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Part I.—Original Articles.

ON CAUSATION.

Through the kindness of Dr. Mercier we have been favoured with an advanced copy of the first instalment of a new work recently completed by him on the subject of Causation, with special reference to causes of death and causes of insanity. Owing to conditions now existing in consequence of the war, with, as a result, an extreme scarcity of suitable literary material for publication, as explained in the October number of the Journal, the Editors have had to face quite unprecedented difficulties; and they wish here to express their acknowledgments to Dr. Mercier for so generously coming to their aid in what may almost be termed a crisis in the history of the Journal. The second (and final) instalment of Dr. Mercier's book will appear in the April number.

CAUSATION

WITH

A CHAPTER ON BELIEF

BY

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Had I not continually exercised my judgement, the greater part of the books on these subjects would have turned my brain. This effect they have certainly had upon many who have not used the same precaution. I know the advantage which I might derive from perplexing the understanding by recurring to abstruse reasoning and logical quibbles. But I wave it all. I shall speak nothing but common sense, and what may be understood by anyone, however slender his acquirements.

—*Horne Tooke.*

I myself frequently meditate by myself long and intently; but in vain; unless I find an antagonist, I have no hope of success.—*Scaliger.*

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CONTENTS.

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PREFACE.

EXASPERATED by the fatuity of an expert in heraldry whom he was cross-examining, Sir William Harcourt at length exclaimed: 'Why, the silly man does not understand even his own silly business!' The reader of a book on orthodox Logic is constantly tempted to make the same comment. Every book on Inductive Logic contains a chapter in which an attempt is made to investigate the nature of Causation, to define it, and to explain how causes are ascertained and assigned; but why Causation should be considered subject-matter of Logic, any more than rotation or imitation, is hard to understand. The proper task of Logic is to describe and explain the principles and methods of reasoning, and causation is not a principle or method of reasoning, nor is the definition of causation or the ascertainment of causation a principle or method of reasoning. These are applications of reasoning. They are examples of reasoning. The results are arrived at by methods of reasoning, but they are not themselves methods or principles of reasoning, and are, therefore, no part of Logic. Mill says, and all subsequent writers have followed him, that causation lies at the very root of Induction. It does nothing of the sort. It is one of very many relations that may be discovered by Induction, but it is no more the basis of Induction than rotation or imitation is the basis of Induction.

However, logicians have appropriated to themselves the examination of causation, and it is not surprising, therefore, that its true nature has never been discovered, and that the subject is entangled in confusion and contradiction; for it is thus that logicians leave the subjects they investigate. Mill is the model and great exemplar, as well as the leader of latter-day logicians, and though it may almost be said that men of all sorts take a pride to gird at him, yet it may also be said that he is not only confused and muddled in himself, but the cause of confusion and muddle that are in other men. He enumerates five Methods of Experimental Inquiry, and he calls them four, and in seventy years not one of his commentators has discovered the inaccuracy; some of his most important terms, such as effect and condition, he never defines at all; others,

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such as cause, causation, and conditionality, he defines over and over again in senses that are different, incongruous, or inconsistent; his Canons for discovering causes are cumbrous, uncouth, and clumsy in expression, and in meaning are absurd. They never have been used, and never could be used. It is time, therefore, to take the matter out of the hands of logicians, and investigate it by the light of common sense.

Everyone has an approximate notion, good enough for most working purposes, of what is meant by causation, and by cause and effect, but no one has been able to put that notion into a verbal expression that will stand criticism, and some of the attempts to do so have resulted in expressions that are preposterous beyond belief, as will appear when they are examined. It may seem that if we know what we mean with sufficient accuracy for working purposes, this is enough, and we need not strive to attain pedantic precision; but apart from the general desirability of defining our terms, the approximate accuracy which is enough for rough working purposes is not enough when subtle, intricate, and important problems have to be determined. Issues involving the determination of causes are frequently brought before Courts of Law, and of late years such issues have become much more frequent in connection with causes of disease, of death, of accident, and of injury. In trying such cases, judges have expressed the embarrassment they have suffered from the want of a trustworthy definition of cause. Many nice points of causation have lately come before the Courts, and have been decided in the absence of any clear or precise notion of what causation consists in, without that guidance from philosophers which judges have a right to expect. They have looked to philosophers for light and order, and they have found Cimmerian darkness and primæval chaos.

Nor is it only in the determination of individual issues that a knowledge of the nature of causation is important in law. A definition of causation, or at least a clear knowledge of what causation means and is, is the root and the basis of one very important department of law, reference to which is made in every case that is tried in the Courts. It is the basis of the Law of Evidence. According to that very high authority, Mr. Justice Stephen, the facts that may be proved in Courts of Law are the facts in issue, and those facts that are relevant to the

issue, and he defines relevancy thus: 'A fact is relevant to another fact when the existence of the one can be shown to be the cause, or one of the causes, or the effect, or one of the effects, of the existence of the other,' etc. Clearly, then, to determine what facts are relevant, and this has to be determined many times in the course of every trial, a knowledge of what is meant by causation, and of the nature of cause and of effect, is necessary. Mr. Justice Stephen, in fact, says that his work on Evidence is founded on Mill's Logic, and that a previous work on the Law of Evidence is founded upon Locke's 'Essay.' As to this previous work, I can give no opinion, but I am sure that Mr. Justice Stephen was mistaken when he said his work was founded upon Mill's Logic, for his treatise on the Law of Evidence is as clear and consistent as Mill's Logic is the opposite. Mr. Justice Stephen's admission is important, however, as showing that in his opinion the Law of Evidence does need a foundation in a proper apprehension of Causation.

In other important matters also the need for a clear notion of the meaning of cause and effect is imperative, and the want of it leads to grave disadvantages. The instructions issued by the General Register Office for assigning the causes of death are such that no doctor can understand them, and their unintelligibility is owing to the want of a definite notion of cause. The causes of insanity published in the annual tables of the Board of Control are mostly guesses; some of them are manifestly not causes at all; others may or may not be causes, but no reason is given why they should be so considered; and in the absence of any definition of a cause, and of any trustworthy method of assigning causes, no reason could be given.

It is always assumed by writers on the subject that the only investigations that are worth making into the methods of assigning causes are investigations into the methods pursued by scientific workers, and that result in scientific discoveries. These writers, following Mill, formulate five methods, which, as I have said, they count as four, which they say are used by scientific workers. Scientific workers, however, never use these methods, and could not use them, for they are utterly futile, as will hereinafter appear. Moreover, the assumption that the methods employed by scientific workers to discover causes are in any respect different from the methods employed in every-day life by the cook, the gardener, the plumber, and the rest of

us, is quite groundless and mistaken. Men who work at science have no monopoly of methods of discovering causes. Their methods are not novel or peculiar, but are the same as those that we all constantly use in the course of our daily lives. For this reason I have not followed the course usual in books on Causation, of restricting my illustrative instances to examples of discoveries in science.

