
events.

Disjunctive Fallacies may be defined as those mis-
takes in reasoning which render the conclusions of
disjunctive arguments erroneous. Disjunctive argu-
ments, as we have seen, derive their character from
the fact that the major premises of such arguments
state a series of alternative predicates any one or
more of which, as a matter of fact, may be found
to qualify their subjects. Any conclusion which is
reached on the basis of a disjunctive major premise
is valid or erroneous according as the enumerated
alternatives do or do not conform to the conditions
of disjunctive statements, and as the inference is
or is not warranted by the premises on which it is
made to rest. With respect to the nature of dis-
junctive statements, it is sufficient to recall that
these must satisfy three conditions. First, the
alternatives must all fall within a single universe;
not any set of terms that we can state in the form
of 'either or' are, in the logical sense, disjunctive.
Second, the terms of the disjunction must be ex-
haustive; all the species that fall within the uni-

verse must be enumerated disjunctively. Third, we
saw that the alternatives do not necessarily, although
they sometimes do, exclude each other; it does not
follow, therefore, that only one of the predicates
can belong to the subject under the conditions that
determine a particular argument. Whenever we
fail to observe either one of these requirements of
disjunctive statements in the process of argument,

we are guilty of one or another of the disjunctive
fallacies.

The fallacy of false disjunction occurs when we
proceed to a conclusion on the ground of a major
premise in which the presented alternatives do not
all belong to a single genus. The neglect of the first
positive condition of disjunctive statements leads
necessarily to fallacious arguments, because, where
it is not satisfied, there is no common field within
which the systematic connections of things, as set
forth in disjunctive statements, may be said to fall.
A failure to keep clearly before oneself the fact
that disjunctive alternatives are definitely alter-
natives within a single field of knowledge, reveals
an .entire misapprehension of the nature of disjunc-
tive statements, and leads unavoidably, therefore,
to erroneous conclusions. When, for example, we
are prepared to find in a stranger to whom we have
been introduced all sorts of social virtues merely on
the ground that he has come from our home town,
or when race prejudices make us blind to the vir-
tues that individuals of a particular race display,
we are, in all probability, guilty of the fallacy of
false disjunction. The logical process underlying
social attitudes of the kind in question may be illus-
trated as follows : 'Either from my home town or
devoid of all or certain current social virtues ; from
my home town, therefore not devoid, etc/

The fallacy of incomplete disjunction occurs when
we proceed to a conclusion on the ground of a major

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premise in which the presented alternatives are
not exhaustively enumerated. It is true, of course,
that the observation of single facts may lead to a
disjunctive statement which does not meet the con-
dition of complete enumeration. We may say, for
example, This tree is an oak or an ash/ But prop-
ositions of the kind just illustrated, while they may
serve as minor premises of disjunctive arguments,
cannot serve as major premises, for the reason that,
although the universe within which the alternatives
fall has been accurately determined, the alternatives
within that universe have not been completely enu-

merated. The necessity of a complete enumeration
of the alternatives is due to the fact that the dis-
junctive syllogism is intended to show, not only
what a thing is, but also to determine, within the
genus to which it belongs, what it is not. Let us
suppose that a particular tree is either an oak or an
ash. Then, if we argue, This tree is an oak or an
ash, it is an oak, and therefore it is not an ash/ the
argument would be formally valid, and the conclu-
sion would be true ; but if we supposed that the con-
clusion stated the whole truth about the subject, we
should fall into error due to the incomplete disjunc-
tion of the major premise. Or, to take another illus-
tration, let us suppose that a particular ore is not
either gold or copper. If, then, we were to argue,
This specimen of ore is either gold or silver or
copper or antimony ; it is not either gold or copper,
and therefore it is either silver or antimony/ we
have fallen clearly into a conclusion which is not at

all necessarily true, for the specimen in question
might be none of those enumerated in the major
premise. Such a conclusion is erroneous because all
the species of the genus to which the particular
specimen belongs were not enumerated. But, some
one may say, we cannot always meet this require-
ment of complete enumeration, and are we, there-
fore, precluded from arguing validly to a disjunctive
conclusion ? The answer is that we must express the
indeterminate state of our knowledge about objects
in a complete enumeration if we are to reach valid
conclusions, and we may do this without necessarily
possessing an exhaustive knowledge of the subject
to which the argument refers. Thus, to state the
above argument in a form from which a valid con-
clusion may be drawn we may say, This specimen
of ore is either gold or silver or copper or antimony
or some other species/ a statement which does not
claim complete knowledge of the subject-matter of
the argument, but does rest upon a complete deter-
mination of the knowledge that is possessed about it.
The fallacy of ambiguous disjunction occurs when
we proceed to a conclusion on the ground of a major
premise in which the presented alternatives are not
precisely determined with respect to their exclusion.
We have seen that any proposition of the form *S is
either A or B' strictly interpreted means *S is either
A or else B,' but we also saw that the alternatives
do not necessarily preclude the possibility that *S
may be both A and B.' Unless, therefore, we take
special pains to make clear, in particular instances,

in which of these two ways the disjunctive major
is to be interpreted, we are likely to be led to a con-
clusion which leaves us in doubt as to the meaning
of that conclusion. If we argue, for instance, that

'Because all male students of the university either
drill, or play football, or baseball or tennis, and be-
cause X drills, therefore, he does not play football
or baseball or tennis/ we are stating a conclusion
of the individual which may be true, but it is not
true for the reason assigned; for there is nothing
in the universe of physical education as conducted
by the university that makes an exclusive -interpre-
tation of the enumerated alternatives necessary. If,
then, we give an exclusive interpretation to a non-
exclusive series of alternatives, or a non-exclusive
interpretation to an exclusive series, we are guilty
of the fallacy of ambiguous disjunction.

REFERENCES

SEE THE END OF THE NEXT CHAPTER

QUESTIONS

1. What is the name and character of Aristotle's treatise
on fallacies?

2. In what senses is the term fallacy used at the present
time?

3. In what two main groups did Aristotle classify the fal-
lacies?

4. To what distinctions drawn in the text do Aristotle's
main groups correspond?

5. Describe the chief features of each of the four main
classes into which the text divides fallacies, and by what
names are they distinguished?

6. Into what subdivisions, and according to what prin-
ciple, may the fallacies of interpretation be divided?

7. What do understand by verbal ambiguity, and how does
it differ from mere indetterminateness in the meaning
of words?

8. Describe and illustrate the fallacy of equivocation.

9. What is the fallacy of accent, and in what respect does
the corresponding Greek fallacy differ from it?

10. In what several ways may one fall into a fallacy of
accent? Illustrate.

11. Describe and illustrate the fallacies of composition and
division.

12. What is the Latin name for the fallacy of accident?
Illustrate the fallacy.

13. Give an illustration of the converse fallacy of accident,
and by what Latin name is it known?

14. Describe the character of structural ambiguity.

15. What is the fallacy of amphibole, and from what other kinds of ambiguity must it be distinguished?

16. State and illustrate the fallacy of false parenthesis.

17. What do you understand by fallacies of implication, and into what two classes may they be divided?

18. What is a fallacy of opposition?

19. To what fallacies are the following logical relations particularly liable: contrariety, subcontrariety, subalter nations?