The chapter on Belief has been added at the request of a friend who, like most of us, has found himself often puzzled what to believe and what to disbelieve. It makes no pretensions to philosophical profundity, and to those who are accustomed to the ponderous tomes that have been written on the foundations of belief, and upon epistemology generally, it will appear, I am afraid, a trifling performance. These books, however, are scarcely accessible to the general reader, and if they were, it is doubtful whether he would take advantage of them. Some work accessible to him and intelligible by him is sorely needed. It is curious that in an age that prides itself before all things upon being scientific, there are as many prevalent beliefs that are irrational, baseless, absurd, and self-contradictory, as at any former time of which we have any record. We smile with confident superiority at the belief of our ancestors in witchcraft, but there was a great deal of very cogent evidence in favour of witchcraft, and it is little discredit to able and cultivated men, like Sir Matthew Hale and Sir Thomas Brown,* that they believed in it. Moreover, the age in which they lived was a credulous age; the age in which we live is sceptical; and yet we now see men as eminent in their several walks of life as Sir Matthew Hale and Sir Thomas Brown, even men who are considered, not very unjustly, leaders in science, holding beliefs much more irrational, and based upon much less evidence, than witchcraft—beliefs in spiritualism, telepathy, psycho-analysis, table-rapping, Christian Science, so called, and the crazy phantasies of the orthodox logician. When we witness these strange aberrations we may well wonder whether credulity has not rather increased than diminished in the last three centuries.

This book is not written for philosophers, and, indeed, it will be scouted by them, for it is written in ordinary English, and

* Usually spelt Browne, but on the title-page of my copy of his works, dated 1686, four years after his death, his name is spelt as in the text.

is quite easy to understand. From St. John Erigena, the first of the schoolmen, to William of Ockham, the last, and with the exception of Roger Bacon, the greatest; from Francis Bacon, the pioneer of scientific method, to Martineau, Herbert Spencer, and Hughlings-Jackson; the English nation has produced a succession of great philosophers such as all other nations put together would find it hard to equal, and impossible to excel; yet during the last quarter of a century English philosophers have been content to tie themselves like a tin kettle to the tail of Germany, and to follow the cult of obscurity and unintelligibility that passes for philosophy in Germany, and now, alas! in this country also. If I do not write Germanised or Germanic philosophy, it is not because I cannot. It would have been easy to fill my pages with stuff like this:

Causation is the act by which the Form of a significant idea presented in a content of Reality, recognised as such by means of a real Identity, is referred to a subject in Reality that is not really real or divergently diverse, but identical with the diverse content of Reality.

It is as easy as pie to write like this when once you have caught the trick of it. You have only to ring the changes on the words content and form, reality and identity, and you will pass for the most awe-inspiring and cogibundantly sublimificent philosopher; but my spiritual home is not in Germany and I prefer to write in ordinary English for the ordinary reader, whose notions of cause and effect are not as definite as he could wish, who may be glad of some clear guidance in methods of assigning causes, and who may welcome assistance in deciding what to believe, to disbelieve, and to doubt.

CHAPTER I.

SOME THEORIES OF CAUSATION.

IN the whole of philosophy, confused as it is, there is scarcely any subject in such utter confusion as causation. There are references to it in the writings of his predecessors, but Hume was the first writer of note who discussed it at length, and he got it into a tangle which has been worse and worse entangled by subsequent writers, until the latest contributors to the discussion have essayed to cut the knots by denying altogether that there is such a thing as causation at all. Few writers treat the subject without contradicting themselves, and none without outraging common sense, a result which does not trouble them, for the first qualification for a philosopher is to set common sense at defiance. The consequence is that no one who retains any remnant of common sense can rise from the perusal of a discussion of causation without a feeling of dazed perplexity. He finds long discussions in which the cardinal terms are used in several different senses, and are either defined in several different ways or never defined at all. He finds things that are quite distinct, such as cause, condition, and agent, confounded together; he finds problems that are quite distinct, such as the nature of causation and the universality of causation, confounded together; and through all the discussions runs the difficulty inherent in examining and defining a notion that is almost primitive.

Primitive notions are by their very nature impossible to define or explain satisfactorily. They can only be described, and even description is not always easy or always satisfactory. Matter cannot be described except in terms of force, nor force except in terms of matter. It is manifest that defining and explaining more complicated notions in terms of simpler notions cannot be continued indefinitely. The process reaches its natural limit when at last we come to notions of primitive simplicity, just as the chemical analysis of substances reaches its natural limit when we have at last reduced them to elements. The notion of causation is almost elementary. Cause and effect, like matter and force, are terms that everyone understands more or less vaguely, more or less precisely, but that it

is difficult to express more simply for want of simpler terms. At any rate it has been found impracticable hitherto to express them, for every effort that has been made to do so has resulted in an expression that is either more obscure than cause and effect themselves, or that does not truly express what they mean.

Dr. Fowler says 'That a cause is . . . ; that every event has a cause; that the same cause is always attended by the same effect; are obviously three different propositions, and still there are few writers who in their treatment of the question of causation have not more or less confounded them.' This is quite true, and he might have added a fourth—we derive our notion of causation from . . . or the origin of our notion of causation is . . .

It is this fourth proposition that is the main theme of Hume's discussion, and he arrived at the conclusion, which is no doubt correct, that we get our notion of causation from witnessing repeated instances of it—that, in fact, as we should say now, it is a generalisation from many individual experiences. So far no doubt he was right; but he went on to assume, and his whole argument rests upon the assumption, that because the notion of causation is a generalisation from repeated experiences, therefore causation itself does not exist in isolated or single instances, and, in fact, does not exist at all, but is a mental fiction, without any corresponding relation in fact.

The common sense doctrine that Hume undertook to demolish is 'that the idea of causation necessarily implies the idea of *power* or *necessary connection*, that is to say, between the cause and the effect, or *power* in the cause to produce the effect.' He set himself to show that power and necessary connection had been illegitimately imported into the idea of causation, and that what we call cause and effect is nothing but casual antecedence and consequence. Antecedence and consequence are all that we ever observe, or can observe; but when we have witnessed many instances of the same antecedent being followed by the same consequent, we jump to the conclusion, without any justification for doing so, that there is between them a tie other and more than bare sequence—that there is a power in the antecedent to bring about the consequent, and a necessary connection between them. Thus Hume teaches.

Briefly put, his argument is that all our ideas are in the last resort analysable into simple ideas, which are themselves copies of impressions or original sentiments, by which he seems to mean what we now call percepts. 'These impressions are strong and sensible. They admit not of ambiguity.' Such are solidity, extension, and motion, each of which we can perceive, so Hume teaches, in a single experience; 'but the power of force . . . is entirely concealed from us, and never discovers itself in any of the sensible qualities of body.' He means, apparently, that we cannot see it: 'It is impossible, therefore, that the idea of power can be derived from the contemplation of bodies in single instances of their operation; because no bodies ever discover any power which can be the original of this idea.' Since, then, we obtain the notions of force or power and necessary connection, not from single experiences, but by generalisation from many experiences, these notions are fictitious, imaginary, and have no basis in fact, neither have they any existence except in our own misguided imaginations. This is Hume's doctrine.

It is very curious that this doctrine should have been practically accepted by every writer since Hume's time, and that no present-day philosopher should have detected any of the fallacies in it. Modern psychologists are pretty familiar, I should have thougnt, with the doctrine that every one of our concepts of the simplest properties of bodies—solidity, extension, motion, and the rest—is a generalisation from many experiences, and is in no case derived from a single instance, but is slowly built up in our early years under the guidance of experience. As far and in the same way as solidity, extension, and motion are revealed to us by experience, so far and in that way is force or power; and if force or power is not revealed in a single instance, neither is existence, extension, or motion. The only force that exists wholly in the imagination, and is without any counterpart outside it, is the force of Hume's argument.

'The generality of mankind never find any difficulty in accounting for the more common and familiar operations of Nature, such as the descent of heavy bodies . . . but suppose that, in all these cases, they perceive the very force or energy of the cause by which it is connected with its effect and is for ever infallible in its operation. They acquire, by long habit, such a

turn of mind that upon the appearance of the cause they immediately expect, with assurance, its usual attendant, and hardly conceive it possible that any other event could result from it.' They do, undoubtedly; but are they not justified in so accounting for these operations of Nature? What is the test? What is the inexpugnable, infallible test? It is that, acting on this supposition, they should never meet with experience that contradicts it; and is not this test satisfied? Hume says that force or power is never revealed in a single instance; but, when the mind has been prepared by previous experiences to entertain the notion, is not the single instance of carrying a bucket of water sufficient to reveal the force or power of the weight of the bucket? If a breaking wave, thundering upon the beach, and carrying away cartloads of shingle in the undertow, does not convey the idea of force or power; if a hurricane, uprooting great trees, unroofing houses, and whirling haystacks into the air, does not convey the idea of force or power; if an avalanche, carrying away woods and villages, and diverting the course of torrents, does not convey the idea of force or power; then no 'contemplation of any body in single instances of its operation' can afford any idea of any description.

Hume denies that we derive the idea of power from subjective experience, from finding 'that by the simple command of the will we can move the organs of our body or direct the functions of our mind.' He denies it on the ground that 'we learn the influence of our will from experience alone, and experience only teaches us how one event constantly follows another; without instructing us in the secret connection which binds them together and renders them inseparable.' But why should it? We might as well deny that we derive from experience the idea that glue sticks to wood, because we know it from experience alone, and experience does not instruct us in the secret connection which binds the glue and the wood together and renders them inseparable.

Thus he summarises his conclusions: 'It appears that, in single instances of the operation of bodies, we never can, by our utmost scrutiny, discover anything but one event following another, without being able to comprehend any force or power by which the cause operates, or any connection between it and its supposed effect. . . . All events seem entirely loose

and separate. One event follows another; but we never can observe any tie between them. They seem *conjoined*, but never *connected*.' Thus he virtually denies causation altogether, and, as we shall see later, recent writers accept this conclusion, and bring it forward as original with themselves; but it is clear that this is Hume's position, though he never actually puts it into these words. Having arrived at this conclusion, which is a virtual denial that there is any such thing as causation, he admits that when a man has observed several similar instances of such conjoined events he 'can readily foretell the one from the appearance of the other'; and then Hume astounds us by defining a cause as '*where, if the first object had not been, the second had never existed*.' It would be difficult to put the necessary connection between them in stronger terms, and Hume seems frightened at having made the admission, for he begins at once to hedge, and offers another, his third, definition of a cause: *an object followed by another, and whose appearance always conveys the thought to that other.* Thus he removes the reference from the world of things to the world of thoughts, and places the matter on an entirely different basis. At length he concludes: 'I know not whether the reader will readily apprehend this reasoning. I am afraid that, should I multiply words about it, or throw it into a greater variety of lights, it would only become more obscure and intricate.' In this he is no doubt right. His argument is based on a premiss that is thoroughly unsound, and leads to a conclusion that is repugnant to universal experience, and that he is himself compelled to repudiate. However, the mischief was done. He opened the floodgates of confusion, and his successors have ever since been floundering in the swamp.

Mill's whole treatment of the problem of causation is a most deplorable muddle, and that he should have been regarded as an oracle for two generations is a startling proof of the poverty of critical acumen and philosophic insight that has prevailed since his Logic appeared. It is evident on the most superficial perusal of his chapters on the subject that he has never thought it out; he wanders on from conjecture to surmise, and from surmise to conjecture, stating his surmises and conjectures as inexpugnable facts; he defines cause and causation over and over again in eighteen different ways, most of them inconsistent with each other, and some of them contra-

dictory of others, and neither he nor his commentators and followers recognise the inconsistencies or the contradictions. The only explanation of his astonishing and overwhelming reputation is that amongst the blind the one-eyed is king ; but even Mill's one eye was purblind.

Mill first states Hume's doctrine in its bare nakedness : 'The Law of Causation . . . is but the familiar truth, that invariability of succession is found by observation to obtain between every fact in Nature and some fact that has preceded it.' It may be noted in passing that however familiar and however true this may be, it is certainly not found by observation, and Mill's study of Hume should have warned him not to make so absolute an assertion ; for Hume says very truly 'on the discovery of extraordinary phenomena, such as earthquakes, pestilence, and prodigies of every kind, they find themselves at a loss to assign a proper cause,' and there are still innumerable facts in nature which baffle all our attempts to discover their causes. However, Mill goes on : 'To certain facts, certain facts do, and, as we believe, will continue to succeed. The invariable antecedent is called the cause ; the invariable consequent, the effect.' He does not recognise that this statement differs very materially from the former. First he says that every fact has an invariable antecedent, and then he says that every fact has an invariable consequent, and he regards the two assertions as equivalent. In his next statement he goes back to his first position, and says : 'The universality of the law of causation consists in this, that every consequent is connected in this manner [invariably] with some particular antecedent, or set of antecedents.' In this he airily gives away Hume's whole position, and introduces a new and vitally important element, without in the least recognising that he is doing more than restating his previous doctrine. The antecedent now not only invariably precedes the consequent, but also is connected with it, a doctrine which Hume positively denies, and which, when introduced into what is virtually a restatement of Hume's doctrine, requires at least some justification or explanation ; but none is given.

As is well known, Reid demolished Hume's definition of causation as invariable succession by adducing the case of night and day. Night invariably follows day, and day invariably follows night, and yet neither is the cause of the other. Clearly,

some qualification and addition is necessary, and Mill, though he gives the expressions quoted above as complete and sufficient statements of the nature and relation of cause and effect, evidently recognises that some qualification and addition is required, and supplies one, in fact, he supplies a good many, not as successive approximations to a complete definition, not as tentative proposals to be discarded when found inappropriate, but all of them as final and complete definitions, which are immediately superseded by others, which are superseded in their turn.

It is very common, he says, when there are many antecedents (as if there were ever an effect that had not many antecedents, and he does not say invariable antecedents connected with the consequent, though presumably he means such antecedents) to single out only one of them under the denomination of cause, calling the others merely conditions. 'But though we may think proper to give the name of cause to that one condition, the fulfilment of which completes the tale, and brings about the effect without further delay; this condition has really no closer relation to the effect than any other of the conditions has.' This leads him to his fourth definition, different from all the rest. 'The cause, then, philosophically speaking, is the sum total of the conditions, positive and negative taken together; the whole of the contingences of every description, which being realised, the consequent invariably follows.'

Having given this final definition of what the cause is, philosophically speaking, he discusses it further, and finds that it won't do. He now finds it necessary 'to advert to a distinction which is of first-rate importance,' which, in spite of its first-rate importance, has been omitted from his previous definitions. Invariable sequence is not synonymous, he now finds, with causation, unless the sequence, besides being invariable, is also unconditional; and this he says immediately after he has defined the cause as 'philosophically speaking,' the sum total of the conditions. It is, therefore, philosophically speaking conditional, and speaking otherwise unconditional. This leads him to his fifth definition, according to which a cause is 'the antecedent, or the concurrence of antecedents, of a phenomenon, on which it is invariably and *unconditionally* consequent.' Still dissatisfied, as well he may be, he tries again, and gives a sixth definition, 'which confines the meaning of the word cause, to

the assemblage of positive conditions without the negative, and then, instead of unconditionally, we must say "subject to no other than negative conditions"'; and if this does not satisfy, he has 'no objection to define a cause, the assemblage of phenomena, which occurring, some other phenomenon invariably commences or has its origin.' So that after asserting in the most positive terms that invariable sequence is not causation unless the sequence, besides being invariable is also unconditional, he now drops unconditionalness, and goes back without a word of apology to invariable sequence.