20. What is a fallacy of education?

21. State what is meant by a fallacy of obversion.

22. What is a fallacy of conversion, and in respect of what propositions, and why, is it likely to occur?

23. What are fallacies of inference, and into what two classes may they be divided?

24. What is a deductive fallacy, and how are such fallacies classified?

25. What is a categorical fallacy?

26. What is meant by a fallacy of four terms, and state in what two ways such fallacies arise

27. Classify and describe each of the fallacies of four terms.

28. What are fallacies of insufficient premises, and what rules of the syllogism do they break?

29. Show, in relation to the nature of syllogistic reasoning, how the fallacies of particular and of negative premises occur.

30. Describe as fully as you can the character of an hypo-thetical fallacy.

31. State and illustrate the two hypothetical fallacies.

32. How does the fact that natural events are complex affect our interpretation of hypothetical statements?

33. What do you understand by a disjunctive fallacy?

34. Into what classes, and according to what principle, may disjunctive fallacies be divided?

35. State and illustrate the fallacy of false disjunction.

36. Describe the fallacy of incomplete disjunction. Illus-trate.

37. What is the fallacy of ambiguous disjunction? Illustrate.

EXERCISES

Examine the following arguments and state in what respect, if any, they are fallacious, the technical name of the fallacy of which each is guilty, and the class to which the fallacy belongs:

(1) It is sometimes argued that the communication of an infectious disease to another person should be punished by law, since the law exists for the purpose of protecting people from harm.

(2) I have made thee free a slave.

(3) How can you argue that it is wrong for me to assist my friend to obtain the office by offering business or financial considerations to the voters of my acquaintance if you agree that it is right for a man to do what he can for his friend's good?

(4) A commercial traveller wrote to his chief: Dear Sir, On Wednesday next I want you to allow me

the day off. My wife having lost her mother is being buried on that date and I should like to attend the funeral.

(5) A, B, C, are all the known instances of the class X, and since they are all found to possess the characteristic p we may conclude that All X is p.

(6) Large numbers, though not all, of the instances of the class X have invariably been found to exhibit the character p, therefore, All X is p.

(7) If it is false that no men are immortal, it must certainly be true that all men are mortal, since there is no middle position between mortal and immortal.

(8) If you perform an unfriendly act, I may certainly conclude that your attitude is hostile.

(9) He who is content with what he has is truly rich, but the covetous man is not content with what he has, no covetous man, therefore, is truly rich.

(10) All Parisians are Frenchmen indeed, when the only reason you have to advance for that statement is that all Parisians and all Frenchmen are Europeans !

(11) What is not compound is an element, gold is not compound, and is, therefore, not an element.

(12) If a substance is a metal, it is a good conductor

of heat and electricity, but this substance does not
conduct either well, and so it cannot be a metal.

(13) If man were not capable of progress, he would
not differ from the brutes, but since he does differ
he must be regarded as capable of progress.

(14) What you speak of must be either blue or green
or yellow, but since you say that it is neither of
these it must be devoid of colour.

(15) That happened on Monday or Thursday or in April,
but it was not in April for I remember that it was
Harvest; it must, therefore, have happened on
Monday or Thursday.

CHAPTER XIX

FALLACIES (CONTINUED)

Inductive Fallacies. By fallacies of induction,
as was stated above, we understand those errors to
which thought is exposed in its endeavour to deter-
mine the principle of connection between a number
of particular facts. Now, since induction requires,
as a condition of the explanation of the particulars
of experience, that the facts of experience be care-
fully observed, it is obvious that we are exposed
mainly to two classes of inductive error, to those,
namely, which arise in connection with our obser-
vation of facts, and to those which arise in connec-
tion with our explanation of facts. But since lan-
guage is an indispensible instrument both for record-
ing what we observe, and for stating the methods
and results of the explanations that we have to offer
of what is observed, we may include in the present
discussion a brief statement of the nature and
sources of the fallacies into which a careless use of
language may be the means of leading us. The fal-
lacies of induction will, then, be studied under three
heads ; first, those which originate in our use of lan-
guage; second, those which involve errors of obser-
vation; and third, those which occur in connection
with the so-called inductive inference, the errors,
that is to say, which invalidate explanation.

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Fallacies of Language. Readers of Plato cannot
fail to have remarked that the difficulties that he
sometimes experienced in making clear to himself
and to others the character of some of the more
elementary logical distinctions was due, in great
measure, to the fact that the nature of even simple
grammatical distinctions was not clearly under-
stood by him and his contemporaries. The fact
that Aristotle attributed, as we have seen, a large
number of the fallacies to the influence of language,

also points to the close connection that there is
between thought and human speech. In more mod-
ern times, Bacon, Hobbes, Locke, and others, have
remarked upon the dangers to which we are liable
through the words that we employ to express our
ideas, and Mill wrote two chapters in which he
discusses the requirements and principles of what
he calls a "philosophical language." These refer-
ences, which might be indefinitely extended, are
enough to show that while our acquired speech
may be sufficient for the ordinary purposes of life,
it must be carefully employed if, in regard to the
subjects of scientific investigation, it is not to become
a source of embarrassment and error.

Bacon gave the name of Idols of the Market-
place (Idola fori) to the fallacies which were due
to language, and he puts the sum of the matter as
follows: "Men imagine that their reason governs
words whilst, in fact, words react upon the under-
standing; and this has rendered philosophy and the
sciences sophistical and inactive." The same truth

is dwelt upon at length by Locke, and the general
nature of the influence that language is capable of
exerting prejudicially upon thought, the only point
with which we are here concerned, is evident from
the following quotation: "Men," he says, "having
been accustomed from their cradles to learn words
which are easily got and retained, before they knew
or had framed the complex ideas to which they were
annexed, or which were to be found in the things
they were thought to stand for, they usually con-
tinue to do so all their lives; and, without taking
the pains necessary to settle in their minds deter-
mined ideas, they use their words for such unsteady
and confused notions as they have, contenting them-
selves with the same words other people use, as if
their very sound necessarily carried with it con-
stantly the same meaning. . . . This inconsistency
in men's words when they come to reason concerning
either their tenets or interest, manifestly fills their
discourse with abundance of empty, unintelligible
noise and jargon, especially in moral matters, where
words, for the most part, standing for arbitrary
and numerous collections of ideas not regularly and
permanently united in nature, their bare sounds are
often only thought on, or at least very obscure and
uncertain notions annexed to them. Men take the
words they find in use amongst their neighbours;
and, that they may not seem ignorant what they
stand for, use them confidently, without much
troubling their heads about a certain fixed meaning ;
whereby, besides the ease of it, they obtain this