It would be tedious and unprofitable to examine any further the mass of confusion and contradiction contained in Mill's exposition of causation, but lest it should be thought that I have at all exaggerated, I will set down here a series of extracts from his Logic.

He prefaces his discussion of causation with the following warning: 'The notion of cause being the root of the whole theory of Induction [it is not], it is indispensable that this idea should, at the very outset of our inquiry be, with the utmost practicable degree of precision, fixed and determined.' This he says, and more than two hundred pages later he is still altering his definition of cause; more than three hundred pages later he alters his definition of causation. This is how he fixes and determines his notion of cause with the utmost practicable degree of precision:—

'The Law of Causation . . . is but the familiar truth that invariability of succession is found by observation to obtain between every fact in Nature and some other fact which has preceded it.' I, 376.

'The invariable antecedent is termed the cause, the invariable consequent, the effect.' I, 377.

'If it [the fact] has begun to exist, it was preceded by some fact or facts with which it is invariably connected.' I, 377.

'The real Cause is the whole of those antecedents.' I, 378.

'All the conditions were equally indispensable to the production of the consequent; and the statement of the cause is incomplete unless in some shape or other we introduce them all.' I, 379. Condition is not defined.

'The cause, then, philosophically speaking, is 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.' I, 383. Contingency is not defined.

'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.' I, 391.

'That which will be followed by a given consequent when, and only when, some third circumstance also exists, is not the cause, even though no case should have occurred in which the phenomenon took place without it.' I, 392.

'Invariable sequence, therefore, is not synonymous with causation, unless the sequence, besides being invariable, is unconditional.' I, 392.

'We may define, therefore, the cause of a phenomenon, to be the antecedent, or concurrence of antecedents, on which it is invariably and *unconditionally* consequent'; or

'The antecedent, or the concurrence of antecedents, on which it is invariably and subject to no other than negative conditions consequent'; or

'The antecedent, or the concurrence of antecedents, in which it is invariably and whatever supposition we may make about things, consequent.' I, 392.

'The series of the earth's motions, therefore, though a case of sequence invariable within the limits of human experience, is not a case of causation.' I, 394.

'I have no objection to define a cause, the assemblage of phenomena, which occurring, some other phenomenon invariably commences, or has its origin.' I, 397.

'There is no Thing produced, no event happening in the known universe, which is not connected by an uniformity, or invariable sequence, with some one or more of the phenomena which preceded it.' I, 400.

'The state of the whole universe at any instant, we believe to be the consequence of its state at the preceding instant.' I, 400.

'The law of causation is, that change can only be produced by change.' I, 407.

'In this example we may go further, and say, it is not only the invariable antecedent but the cause.' I, 450.

'The *cause* of it, that is, the peculiar conjunction of agents from which it results.' I, 511.

'That which would not be followed by the effect unless something else had preceded, and which if that something else had preceded, would not have been required, is not the cause, however invariable the sequence may in fact be.' II, 37.

'Fresh causes or agencies.' II, 38.

'The uniformity in the succession of events, otherwise called the law of causation.' II, 108.

From these dicta we may extract the following definitions or descriptions of cause, and in repeating them I will put in italics the words which are discordant or incongruous with previous utterances.

A cause is:

(1) The invariable antecedent.

(2) The preceding fact with which the effect is invariably *connected.*

(3) *The whole* of the antecedents.

(4) All the *conditions.*

(5) The *sum total* of the conditions.

(6) The whole of the *contingencies.*

(7) The antecedent which not only always has been followed, but that always will be followed by the consequent; although

(8) That which always has been and always will be followed by the consequent is not necessarily the cause.

(9) The invariable *unconditional* antecedent.

(10) The antecedent on which the effect is invariably *and subject to no other than negative conditions* consequent.

(11) The antecedent on which the effect is invariably consequent *whatever suppositions we may make about other things.*

(12) *The assemblage of phenomena,* which occurring, some other phenomenon commences or has its origin.

(13) *The peculiar conjunction of agents* from which the consequence results.

(14) *An agency.*

Causation, or the Law of Causation, is:

(1) Invariability in succession.

(2) Invariable *and unconditional* sequence.

(3) *Uniformity* in the succession of events.

(4) *That change can only be produced by change.*

In addition to the discordances in these definitions, account must be taken of the following pairs of assertions:

'Causation is invariability of succession.'

'The series of the earth's motions, though a case of sequence invariable within the limits of human experience, is not a case of causation.'

'The cause is the invariable antecedent.' 'The invariable antecedent is the cause.'

'That which would not be followed by the effect unless something else had preceded, and which if that something else had preceded, would not have been required, is not the cause, however invariable the sequence may in fact be.'

'Causation is invariability of succession.'

'Invariability of sequence is not synonymous with causation unless the sequence, besides being invariable, is unconditional.'

The majority of writers since Mill have followed rather slavishly in his footsteps, but a few recent writers have struck out more independent courses, and some of these must be examined. I confine the examination to the writings of Mr. Welton, Prof. Karl Pearson, Mr. Bertrand Russell, and Dr. McTaggart.

Mr. Welton accepts Mill's doctrine that the cause is the sum of the conditions, though he prefers to call it the totality of the conditions, but he rejects altogether the time factor, or antecedence and consequence, which every previous writer on the subject considers a necessary ingredient in our concept of causation. 'The cause,' he says, 'is not dependent on time sequence. For if we analyse any case of causation we find that time sequence is not an essential aspect of it.' I am not so sure. *Gutta cavat lapidem.* The continual dropping of water wears away a stone, and surely this takes time. The ploughing, harrowing, and sowing of the ground are causes of the subsequent harvest, but the harvest is not simultaneous with these operations. It gradually matures for months, and not until months have elapsed is the effect produced. The administration of an excess of food causes a pig to grow fat, but the pig does not instantaneously explode into a state of obesity. Perhaps, however, in giving these examples I should be tripped up by the expression, 'essential aspect.' What an essential aspect may be I do not know, but whatever it is, I find it hard to reconcile Mr. Welton's assertion with his subsequent assertion that the fact to be accounted for is change. Change, he says, implies something which changes. So it does, but it implies

something else also. It implies duration. We speak of instantaneous changes, but in fact and in Nature there is no such thing. Change implies duration. It implies an antecedent state from which, and a subsequent state to which, the change takes place. If the fact to be accounted for is change, which Mr. Welton says it is, and which it is sometimes, then causation does imply sequence in time, and time sequence is an 'essential aspect' of it, if by an essential aspect of it Mr. Welton means a necessary factor in it.

But he has another reason for rejecting time sequence as a factor in causation. We cannot, he says, find the explanation of change in preceding change; for that would simply land us in infinite regress; by which he means that for each cause we must find a preceding cause, and so *ad infinitum*. I do not see the necessity. In following the chain of causes backward we can stop where we please, and we usually have a good reason for stopping at a certain point; but supposing that time sequence in causation does land us in infinite regress, why not? There is nothing inconsistent with our knowledge of the universe in supposing that the causes of any change go back to an infinity of past time. Infinite regress is no argument against the time element in causation. Mr. Welton might as well say that the explanation of night and day cannot be found in the rotation of the earth, for that would simply land us in a movable earth. No doubt it would, and what then?

Instead of sequence in time, Mr. Welton presents us with contiguity in space as the necessary element, or, as he calls it, the essential aspect, of causation; for, he says, it is only under the form of space that we can rationalise our experience of the influence of bodies on each other. I must confess I cannot fathom this cryptic reason. I do not know what the form of space is, nor do I know how to rationalise an experience; but if by essential Mr. Welton means necessary, and if by contiguity he means contact, or even nearness in space, of an acting body to a body acted on and consequently changing, then I deny altogether that contiguity is essential to causation. The instance that must at once occur to everyone is the action of an astronomical primary in causing the motion of its satellite to pursue a certain path. Mr. Welton sees this, and his way out of the difficulty is a very extraordinary one. 'How,' he

says, 'can we conceive a causal influence exerted on an object distant in space from the agent; as *e.g.* that of the sun on the planets? In reply to this it must be said that in one very true and important sense of its reality a body must be thought to be where its influence is felt: the power of exerting influence is one of its properties, and where, therefore, that power is felt there the agent truly *is* in this, the only applicable sense. Of course in another sense of its reality—the sense in which reality is identified with visible and tangible form and tangible resistance—the body may be absent, but then that aspect of its reality is, in this case, beside the mark.' If Mr. Welton succeeds in deceiving himself by thus juggling with the word reality, the abracadabra of the philosophy that is made in Germany, I know not whether he is more to be envied or pitied, but I am very sure that he will not deceive anyone else who has any appreciation of the meaning of words. He might as well say that the German Emperor is omnipresent throughout Central Europe, for that is where his influence is felt. He might as well say, when a drunken man gives his companion a black eye, that in a very true and important sense of its reality the drink is in the black eye, for that is where its influence is felt. Of course, in another sense of its reality the drink is absent from the eye, but then that aspect of its reality is beside the mark on the eye. Mr. Welton is, I am afraid, not so thoroughly Germanised as he tries to make out. No truly Germanised philosopher would spell the word Reality without the capital, which makes it so much more imposing. It will not, however, impose upon anyone who looks to the meaning of words.

Cause and effect, says Mr. Welton, are not successive, but simultaneous; and to prove this he instances the formation of water. 'The cause of the formation of water is the combination in definite proportions of hydrogen and oxygen, but this combination does not precede the formation of water, it *is* that formation.' Of course it is. He is juggling with words again. The formation of water is the same thing as the combination of the two gases. That is a truism. It is an identical expression. It is expressing the same thing in two different sets of words. But the combination of oxygen and hydrogen, which is the formation of water, is not the cause of that formation. The cause of the formation, or of the combination, is first the mixture

of the gases, and then the passage of a spark through them. And though the formation of water and the combination of the gases is simultaneous, if, that is to say, a process can be said to be simultaneous with itself, it is not simultaneous with the mixing of the gases, nor is it simultaneous with the passage of the spark. The mixing of the gases may precede the combination by days, months, or years; and though the combination follows very rapidly on the passage of the spark, they are not simultaneous. The combination begins in the neighbourhood of the spark, and spreads throughout the mixture, and this spreading takes time—a very short time, it is true—but it takes time. The passage of the spark is antecedent, the formation of water is consequent.

'So it is,' says Mr. Welton, 'in every other case.' I agree to this extent, that in every other case of change in which he makes out that the cause is simultaneous with the effect, either what he calls the cause is not the cause, or what he calls the effect is not the effect.

Mr. Welton continues thus: 'We, then, arrive at this. Cause and effect are not two but one.' So we advance from contiguity in space to simultaneity in time, and from simultaneity in time to identity! How a body, supposing, as Mr. Welton supposes, that a cause can be a body, can be contiguous in space to itself, I do not know. I suppose that is another aspect of its Reality. The question that arises in my mind is whether the body is beside itself, or whether the person who makes the assertion is beside himself.

A dropping of ink, says Mr. Welton, upon paper causes a blot, but the blot is there as soon as the contact of ink and paper is made: it *is* that contact. But on his own showing it ought not to be. What he says is that cause and effect are one, but the one he takes is neither cause nor effect. The cause is the dropping of the ink: the effect is the blot. If cause and effect are one, the blot ought to be the dropping of the ink; but Mr. Welton says it is not. It is the contact of the ink with the paper. Such confusion and self-contradiction could scarcely be found outside a book on logic. By a parity of reasoning, when a man gets into bed, the getting into bed *is* the man, or, if we take Mr. Welton's second alternative, which he does not recognise as an alternative, but asserts as the same thing, then the contact of the man with his bed *is* the man. It

ought not to be necessary to clear up such a very simple matter, but seemingly it is necessary to point out that the blot is not the contact of the ink with the paper: the blot is the layer of ink in contact with the paper. And this layer of ink on the paper does not appear simultaneously with the dropping of the ink, it follows the dropping of the ink. The blot is not on the paper until the dropping is arrested by the paper, is over and done.

The fact to be accounted for, says Mr. Welton, is change; and the first example of causation that he adduces is that the weight of the atmosphere is the cause of the height of the mercury in the barometer. But the height of the mercury in the barometer is not a change. Quite the contrary. The fact to be accounted for in this case is not change, but the absence of change. The fact to be accounted for is that the mercury in the barometer does not sink. Perhaps the explanation is to be found in another aspect of Reality, and it may be that in a very true and important sense of its reality the absence of change is the same as change. It is perhaps a Reality of Identity, or an Identity in Reality, such as Mr. Bradley and Dr. Bosanquet delight in.

'We, then, arrive at this,' says Mr. Welton, 'cause and effect are not two, but one. That they are inseparable is indeed recognised by the relativity of the terms themselves. A cause without an effect, or an effect without a cause, is a contradiction in terms and unthinkable.' So it is, but it is not more unthinkable than a cause which is identical with its effect, or an effect which is identical with its cause. 'But we must go further,' says Mr. Welton, 'and say that in *content* they are absolutely identical. It is only in *form* that they can be distinguished.' Here is the hoof—it is not a cloven hoof, but a soliped—of Germanism again. Content is another of its shibboleths or abracadabras. Content and form, reality and identity, are its stock-in-trade, they are the four hoofs on which it goes. Lug them in by head and shoulders, use them in any sense or nonsense that you please, mix them up anyhow, and you will pass for an up-to-date philosopher. Mr. Welton confines his illustrations to cause and effect, but it seems a pity so to limit the application of such a fertile philosophical principle, and I rejoice in being able to extend it to other pairs of relatives. Parent and offspring are not two but one. That they are

inseparable is indeed recognised by the very relativity of the terms themselves. A parent without offspring, or an offspring without a parent, is a contradiction in terms, and unthinkable. But we must go further, and say that in *content* they are absolutely identical. If is only in *form* that they can be distinguished. And the same is true of higher and lower, outside and inside, murderer and victim, robber and robbed. In *content* they are absolutely identical. It is only in *form* that they can be distinguished. How charming is divine philosophy!