advantage: That, as in such discourses they seldom

are in the right, so they are as seldom to be con-
vinced that they are in the wrong; it being all one
to go about to draw those men out in their mistakes
who have no settled notions, as to dispossess a
vagrant of his habitation who has no settled abode."
Fallacies of Observation. Observation may be
defective chiefly in two respects. It may be insuffi-
cient in amount, or incomplete or imperfect in
detail. If we consider these two cases separately, it
must not be forgotten that, frequently and perhaps
usually, the fallacies which depend upon observation
occur as the result of both kinds of defect. Induc-
tion, as we have seen, depends upon the collection
of data sufficient in amount to suggest a law of con-
nection; but, more important than the number of
the facts observed, is the degree of thoroughness
with which we are able to analyse them. Mere col-
lections of fact, if such a thing were possible, have,
as we have seen, no special value for science, and
alone can lead to the formulation of no general
principles of connection. The particular data which
are the material of science are brought under obser-
vation by the exercise of discrimination, comparison,
synthesis, in a word, judgment; and this differs
in no essential respects from the process by which
we detect, within collected groups of fact, the fea-
tures that are common, and the connections that
are causal. But while this should be kept clearly in
mind, it is nevertheless true that we may be led into
an inductive fallacy, either because the amount of

data available does not warrant an inference, or
because, although sufficient in amount, our analysis
of the data has not been carried out with sufficient
care and thoroughness.

Observation, then, is defective, in the first place,
when the number of the observed data is not suffi-
cient in amount to guarantee the conclusion that is
based upon it. In view of the situations which this
statement has in view, we are particularly inter-
ested, in logic, to ascertain what are the conditions
that lead to insufficient observation. One important
condition is the general tendency to neglect the
observation and collection of what are called nega-
tive instances. By a negative instance is meant an
instance in which a given phenomenon is observed
not to occur. If we take, for example, the popular
superstitions, such, for instance, that it is un-
lucky to begin any new task or undertake any new
enterprise on Friday, for people to be associated
together in groups of thirteen, or to walk under a
ladder that is inclined against a wall, we are
seriously expected, by those who entertain them, to
share these superstitions in view of the instances
that these persons are able to enumerate in which
some untoward result has occurred. An enumer-
ation of the instances in which no such consequence
has followed, it would seem, is sufficient to show that
the superstitituous conclusion is defective if not

fallacious by reason of the failure to observe these
negative instances.

To have called our attention to this tendency to
neglect the evidence afforded by negative instances
is one of the merits of Bacon. The following quo-
tation from the Novum Organum, not only states
the nature of the fallacy, but indicates also its scope.
Bacon writes: "The human understanding, when
any proposition has been once laid down (either
from general admission and belief or from the
pleasure it affords), forces everything else to add
fresh support and confirmation; and although most
cogent and abundant instances may exist to the con-
trary, yet either does not observe or despises them,
or gets rid of and rejects them by some distinction,
with violent and injurious prejudice, rather than
sacrifice the authority of its first conclusions. It
was well answered by him who was shown in a
temple the votive tablets suspended by such as had
escaped the peril of shipwreck, and was pressed as
to whether he would then recognise the power of
the gods : But where are the portraits of those who
have perished in spite of their vows? All super-
stition is much the same, whether it be that of
astrology, dreams, omens, retributive judgment, or
the like, in all of which the deluded observers
observe events which are fulfilled, but neglect and
pass over their failure, though it be much more
common. But this evil insinuates itself still more
craftily in philosophy and the sciences, in which a
settled maxim vitiates and governs every other cir-
cumstance, though the latter be much more worthy
pf confidence. Besides, even in the absence of that

eagerness and want of thought (which we have
mentioned), it is the peculiar and perpetual error
of the human understanding to be more moved and
excited by affirmatives than by negatives, whereas
it ought duly and regularly to be impartial ; nay, in
establishing any true axiom the negative instance
is the more powerful."

The testimony of Darwin is to the same effect.
He says : "The success of the 'Origin' may, I think,
be attributed in large part to my having long before
written two condensed sketches, and to my having
abstracted a much larger manuscript, which was
itself an abstract. By this means I was enabled to
select the more striking facts and conclusions. I
had also, during many years, followed a golden rule
namely, whenever a published fact, a new obser-
vation or thought, came across me, which was op-
posed to my general results, to make a memorandum
of it without fail and at once; for I had found by
experience that such facts and thoughts were far

more apt to escape from memory than favourable
ones. Owing to this habit, very few objections were
raised against my views which I had not at least
noticed and attempted to answer."

Another condition of insufficient observation
that may be mentioned is education. Whatever our
conception of the aim of education may be, there is
no doubt that a large part of the educative process,
as we actually experience it, is taken up with an
effort to gain familiarity with a body of knowledge
that is regarded as traditionally important and fun-

mental. This statement is true for all grades of
education from the grammar school to the univer-
sity. Now it is not only inconceivable, but contrary
to experience, that the acquisition of any con-
erable body of knowledge should be without its
effect upon our mental habits; for acquaintance
with any class of facts means, in terms of men-
tal habit, a trained ability to perceive with in-
creasing facility other facts that are the same in
kind as these, and a corresponding inability to per-
ceive facts that differ considerably from them in
kind. A particular illustration of this general truth
is found in the case of those individuals whose edu-
cation assumes a special character, as it does, for
instance, in law, medicine, theology, engineering,
etc. And even if we consider the case of those
whose common school education is not followed by
a university training, but by apprenticeship in some
business, it is quite apparent, even then, that the
knowledge of the business, of its material, methods,
and aims, acts exactly in the same way to sharpen
the perception to observe a specialised group of
facts, and to limit the facility with which facts
dissimilar to these are perceived. The truth is
that all of us perceive what we are educated to
perceive, and that we are limited in respect to the
kinds of things that we perceive by the education
that we have received.

Bacon referred to the errors into which we are
led as the result of the limitations that education
and inherited beliefs may have upon the range of

our perceptions as Idols of the Theatre (Idola The-
atri) . Doubtless, as is shown by his illustrations,
he had in mind the cramping effect of the traditions
of the Schoolmen upon the new learning in his day.
Bacon lived at the dawn of the modern scientific
era, and he was acquainted with some of the ob-
stacles that it had to encounter on account of theo-
logical prejudice (odium theologicum) of the times.
But if we have passed beyond the stage where the
prejudices which come from a one-sided theological

position and training are allowed to interfere with
the freedom of thought and investigation, it is still
possible that prejudices the same in kind, though
different in form, may hamper the human mind in
its search for truth. The fact that these hindrances
are not officially administered, but are grounded in
that specialisation, upon which our modern educa-
tion lays so much importance, would make the ten-
dency to which we are referring the more insidious,
and hence more difficult to detect and avoid or over-
come. "The success of modern scientific methods,"
as Creighton remarks, "has sometimes led investi-
gators to despise and belittle the work of those who
do not carry on their investigations in laboratories,
or do not weigh and measure everything." Thus
the mechanical conceptions which were worked out
successfully in the realm of physics and astronomy,
have been extended to psychology, ethics, and polit-
ical science, without any consideration being given
to the differences in the material which is the sub-
ject-matter of this latter group of sciences. In our

own day, the evolutionary hypothesis has provided
us with a point of view for looking at all the details
of human experience; but it is not impossible that
the limitations of this point of view and the errors of
observation to which it has led, may, at some future
time, be as clear as today are the insufficiencies of
the notion of mechanism as employed by the thinkers
of the eighteenth century.