If cause and effect are not two, but one; if they are absolutely identical (I leave out content, for I do not know what the content of a cause is, or how it can have any content. A cause is not a box or a bag); if, I say, they are absolutely identical, how idle it is to seek for causes or for effects! The main occupation of the whole human race, ever since it attained the status of humanity, is founded on a chimæra. What is the cause of the alternation of day and night? That silly man, Copernicus, thought he had discovered it. What is the cause of the spout of blood from a severed artery? The stupid Harvey thought he had discovered it. What is the cause of the suppuration of wounds, of pyæmia, of septicæmia? The foolish Lister pretended that he had discovered it. What is the cause of malarial fever? of earthquakes? of Brown's success in growing roses? of Jones' failure to secure the hand of Miss Robinson? What is the cause of mimicry in animals? What makes the days warmer in summer than in winter?

> What makes the price of corn and Luddites rise?
> What fills the butchers' shops with large blue flies?

And finally, what is the cause of philosophers writing nonsense? Nothing could be clearer. Nothing could be plainer or more manifest. The chief, the most important, the most absorbing occupation of mankind has always been the search for causes. What folly! The causes were under their noses all the time. They saw the effects, and the effects are absolutely identical with the causes.

Another recent writer on the subject is Prof. Karl Pearson, whose *Grammar of Science* has achieved a popularity remarkable for a work of the kind. It is disfigured by much uncouth phraseology, and by the Papal infallibility that the author claims for his own doctrines, which he attributes to a personified

science. On nearly every page he speaks of 'a routine of experience,' a 'routine of sense impressions,' a 'routine of perceptions.' These are his fundamental terms, but he never defines them, and we are left to conjecture what he means by them. Far on in the book he speaks of the routine of perceptions as equivalent to 'the uniform order of phenomena,' and 'the uniformity with which sequences of perception are repeated'; but whether this is another name for causation, or whether it is merely our old familiar friend the Uniformity of Nature, we are left in doubt. Even if he does mean the Uniformity of Nature, we are no better off, for no two philosophers agree on what is to be meant by the Uniformity of Nature. The only thing on which they agree, and when they do agree their unanimity is wonderful, is that Nature is not uniform.

Much of the authority that Prof. Pearson's *Grammar of Science* has unquestionably achieved is due to his habit of attributing his own opinions to a personified science, a trick that enables him to pose as infallible, while adroitly avoiding the appearance of arrogance that such a pose carries with it. When he says that for science cause is meaningless, he means that Prof. Pearson does not understand the meaning of it; when he says that science can in no case demonstrate this or that, he means that Prof. Pearson cannot demonstrate it; when he says that science can find no element of enforcement in causation, he means that Prof. Pearson is too blind to see the element of enforcement; and so on. This is an adroit method of imposing on the gullibility of his readers, for who, in these 'scientific' days, would have the temerity to question the pronouncements of science? But I must confess to some surprise that it has been so successful. I should have thought that it might have occurred to some one that science in this sense is only a name for a body of opinion; a body of fluctuating opinion, varying from time to time and from person to person, so that what is science to-day was heresy yesterday, and will be superstition to-morrow; what is science to one is stupidity to another, and falsehood to a third. What is science to Prof. Pearson, for instance, is nonsense to me.

Professor Pearson belongs to the school of Hume and Mill, and with them denies that there is any 'enforcement' of an effect by its cause, or any necessary connection between them. The cause is merely the antecedent, the effect merely the sub-

sequent. The one happens to follow the other, but there is no reason or necessity why it should do so: they are in no way connected; but when we see repeated instances of the same succession of events, we deludedly jump to the conclusion that the predecessor is the cause of the successor. Almost as soon as it was stated, Reid blew this doctrine sky high by adducing the instance of night and day. Day always precedes night, and night always follows day, but no one supposes that day is the cause of night or that night is the effect of day. And why not? Manifestly because they are merely antecedent and subsequent; because there is no power in day to produce night; because there is no enforcement of night by day. Prof. Pearson bases his repudiation of enforcement on practically the same ground as Hume does, *viz.*, that our notion of force is purely imaginary, and has no counterpart in the world outside our imagination. In this he confuses, as Hume does, imaginary with conceptual. Our concept of force, like all our concepts of primitive things, such as motion, resistance, extension, duration, and so forth, is a generalisation from many experiences of individual instances; and if we are to discard the one because it is conceptual, that is to say, a generalisation, then we must discard the rest for the same reason. In that case our minds are left blank, and reasoning is impossible for want of pabulum. In contradiction to this doctrine it is enough to appeal to universal experience. By cause we do not mean mere antecedence, nor by effect do we mean mere succession. If we did, we should accept day as the cause of night, and night as the effect of day. If we did, the old and notorious fallacy, *post hoc, ergo propter hoc*, would be no fallacy: it would be an unassailable truth; yet the same logicians who declare in their Chapters on Causation and Induction that causation is nothing but sequence, declare in their Chapter on Fallacies that it is fallacious to argue from *post hoc* to *propter hoc*. But no inconsistency or self-contradiction in a doctrine ever yet deterred logicians from teaching it; and no doubt they will continue to teach this self-contradiction along with the rest, until the whole silly pseudo-science is swept away, and goes to join Judicial Astrology, Phrenology, and Humoral Pathology upon the rubbish heap. In forming our idea of cause and of causation, the enforcement of the effect by the cause enters as an inseparable and necessary element into the notion, and if that

element is extruded, that which appeared to be a cause is a cause no longer. 'The necessity,' says Prof. Pearson, 'thus lies in the nature of the thinking being, and not in the perceptions themselves; thus it is conceivably a product of the perceptive faculty.' How it can be a product of the perceptive faculty and not be a percept or perceived; how that can be perceived which is purely imaginary, and has no sensory impression as a basis or provocation to perception, Prof. Pearson does not inform us. His psychology is as hazy as his notion of causation.

However, Prof. Pearson goes with the crowd, and quotes as from Mill the definition that causation is uniform antecedence; and this definition, says Prof. Pearson, is perfectly in accord with scientific concept—that is, with Prof. Pearson's concept. It may be a good definition, but when Prof. Pearson says it is John Stuart Mill's definition, he is mistaken. Among all of Mill's many definitions of cause and causation this one is not to be found. In this instance 'science' is at fault.

'For science,' that is, for Prof. Pearson, 'cause, as originating or enforcing a particular sequence of perceptions, is meaningless—we have no experience of anything which originates or enforces something else.' The most obvious answer to this is that it is not true. It contradicts the whole experience of the whole human race. Every time we move a thing from one place to another we demonstrate the falsity of the assertion. The word 'originating' is used equivocally. A change in anything is originated when the change begins; that is, when the thing begins to change. But it seems from the context that Prof. Pearson denies that change—the sequence of perceptions, as he calls it—is then originated, because it can always be traced to previous change, and therefore in this sense it is not 'originated.' This is an obvious confusion. The particular change in the thing changing is none the less originated, although it may be the effect of some previous change in something else. What Prof. Pearson means is that the total sequence of changes never originates, or, as I should say, begins. It is the same difficulty that Mr. Welton calls infinite regress, and which he takes as a conclusive argument against the time element in causation, while Prof. Pearson takes it, with equal inconsequence, as an argument against causation itself. In so far as it is an argument at all,

it is as much an argument against the existence of change as against the existence of causation, or of a time element in causation; but it is no argument against either. Grant that change generally, apart from individual changes, never begins, but can be traced back until it is lost in the infinity of past time, still that is no argument against causation. It merely shows that every cause has itself a cause; and so far from abolishing causation, it renders causation more than ever certain, and necessary, and universal. But I need not labour the argument, for Prof. Pearson has himself refuted it. On p. 9 he says, 'the man who has accustomed himself to marshal facts, to examine their complex mutual relations, and predict upon the result of this examination inevitable sequences.' Here he is evidently referring to himself, and if a sequence is inevitable, it is enforced; it is necessary; it is not the mere casual sequence that he says causation is. To say that a sequence is inevitable, and to say that it is enforced, is to say the same thing in different words.