In the second place, observation may be defective
either because it is incomplete or imperfect in detail.
The instances of fallacious inference which belong
in this group are those which arise from the fact
that the collected data, upon which the inferences
rest, have not been examined with sufficient thor-
oughness. Defects of the kind here in question may
be due either to the fact that only part of the mate-
rial has been studied, or to the fact that, while all
the material may have been studied, this has not
been done for all or parts of the material with suffi-
cient minuteness. In either case, the inference will
be erroneous on account of a failure to carry our
analysis of the phenomenon under observation into
sufficient detail.

A number of conditions may operate to arrest
our analysis of observed data at a point which falls
short of that at which it is possible to determine
with some degree of accuracy the law of their
connection, but two are, from the logical point
of view, of sufficient interest to require brief men-
tion. There is no doubt, in the first place, that great

differences exist in the ability of different investi-

gators to perform the task of analysing a group of
collected facts. Some individuals, it is found, are
splendid collectors, and are exceedingly fertile in
devising ways and means of bringing under obser-
vation specimens that entirely escape the notice of
others not gifted as themselves. But it sometimes
happens that among these born collectors there are
many who can go but a little way toward that com-
plete analysis of their collected material upon which
alone any general conclusion can safely be based.
The recognition of this fact has led, in practice, to
the introduction of a large amount of cooperation
between workers in the same line of research, and
has tended to make the laboratory a workship in
which there is found employment for a great variety
of talent. It is only the exceptional man who, like
Darwin, combines the collector's skill with a keen
analytic mind that brings to light the common fea-
tures that lie hidden under a mass of differences in
any group of facts. Natural limitations, then, of
the sort we are discussing operate frequently to
render the observation of details incomplete, and to
throw doubt upon any conclusion which rests upon
such imperfectly analysed data.

Another condition which tends to make analysis
defective is an imperfectly developed technique or
method. We have spoken above of the importance
of the construction and use of apparatus if the work
of scientific observation is to be successfully carried
on. Indeed, we may say that the progress of modern

science has been dependent, in large measure, on
the success that has attended the development of
special methods for bringing the structure of col-
lected data under detailed observation. In the bio-
logical sciences, for example, the methods of hard-
ening, embedding, and staining the various tissues
have gone a long way toward placing these sciences
on the same experimental plane as physics and
chemistry. The further progress of these, as of the
other, sciences depends upon the adaptation of the
methods already in vogue to new material, and the
development of new methods to meet new conditions
and situations as they arise. But whenever we
speak of improvement, and recognise the possibility
of new discoveries, we at the same time imply that
our present knowledge is defective in just those
respects in which advancement may be expected.
This, however, is only to say that so long as the
technique of any science is capable of improvement,
the conclusions of that science must be entertained
with caution and subject to certain reservations.

Fallacies of Explanation. There are two sources
of error in inductive processes of reasoning to which
we shall direct attention: hasty generalisation and
false analogy. It is exceedingly difficult to give a
concise statement of what is meant by hasty general-
isations, since any explanation may be rendered

erroneous by undue haste at any of the stages of the
inductive process. For instance, an inductive con-
clusion may be fallacious on account of haste at
either the stage of what was called above empirical

generalisation, or at the stage of hypothesis, or at
the stage of verification. Whenever, therefore, any
part of the task of explanation is not thoroughly
performed, our conclusion, resting as it does upon
an incomplete or imperfect acquaintance with the
details of the phenomenon, may be called a hasty
or premature generalisation. The essential nature
of the fallacy consists, then, in the absence of an
analytic thoroughness requisite for a true explana-
tion, without respect to the part of the explanatory
process in which the failure to be sufficiently thor-
ougs occurs.

We may remark, however, that we are not guilty
of this fallacy when we consciously arrest our anal-
ysis of a phenomenon to be explained at a point
which falls short of completeness, or when imper-
fectly observed or analysed data are generalised,
but are not offered as an explanation. The fallacy
occurs only when an incomplete analysis is presumed
to be complete, or when a preliminary generalisation
is mistaken for a final one. As has been said, the
value of logic consists in calling attention to the fact
that, not only must conclusions be true, but the
reasons for the truth of conclusions must be defi-
nitely ascertained, if science is to exist. Science, as
we have seen, is a consciously controlled process, a
process of arriving at a certain conclusion, by means
of a method; which is definitely regulated at all the
stages through which it passes from the earliest
observation to the finally accepted explanation.
When the control of the method by which conclu-

sions are reached gets out of hand, when we become
careless in the use of the methods we adopt for the
examination of phenomena, our explanation of such
phenomena is erroneous, because it involves, in the
sense in which the term has been explained, a hasty
generalisation. Such conclusions are fallacious be-
cause they do not rest upon a sufficiently detailed
basis of fact.

Analogy may give rise to erroneous conclusions
when it is supposed that the phenomenon under
observation has all the characteristics of the instance
which provides us with the analogical resemblance.
We have seen that analogy is a useful method, or
step in the method, of scientific explanation, but
unless it is strictly guarded it is likely to arouse all
sorts of distracting associations which lead to mis-
understanding and error. When considered as a

possible source of error, analogy has certain affin-
ities with figurative language, on the one hand, and
with the disregard of negative instances, on the
other. With respect to its relation to figurative
language, analogy leads us astray when the illustra-
tion which provides us with the analogical resem-
blance engages the whole attention, and we are
thereby led to predicate of the phenomenon under
investigation qualities that have been actually ob-
served only in the illustration. It was with the dan-
gers of analogical reasoning in mind that a professor
was wont to say to his students that they should
not try to make the parables of the New Testament
"go on all fours," that is, they must not try to find

a point for point resemblance between the truth of
the parable and the story which provided the basis
of the analogy. It is neglect of such counsel that
leads in the sciences to the fallacy of false analogy.
With respect to its relation to negative instances,
analogy is likely to lead us into error if the points
of difference between a phenomenon and its illus-
tration are lost sight of, and only the resemblances
are retained. "For instance," to borrow an illus-
tration from Sidgwick, "during the recent Boer
War various analogies were appealed to by various
people as helping to throw light on the situation.
It was compared to the operations of America in
the Philippines, to the Armenian massacres, to the
American Civil War, and even to the high-handed
action of Spain in the Netherlands in the time of
Elizabeth. Our action in South Africa was sup-
posed (by different people) to be analogous to those
and other historical precedents, and the analogies
were used to support the various judgments passed
by these various people on the rights of the war and
its probable outcome. It is easy to see that in all
these comparisons there is some likeness and also
some difference, and that the justice of the analogy
depends upon the relevance of the likeness and the
difference." But if the difference is a relatively
important one, and we proceed nevertheless to build
up an explanation on the ground of the likeness
alone, we are guilty of the fallacy of false analogy.
The fallacy assumes the converse form if we are led
to underestimate the value of a resemblance because

it is accompanied by striking differences. In any
case, the fallacy arises when we forget that analog-
ical reasoning depends upon what Sidgwick calls
"the relevance of the likeness and difference."

Fallacies of the Context. The fallacies that we
have considered in the foregoing pages arise out of
a failure to determine precisely the nature and rela-
tions of the subject-matter which constitutes the

contents of particular arguments. The group of
fallacies to which we have now to direct attention
arises from the fact that the meaning of particular
arguments, as we have shown, is determined in part
by their relation to a context which they imply with
varying degrees of clearness. Now when we say
that the context supplies part of the meaning that
an argument may rightly be said to have, it is im-
portant to bear in mind that the context may be
said to refer, not only to the undetermined aspects
of the subject-matter under discussion, but also to
the interests or purposes which sustain, as we have
seen, our inquiries into truth and our search for
knowledge. Any discussion of what knowledge or
truth is cannot fail to be inadequate, as we have
shown, if attention is not given to the part played
by the complex character of the material about
which knowledge is desired, and also to the character
of the interest which knowledge is intended to sat-
isfy. Because, therefore, of its relation to a context,
every argument is liable to errors which do not arise
directly out of the facts and relations which are
expressed by its constituent propositions. There

may be imported, that is to say, into the meaning
of arguments elements from their contexts which
lead to conclusions which are at variance with what
the premises, logically interpreted, really support.
Whenever this happens, whenever, that is, we accept
arguments on the ground of suggestions, derived
from their contexts, which are not related to the
truth character of the arguments themselves, there
ensues a fallacy of the context. A fallacy of the
context may be defined, therefore, as an error in
reasoning which is due to the influence that some
feature or features of a context, not related to the
truth character of the argument, has upon our inter-
pretation of the subject-matter of the argument,
such influence inducing us to accept a statement
about the subject-matter of the argument as true for
reasons which, apart from the influence referred to,
would fail wholly or in part, to justify its accept-
ance.

The nature of these fallacies may be made still
clearer, if we observe that in arguments of the kind
under consideration the context may contribute
irrelevant elements derived from either of the fac-
tors by which, as was pointed out, human knowledge
is determined, from the world of relatively inde-
pendent objects on the one hand, and from the world
of our interests, on the other. An imperfect deter-
mination of the universe within which an argument
is intended to be considered leads to a group of fal-
lacies of which Petitio Principii, Ignoratio Elenchi,
Non Sequitur, and Complex Question are the chief;

and a failure to confine the interests by which we
are guided in our search for truth to those which
have a direct relation to that end leads to another
group of which Post Hoc, Argumenta ad Hominen,
ad Populum, ad Verecundiam, ad Misericordiam,
may be taken as the most important. In the former
group, we are considering how the relations which
a given object has to other objects may become a
source of error in our knowledge of the world of
relatively objective things, and to these we may give
the name, fallacies of assumption. In the latter, we
are studying the ways in which knowledge may be
deflected by reason of the operation of certain nat-
ural and acquired characteristics of the mental life ;
and to these we may give the name, fallacies of
interest. In both cases the fallacy is due to the
admission into our reasoning of elements which have
no direct bearing upon the truth character of the
judgments in which our knowledge is asserted.

Fallacies of Assumption are those errors in rea-
soning which occur when the assumptions on which
an argument rests are not clearly distinguished from
the judgments of which the argument consists. ^ An.

^assumption, in this connection, is anything we take
for granjejL-but do not assert, about the subject-
matter of anjirgument. It is the equivalent of what
we have had occasion hitherto to speak of as the
universe of discourse. Interpreted from this point
of vtew f it is readily seen that an assumption is not

<^afl-assertion. and forms no part of the asserted con-
tents of an argument, although, as we have seen, it

has a relation to the argument, a relation which is
indicated with sufficient clearness by saying that it
points out the sphere of reference in which what is
asserted may or not be accepted. Now it is a misin-
terpretation of the relation betweeji what an argu-
ment assumes and what it asserts that lies at the
foundation of the fallacies that we have here to con-
sider. Thus, when what is taken for granted or as-
sumed is allowed to function in any part of an argu-
ment as an assertion or judgment, or when the as-
sumption on which an argument proceeds is ambig-
uous, the resulting fallacy is one of assumption.

Petitio Princpii is the name of an argument which
assumes the conclusion that is to be proved. It is,
as Sidgwick says, "the surreptitious assumption of
a truth you are pretending to prove." Since, then,
the fallacy is one of assumption, it is evident that
its source must be found, not in what is definitely
asserted, but in the world of reality or existence in
which what is asserted has a definite meaning or
fulfillment, that is to say, in the universe of dis-
course from the standpoint of which the argument
is interpreted. The nature of the fallacy is seen in

the confusion that exists, for the person guilty of
it, between the asserted grounds of a conclusion,
and the assumptions that thought postulates with
respect to the subject - matter of an argument,
Whenever it exists, the fallacy directs attention to
the fact that the truth of what an argument asserts
depends in part upon what assumptions the argu-
ment makes ; and, in view of the nature of an argu-

ment, it follows that when assumptions are put
forward as reasons we necessarily fail to establish
a conclusion, and fall into the merest dogmatism
unless we are willing to have these assumptions
called into question. "When," for instance, "Galileo
maintained that the earth goes round the sun, he
fully believed it and yet was willing to treat it as a
disputable question ; but when Pope Urban VIII and
his cardinals maintained that the earth stood still,
they shut their eyes to the arguments, and said their
view was only disputable by any one who chose to
be burnt alive." Now, with respect to the right to
call into question any of the grounds on which con-
clusions are supposed to rest, we can only say that
this right must be conceded, or that the fallacy we
are now considering can have no logical standing.
But further, if we cannot go behind the premises,
nor consider ^e rights of assertions to stand as
premises, but must accept any set of assertions at
their face value as grounds of argument, then the
whole of logic has been reduced to a mere formal
science, and its processes are valuable only as they
enable us to secure consistency of statement. Either
this, or we must admit that there is a real difference
between assertions and assumptions, between judg-
ments and postulates, that the human mind is likely
at times to fail to keep the distinction clearly before
it, and, consequently, that the one may sometimes
slip, in the course of argument, into the place of the
other. Now, when this happens, when in the course
of argument assumptions take the place of reasoned

judgments, the argument is fallacious because, for
the reason assigned, it involves a petitio principii.