However, Prof. Pearson sees what Hume did not appear to see, and what Mill certainly did not see, that if we take away from causation the element of enforcement, or of power in the cause to produce the effect, causation vanishes with it, and the only logical attitude is to deny altogether that there is any such thing as causation. To this necessary result of their teaching, Hume and Mill were blind; but Prof. Pearson sees it, and Mr. Bertrand Russell sees it, though they both see it only in transitory and occasional glimpses, and for the most part lose sight of it. They both deny that causation exists, and they both define what it is—not what it means, but what it is. Prof. Pearson asserts that the 'category of cause and effect' is a fetish; that the law of causation is a figment; that no experience demonstrates causation; that for science, that is to say, for him, cause is meaningless; and he asks whether causation is anything but a conceptual limit to experience, a cryptic question that, for my own part, I am unable to answer until I know what it means. Having said this, he says he will show how antecedents are true scientific causes; he states the law (which, by the way, is nonsense, as he himself in another place shows, though he endorses the law) that the same set of causes is always accompanied by the same effects; he says that no phenomenon has only one cause; and he even goes so far

as to say we fail to comprehend a world to which the conception of cause and effect would not apply. How he reconciles these contradictions in his own mind I shall not speculate, but I am very sure that he will not succeed in reconciling them in the mind of anyone else, except, perhaps, in the minds of Mr. Bradley and his followers, or in the mind of a German of the school of Hegel.

The most popular doctrine of Prof. Pearson's is his distinction between *how* and *why*, a distinction which is either the cause, or the chief effect, of his theory of causation. He denies that we can ever discover *why* a thing happens, or explain it; and limits our powers to saying *how* it happens, or describing it. In this he is demonstrably wrong. It is often as impossible to describe how things happen as to explain why they happen: it is often as easy to explain why they happen as to describe how they happen. The fact is that both *how* and *why* are equivocal words, having more than one meaning; but whichever meaning we take, what I have said is true. *How* may mean in what manner, or it may mean by what means. *Why* may mean for what purpose, or it may mean in obedience to what law, in conformity with what rule. In any of the four cases the answer may be easy, or difficult, or impossible; and as to either *how* or *why*, we may be able to answer one meaning and not the other. If, for instance, we ask how, in the sense of by what means, gravity acts, we cannot answer. It is impossible to imagine by what means a body can attract another through an immeasurab y great distance. It is only when we ask how, in the sense of in what manner, gravity acts that we are able to answer that it acts inversely as the square of the distance. If we ask why, in the sense of with what purpose, the sap circulates in the tree, we have no difficulty in explaining that it is that the sap may be aerated, the tree nourished, its life maintained, and its growth increased. It is only when we ask why, in the sense of in conformity with what law, the sap circulates, that we are unable to answer. We do not know whether it is capillary attraction or what it is.

A good example of the manner in which Prof. Pearson poses as a superior being is the advice he gives to his readers, to analyse what is meant by such statements as that the law of gravitation *causes* bodies to fall to the earth. The law, he says, really describes how bodies do fall. Of course

it does; but before Prof. Pearson gave this advice to his readers, he should have shown some evidence that some one besides himself had ever said such a silly thing. As far as I know, no one has ever pretended that the *law* of gravitation causes bodies to fall to the earth; but if anyone should say that the *fact* of gravitation—the fact that they attract each other—causes bodies to fall to the earth, he would say what is exactly and punctually true. The law of gravitation describes *how* bodies fall: the fact of gravitation explains *why* they fall; and the explanation is as good and as valid as the description. As far as I know, Prof. Pearson never answers the actual arguments of real antagonists; and if he prefers the easier task of answering silly arguments that he puts into the mouth of an imaginary antagonist, then, whatever we may think of his courage and sincerity, we cannot question his wisdom.

Mr. Bertrand Russell follows Professor Pearson in denying the existence of causes. He says there are no such things. He wants the word abolished, and regards the law of causation, or, as he calls it, of causality, as a relic of a bygone age. To prove this contention he selects from Baldwin's *Dictionary* the definitions given therein of Causality, of the notion of Cause and Effect, and so forth; he takes one of Mill's definitions of Causation, and an expression of Bergson's, and analyses them all destructively.

All these expressions assume, and Mr. Russell repeatedly in his own expressions assumes, that repetition of instances is necessary before we can identify causation, and I think it is not too much to say that he regards recurrence or repetition as a necessary element, either in causation itself, or in our idea of causation. The definitions that he quotes all countenance this supposition. They run: *Whenever* the cause ceases to exist; *whenever* the effect comes into existence; the Law of Causation is *invariability* of succession; the *same causes* produce the *same effects*; a certain phenomenon will not fail to *recur*; and so on; and he himself says that an 'event' in the statement of the law is obviously intended to be something that is likely to recur; and he makes this the basis of his criticism. Criticism directed against such notions of causation, however destructive of them it may be, is not relevant against a definition of cause or of causation into which the element of repetition or recurrence does not enter. To me, repetition or

recurrence is not a necessary ingredient, either of causation itself, or of my idea of causation, and therefore against my definition Mr. Russell's attack is not directed ; but even against the definitions that he does attack, erroneous as I believe them to be, his criticisms do not appear to me to be destructive, or even damaging.

Thus he confutes the succession in time of cause and effect, or that antecedence and consequence on which Mill and his school lay so much stress : 'No two instants are contiguous, since the time series is compact.' I cannot see that the conclusion follows from the premiss. It seems to me that the more compact the time series, the more closely contiguous must be its instants. If Mr. Russell means that time is continuous, and not made up of instants separated from one another by intervals that are not time, or in which there is no time, I should agree with him ; but it is only in such an interrupted time series that the instants would not be contiguous. An instant, like an hour or a day, is a portion of time arbitrarily divided by an imaginary limit from that which precedes and that which follows, with both of which it is continuous or contiguous. But if Mr. Russell is right, and no two instants are contiguous, and if serial contiguity in time between cause and effect is necessary to causation, then this settles the question : then causation is impossible, and Mr. Russell's further argument is redundant, supererogatory, and unnecessary. But he does not think so, for he goes on : 'Hence either the cause or the effect or both must, if the definition [Baldwin's definition of Cause and Effect] is correct, endure for a finite time . . .' I agree that both the cause and the effect must endure for a finite time, though I do not see how this follows from the supposition that no two instants of time are contiguous. 'But then we are faced with a dilemma : if the cause is a process involving change within itself, we shall require (if causality is universal) causal relations between its earlier and later parts ; moreover, it would seem that only the later parts can be relevant to the effect, since the earlier parts are not contiguous to the effect. Thus we shall be led to diminish the duration of the cause without limit, and however much we may diminish it, there will still remain an earlier part which might be altered without altering the effect, so that the true cause, as defined, will not have been reached.' This may

or may not be an effective criticism of a definition of cause and effect that defines them as contiguous in time, but to me it is too much like the old problem of Achilles and the tortoise to be convincing. Zeno proved quite satisfactorily that Achilles could never overtake the tortoise—only he did; and Mr. Russell proves less satisfactorily that there is no such thing as causation, but yet he, in common with the rest of us, always acts on the supposition that there is such a thing, and, so acting, he never meets with experience that contradicts the supposition; and this is for us the conclusive and inescapable proof, first that the supposition is true, and second that Mr. Russell is convinced that it is true.