The English language, as Whately pointed out,
is peculiarly "suitable for the fallacy of Petitio
Principii, from its being formed from two distinct
languages, and thus abounding in synonymous ex-
pressions which have no resemblance in sound, and
no connection in etymology, so that a Sophist may
bring forth a proposition expressed in words of
Saxon origin, and give as a reason for it the very
same proposition stated in words of Norman origin ;
e. g. To allow every man an unbounded freedom of
speech must always be, on the whole, advantageous
to the State ; for it is highly conducive to the inter-

ests of the community, that each individual should
enjoy a liberty perfectly unlimited of expressing
his sentiments/ *

When the fallacy of petitio principii is com-
mitted in a single step it is called vvrepov irporepw
(hysteron proteron) ; and when it involves more
than a single step it is called circulus in probando or
reasoning in a circle.

Closely connected with the foregoing is the fal-
lacy of the Complex Question. By a complex ques-
tion, in the broadest meaning of that term, is meant
one that suggests its own answer. Any question,
for instance, that forces us to select, and assert in
our answer to it, one of the elements of the question
itself, while some other possibility is really open, is
complex in the sense in which that term is here em-
ployed. If, for example, one were to ask whether

you were going to New York or London, or if your
favourite colour were red or blue, or if you had
given up a particular bad habit, he would be guilty
of the fallacy of the complex question, if, in each
case, the alternatives, as a matter of fact, were more
numerous than, or were in any way different from,
those stated in the question. Any leading question
which complicates an issue by over simplification is
fallacious for the same reason. Now, in the light
of what we have said with respect to the petitio
principii, it is not difficult to see that the fallacy of
the complex question is occasioned by the character
of the assumption on which the question rests. In
the petitio principii an assumption with respect to
the subject-matter of an argument functions as a
premise, in the complex question it is a similar as-
sumption that shuts out some of the material possi-
bilities of a situation and confines an issue within
too narrow limits. As in the former case, so here,
the only way of meeting the difficulty is to raise the
previous question, that is, to call the assumption
which lies back of the fallacy into question.

Ignoratio Elenchi, according to Aristotle, is a
fallacy which arises from "ignorance of the nature
of refutation." In order to refute an assertion,
Aristotle says we must prove its contradictory; the
proof, consequently, of a proposition which stood in
any other relation than that to the original, would
be an ignoratio elenchi.

Since Aristotle, the scope of the fallacy has been
extended to include all cases of proving the wrong

point. Thus, when H. Spencer, in arguing against
the advocates of a classical education, says that

"Throughout his after career, a boy, in nine cases
out of ten, applies his Latin and Greek to no prac-
tical purposes," he is guilty of an ignoratio elenchi,
for the argument, as Welton points out, "ignores
the fact that the advocates of a classical education
do not claim that Latin and Greek are of direct use
in practical life. What they do urge is that the
study of the classics furnishes an unrivalled mental
training; and it is this proposition which a true
cAcyxo? (elenchus) must disprove." With this inter-
pretation of the fallacy Whately is in agreement.
He writes : "I am required to prove a certain con-
clusion ; I prove, not that, but one which is likely to
be mistaken for it; in that lies the fallacy. . . For
instance, instead of proving that 'this person has
committed an atrocious fraud/ you prove that 'this
fraud he is accused of is atrocious / instead of prov-
ing, as in the well-known tale of Cyrus and the two
coats, that 'the taller boy had a right to force the
other boy to exchange coats with him/ you prove
that 'the exchange would have been advantag-
eous to both/ instead of proving that 'a man
has not a right to educate his children or dis-
pose of his property in the way he thinks best/ you
prove that 'the way in which he educates his chil-
dren or disposes of his property is not really the
best;' instead of proving that 'the poor ought to be
relieved in this way/ you prove that 'they ought to
be relieved.' " The fallacy usually occurs, as Jevons

remarks, "in the course of long harangues, when
the multitude of words and figures leaves room for
confusion and forgetfulness." Hence, an ignoratio
elenchi has been called by Aikins the fallacy of the
forgotten issue. Thus it is frequently necessary,
for example in debate, to call the discussion back to
the point at issue. For example, in a speech in the
House of Commons, Canning is reported to have
said, in reply to Mr. Percival, that "The question is
not, as assumed by my opponent, whether we shall
continue the war in the Peninsula, but whether it is
essential to our success in the war that our present
system of currency remain unchanged."

The nature of the fallacy, then, consists in sub-
stituting for a certain issue another which is more
or less closely related to it, and arguing the substi-
tuted issue. The fallacy does not take into account
whether the arguments do or do not really support
the substituted issue, it only calls attention to the
fact that they do not constitute a proof of the orig-
inal one. Sudents are quite often guilty of an
ignoratio elenchi when in reply to questions they
substitute some other though related question and
allow their answers to be guided by it. It is a par-
ticularly prevalent and subtle fallacy and it assumes
a great variety of forms. But whenever it occurs
and whatever form it takes, it is brought about by
an assumption that leads the person guilty of it to
substitute for a definite subject of inquiry another

which is in close relation with it. In the petitio principii the fallacy may be described as an assump-

tion of the premises ; in the complex question, as an assumption of the answer; and in the ignoratio elenchi, as an assumption of the question at issue.

Whenever, for any reason, a conclusion does not follow from the assigned premises, we have, in the literal sense of the term, a Non Sequitur. When used in this sense to include all the errors in reasoning which leads to erroneous conclusions, the term is generic, and must be understood as synonymous with 'fallacy.' Any kind of loose or inconsequential argument, from this point of view, would be a non sequitur.

More particularly considered, the fallacy of non sequitur, as was indicated by Aristotle, is the name we apply to the erroneous conclusion of a hypothetical syllogism. Aristotle regarded it as an "argument from the affirmation of the consequent," and for this reason it is sometimes called the fallacy of the consequent. If, for example, we argue that a particular individual who has no visible means of support must be a prefessional thief, because "if a man is a professional thief, he will have no visible means of support," the argument will be fallacious because, as we have seen, no conclusion can be reached by affirming the consequent of hypothetical propositions. The term non sequitur may also be applied to the other hypothetical fallacy of denying the antecedent. In both the cases to which the term has been said to apply, the assumption is made that the relation between antecedent and consequent of the major premise is causal, an assumption which

we have no right to make in view of the complex interconnection of the facts with which our human knowledge has always to deal. But if it is made, the only way we can avoid a possible fallacy is to call into question the assumption, and thereby to raise definitely the question whether antecedent and consequent are causally connected or not.

The attempt has sometimes been made to apply the name non sequitur to the fallacies which occur in connection with categorical arguments. This cannot be considered a useful employment of the term. For if the term applies to any and all of these errors, it must be regarded, as we have said above, as a generic term, and loses all particular significance, and if it is used of a particular kind of categorical fallacy, it immediately takes its place as a synonym of the name of that fallacy. Some logicians, however, do not take this view of the case,

and they assign the term to a group of cate-
gorical arguments of which the following may
be said to be fairly representative : 'Episcopacy is
of scriptural origin, the Church of England is the
only established church in England, therefore the
church established in England is the only church
that should be supported.' Again, 'Pennsylvania
contains rich coal and iron mines, Pennsylvania has
no sea coast, therefore the battle of Gettysburg was
fought in that state/ These examples are so flimsy,
as examples of argument, that the only sensible
course to take with regard to the class of reasoning

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for which they stand is to deny that it can have any
logical recognition at all. Logic presupposes at the
least some development of common sense on the
part of those to whom it addresses itself, and one
can hardly be expected to take so low an estimate of
logic as to think that it can be of any possible service
to the individual upon whom such so-called argu-
ments would have the least chance to impose. The
logician has absolutely nothing to do with such an
individual who, in the interests of society, had much
better be placed in the care of an alienist.

We conclude, therefore, that non sequitur is a
name that can be applied only to fallacies of the kind
that occur in the course of hypothetical arguments.
The fallacy consists in misinterpreting the implica-
tions of the relation of antecedent and consequent
stated in the major premise of hypothetical syllo-
gisms.

Fallacies of Interest. Knowledge, as we have
shown, depends for one of its conditions upon what
we call interest. But knowledge is not secured and
advanced by any or any kind of interest. It is only
when, as we have seen, the interest is directed
toward, and is accompanied by a desire to ascertain,
the nature and relations of the objects by which it
is stimulated that it can be considered to be of
service in the establishment of knowledge in the
strict sense of that term. The interest that must be
recognised as an indispensable condition of all
knowledge whatever is specifically an interest that
points toward and terminates in the establishment

of the knowledge relation. Whenever any other
interest than this is allowed, consciously or uncon-
sciously, to influence the steps we take toward
knowledge, or the conclusions we accept, the process
and the conclusion are for that reason fallacious.
Instances of the kind of argument just indicated
will be considered in the following paragraphs, and

they are grouped together because they all imply
that some other interest has been substituted for
the one which alone, as we have said, can be of
service in the attainment of truth.

Perhaps the most reputable of the fallacies of
the kind in question is that which is known as post
hoc, ergo propter hoc. In discussing the problems
connected with the establishment of causal relations,
we have seen that a succession of events is to be
interpreted always as containing the suggestion of
a possible causal connection between the events in
question, or with other with which they are con-
stantly associated ; but we saw also that the succes-
sion itself is never to be taken as evidence of such
connection. If, therefore, neglecting this latter con-
sideration, we should argue from an observed suc-
cession of events to the causal connection of the
events, the conclusion would be fallacious because
the only reason that could be assigned for the infer-
ence, namely, that, since the one event had followed
the other, it was, therefore, caused by that other,
is never sufficient to establish a causal relation. The
fallacy arises, then, from neglect of the negative
criterion of causal relations to which we have just

referred, namely, that mere succession is never a
sufficient reason for a causal inference.

The relative prevalence of this fallacy, and the
charitable attitude most of us take toward those who
are guilty of it, suggest that the error which it
implies lies somewhat deeper in the mental life than
some others that have come before us. If this is
true, the explanation and full exposition of the
nature of the fallacy belong to psychology rather
than to logic. In a general way, however, we can
see that whenever the scientific interest, which seeks
to safeguard conclusions from possible sources of
error, is not strictly emphasised, or when it is for
some reason temporarily weakened, it is easy for the
human mind to slip into one of the more usual or
conventional attitudes toward the objects of its ex-
perience, and thus to arrive at conclusions which,
to the extent that this has taken place, are fallacious.
In these fallacies, we observe a tendency to confuse
associative combinations with causal connections, a
tendency which is emphasised whenever the prac-
tical takes the place of the theoretical interest in
determining our relations to the objects of our ex-
perience. An example of this fallacy, frequently
met with in educational circles, is the contention
that because students who are handicapped by the
necessity of earning their livelihood usually manage
to pass their examinations, while others who are
not so handicapped sometimes fail, the handicap is
part of the cause of their success. In similar
fashion, we have heard it argued that because Spur-

geon, who never went to college, was a great
preacher, that this was due to the fact that he never
attended college. There is more common sense and
logic in Spurgeon's remark, referring to the above
contention, that the result was accomplished in
spite of his lacking a collegiate training.

There are a number of fallacies which are due
still more obviously to the way in which arguments
connect themselves with interests which are distinct
from the one with which our search for truth is
more particularly associated, and in which the con-
clusion assumes a character in conformity with
these interests. When, for instance, an argument
makes an appeal to the character, principles, pro-
fession, or interests of an individual, and it is ac-
cepted or rejected for that reason, there results a
fallacy which is called an argumentum ad hominem.
If, for example, the evidence for the movement of
the earth round the sun is rejected because it is
inconsistent with one's religious convictions, the
rejection is fallacious because the argument reaches
its conclusion by the substitution of the religious
for the scientific interest. If, again, the fact that
one owns stock in a brewery is allowed to influence
his judgment as to what conclusion, with respect to
the sale of alcoholic beverages, is warranted by the
scientific evidence that is available on the physio-
logical effects of alcohol on the human system, he is
guilty of the fallacy under consideration. When,
once more, the demands of religion upon the indi-
vidual are rejected because preachers or church

members are not free from obvious faults, or when
they are accepted because thereby business will be
helped, the position in each case involves an ad
hominem fallacy.

The admission, by courts of law, of testimony
bearing upon the character of witnesses, requires
a word of explanation, because it seems to be in
contravention of the recognised fallacious nature
of the arguments we are now considering. The
difficulty created by this instance is removed when
we observe that courts of law do not admit testi-
mony as to the character of witnesses for the pur-
pose of deciding whether the verdict shall be for
or against the plaintiff, but for the purpose of
eliminating, from the evidence that comes before it,
testimony that is irrelevant to the issue, that is,
testimony which, because it is prejudicially affected
by the character of the individual who gives it,
involves an argumentum ad hominem. Prejudiced
or perjured evidence is fallacious in exactly the
sense in which any ad hominem argument is falla-
cious.

When an argument is accepted because it enlists
on one side or other of the question at issue, our
feelings, passions or prejudices, it is called an argu-
mentum ad populum. This is essentially the fallacy
of public address. Any cause, as we all know, that
can bring impressive oratory and brilliant metaphor
to its aid is very likely to secure the support of many
upon whom the cause itself and the arguments which
really support it, would have little or no influence.

Conspicuous examples of fallacious reasoning of
this kind may be found on almost every page of the
voluminous writings of the late Robert Ingersoll.
A somewhat similar fallacy is that which is known
as argumentum ad misericordiam. In this case, our
judgment is determined by the appeal that is made
to our pity or sympathy. Whenever, for example,
we recommend a cause by emphasising the plight of
those whom it is intended to benefit, or give our sup-
port because of our interest in the individuals who
advocate it, or give alms to a beggar because he is
in rags, we are guilty of letting our sympathy inter-
fere with our judgment, and this is exactly what
occurs in any argumentum ad misericordiam.

The influence of a great name or of long estab-
lished customs is pretty generally recognised as serv-
ing a useful purpose in the development of the indi-
vidual and the race. When, however, our reverence
for individuals or institutions leads us to accept,
without consideration of the arguments which may
be advanced for and against them, positions which
receive the support of or are in conformity with
any established authority, we are said to be guilty
of the fallacy, argumentum ad verecundiam. This
is a fallacy to which the conservatives among us
are particularly prone. Our interest in order, in
things as they are, unless balanced by a due regard
for change, may lead us to accept a position merely
because it is in agreement with some established
custom, or to reject another merely because it re-
quires the rejection of some accepted authority. A

peculiarly aggravated form of the fallacy comes to
light in those instances where an individual's right
to speak with authority in one field of knowledge is
taken as the ground of our acceptance of that indi-
vidual's opinion in another field with respect to
which he has no special acquaintance. "The pres-
tige of a great name," as Creighton remarks, "is
thus irrelevantly invoked when no significance prop-
erly belongs to it. Thus, for example, a successful
general is sometimes supposed to speak with author-
ity upon problems of statescraft, and the opinions
of prominent clergymen are quoted regarding the
latest scientific or political theories."

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QUESTIONS

1. What is an inductive fallacy, and into what classes
may such fallacies be divided.

2. What testimony can you quote showing the importance
of a careful and accurate use of language for logical
thinking?

3. What did Bacon mean by Idols of the Market Place?

4. How does Locke explain the fact that language often
renders thought fallacious?

5. In what two ways may the observation of facts be
fallacious?

6. State and illustrate the fallacy of insufficient observa-
tion.

7. What do you understand by a negative instance?

8. What is the testimony of Bacon and Darwin as to the
importance of negative instances?

9. In what respect does education predispose one to the
neglect of negative instances?

10. What does Bacon mean by Idols of the Theatre?

11. In what form is the fallacy described by Bacon in these terms likely to appear at the present day?

12. What is the fallacy of incomplete or imperfect observation?

13. Explain how the personal factor may lead to incomplete or imperfect observation.

14. In what way does technique affect the thoroughness of observation?

15. What are the two fallacies of explanation considered in the text?

16. Explain what is meant by a hasty generalisation.

17. To what consideration of scientific importance does the possibility of hasty generalisations point?

18. What is the fallacy of false analogy?

19. In what respect is the fallacy of false analogy similar to the fallacy of figurative language?

20. In what respect does false analogy resemble the fallacy of negative instances?

21. What is the general character of the fallacies of the context?

22. Into what two classes may fallacies of the context be divided? Describe each class, naming the particular fallacies that belong therein.

23. What do we mean by a fallacy of assumption?

24. Describe the essential character of a petitio principii.

25. How may we proceed to break down a petitio principii?

26. How may a verepov irporepov be distinguished from a circulus in probando, and how are they related to a petitio principii?

27. What is the fallacy of the complex question?

28. What, according to Aristotle, is an ignoratio elenchi?

29. What is an ignoratio elenchi according to modern logic?

30. What is Aikin's term for an ignoratio elenchi, and discuss its appropriateness.

31. From the standpoint of the assumptions involved, how do the petitio principii, the complex question, and the ignoratio elenchi differ from one another?

32. What is the genereic meaning of the non sequitur?

33. What, according to Aristotle, is a non sequitur, and what, accordingly, is another name for the fallacy?

34. With what meaning is the term non sequitur now used in modern logic?

35. Discuss the relation of the non sequitur to categorical arguments.

S6. What are the fallacies of interest?

37. Describe the post hoc, ergo propter hoc fallacy.

38. What is understood by an argumentum ad hominem?

39. Does the admission of evidence as to the character of accused persons, or of those giving evidence, by courts of law involve the verdict in the ad hominem fallacy? Explain.

40. What is the argumentum ad populum? Illustrate.

41. State and illustrate the argumentum ad misericordiam.

42. Show by means of illustrations the nature of the argumentum ad verecundiam.

EXERCISES

Examine the following arguments, and state in what respects, if any, they are fallacious, the technical name of the fallacy of which each is guilty, and the class to which the fallacy belongc:

(1) In the act of landing on the African coast, Caesar accidentally stumbled, and, as he did so, he exclaimed, 'Africa! I embrace thee.' Against what fallacy on the part of his followers was this exclamation intended to guard?

(2) It is a dictum of the Cartesian philosophy that whatever can be clearly conceived exists. Is this fallacious, and if so, why?

(3) The opponents of the Copernican system argued that if the earth moved, a stone let fall from the top of a tower would not reach the ground at the foot of the tower, but at a point some distance from it, in a direction opposite to the earth's movement. Such, however, is not the fact.

(4) It is reported by travelers that the negroes among whom coral is worn as an amulet affirm that it is always affected by the state of health of the wearer, becoming pale in disease. This is not true.

(5) Women, as a class, are supposed not to have

hitherto been equal in intellect to men, therefore
they are necessarily inferior.

(6) The twenty-five years of Republican tariff legis-
lation have been a nera of unparallelled prosperity.
Why kill the goose that lays the golden egg?

(7) The metropolis of a country may be compared to
the heart of a living body, hence we may infer that
any considerable increase in size of the metropolis
is evidence of a diseased condition of the body
politic.

(8) The early Teutonic societies were held together
by ties of kinship, because all societies were so
held together originally.

(9) It is sometimes contended that because punishment
can only intimidate it is brutalising, and therefore,
it should not be employed, but that only shows that
there are persons who are so brutalised that they
can be influenced only through fear.

(10) The apologists of Charles I., McCaulay complains,
defend the king by urging that he was a good
judge of pictures and indulgent to his wife.

(11) This is a party measure and therefore we must
vote for it.

(12) A religion which elevates the soul above the body
can survive persecution, and since the Christian
religion has survived persecution, it enables its
devotees to prefer the interests of the soul to
those of the body.

(13) It is frequently assumed, because the animals and
men native to countries of inclement climates,
where the conditions of life are severe, are usually
robust, that the hardships they are forced to
undergo in youth are the cause of their hardiness.

(14) I do not know that you will approve it, but I gave
him a pair of shoes, an old coat, and something
to eat. I felt so sorry for him.

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