He goes on to show that if cause and effect are not contiguous in time, then there must be an interval between them; and 'since there are no infinitesimal time intervals' this lapse of time must be finite. But if there is a finite interval of time between cause and effect, something may happen in that interval to prevent the effect following the cause. It is all very pretty word spinning, and for all I know it may apply to the kind of 'causality' that occurs in the moon, or in a universe of one dimension, but it has no relation whatever to causation as it is known on this earth. Mr. Russell assumes that effect follows cause in the sense of what carpenters call a butt joint, in the sense that the effect does not begin until the cause has ceased to act. That may be what happens in some other universe, but it is not what happens here. What happens here is quite different, as Mr. Russell might have known if he had considered an actual case of causation instead of speculating with $e_1, e_2, \ldots e_n$, and $t_1, t_2, \ldots t_n$, and τ. When, for instance, a man pushes a trolley, he causes it to move. The pushing is the cause, the movement is the effect. But the effect is not postponed until the cause has ceased to act. The effect does not come suddenly into existence at an instant contiguous to the cessation of the cause. The effect begins as soon, or almost as soon, as the cause begins; thereafter, cause and effect, the pushing and the movement, accompany one another, and proceed contemporaneously for a certain time; and at length, when the cause ceases, the effect ceases. Cause is contiguous to effect in this case, not end to end, but side by side for the greater portion of their duration. The joint is not a butt joint but a fish joint;

and all Mr. Bertrand Russell's pretty word spinning goes for nothing.

His own statement of 'causality,' cannot, he says, be put accurately in non-mathematical language; the nearest approach would be as follows: 'There is a constant relation between the state of the universe at any instant, and the rate of change at which any part of the universe is changing at that instant, such that the rate of change in the rate of change is determinate when the state of the universe is given.' It is with diffidence that I comment on this mysterious formula, but it seems to me clear that if anything can be discovered by its means, it is not the cause of a change, but the rate at which a change takes place, or rather the rate of change in a rate of change; which may be a desirable thing to know, but by no perversity of ingenuity can be twisted or tortured into a cause. But suppose the impossible to be true, and suppose that no cause of anything can be discovered or assigned unless and until the state of the whole universe is known; then it is clear that no cause of anything ever has been discovered or ever can be discovered, for we can never know the state of the whole universe. But in fact many causes of many things are known, and more are being discovered every day. I know, for instance, that pushing a trolley is a cause of the movement of that trolley. I know that reading such disquisitions as Mr. Welton's, Professor Pearson's, and Mr. Bertrand Russell's, are among the causes of the estimate I have formed of philosophers. Mr. Bertrand Russell may be a great mathematician, Professor Pearson a great statistician, and Mr. Welton a great authority on education; but there is a certain proverb about the cobbler and his last that I would commend to the notice of all three. It may be that I must determine the state of this earth, and of everything upon it, in it, and around it; of all its continents, seas, rivers, lakes, and islands; of all its minerals, from the coal to the diamond; of all its vegetables, from the bacillus to the oak and the orchid; of all its animals, from the spirochæte to the whale; of all its human inhabitants, from the Bushman to Mr. Russell himself; and beyond this, of all the solar system, with its planets, planetary streams, satellites, and comets; of all the stars which we call fixed, with their temperatures, positions, sizes, movements, and chemical composition—it may be that I must know all these things with accuracy before I can

discover what it is that is tickling my nose ; but for my own part I don't believe it. In fact, I do not know all these things, I know only some of them, and I have already discovered the cause. No doubt Mr. Bertrand Russell knows best, but my own private belief is that though mathematics cannot err, mathematicians can.

The last view of causation that I shall examine is Dr. McTaggart's, which I select because it is the latest to be published, having appeared only last July. Like Mr. Russell, he calls it causality, which, to be sure, is a more imposing term ; but sometimes he fails to maintain the philosophical nomenclature, and drops back into common causation. For thorough mystification, and for the most extreme departure from plain meaning and common sense, Dr. McTaggart runs Mr. Bertrand Russell very hard. According to Dr. McTaggart, 'causation is a relation of implication between existent realities—or to put it more precisely, between existent substances.' This does not on the face of it afford us much help in understanding what causation is, but unlike most philosophers, Dr. McTaggart defines his terms, and for this one cannot be sufficiently grateful to him, not only on general grounds, but also for the surprising meanings that he shows lurk unsuspected in the most ordinary terms. A substance, for instance, according to Dr. McTaggart, is anything that can have qualities and relations ; so that, for instance, the battle of Waterloo and a flash of lightning are substances in the McTaggartian sense. This is a bit startling, but definitions are so rare in philosophy that we must be thankful for any we can get, even if they leave us more mystified than before. The battle of Waterloo is presumably not only a substance but also an existing substance in the McTaggartian world, though to the rest of us it ceased to exist a hundred years ago. Causation, then, is a relation of implication between such existing substances as the battle of Waterloo and a flash of lightning ; but what is a relation of implication? Here again Dr. McTaggart comes to the rescue with a definition. A relation of implication is a relation between two propositions, P and Q, such that P implies Q, when, if I know P to be true, I am justified by that alone in asserting that Q is true, and, if I know Q to be false, I am justified by that alone in asserting P to be false.

So far, so good, but still we are a long way from attaining a clear idea of causation ; but Dr. McTaggart is not done yet.

'Strictly speaking,' he says, 'implication is a relation between propositions or truths [is a proposition, then, necessarily true?] and not between events. But it is convenient to extend our use of it, so as to say that if one proposition implies another, then the event asserted in the first implies the event asserted in the second [but how if neither of them asserts an event?]. It is in this sense that the cause implies the effect'—causes it, in fact. The jump from propositions to events is a bit startling to those who are not accustomed to the proper meaning of realities and substances, but interpreting these expressions to the best of my ability, I gather that when we say the cause implies the effect, we mean that if the cause is true the effect is true, and if the effect is false the cause is false. But what on earth is the meaning of a cause or an effect being true or false? It does not appear that by a true cause Dr. McTaggart means the *causa vera* of the Schools, but what he does mean I cannot conjecture; and supposing this difficulty to be cleared up, what is the meaning of a false effect? Is it an effect that never happens? or is it an effect that is wrongly attributed to a certain cause? or is it something else? It is to be regretted that Dr. McTaggart has not supplemented his definitions with others, explaining the meaning of these terms. In this difficulty the only practicable expedient is to clothe the expression in circumstances—to apply the general rule to an individual case.

I take, therefore, two propositions, *Brutus killed Cæsar*, and *Brutus and Cæsar were contemporaries*, which stand in a relation of implication; for if P, or Brutus killed Cæsar, is true, then we are justified by that alone in asserting the truth of Q, that they were contemporaries; and if Q, or Brutus and Cæsar were contemporaries, is false, then we are justified by that alone in asserting the falsity of P, that Brutus killed Cæsar. This specimen fulfils all Dr. McTaggart's conditions. The relation is undoubtedly a relation of implication; and the killing of Cæsar by Brutus is a substance, for it can have qualities, such as treachery, unexpectedness, rapidity, and so forth. It does not seem to me to be an existing substance, it is true, but it is as much an existing substance as the battle of Waterloo. The contemporaneousness of Brutus and Cæsar is a relation, and therefore this also is a substance, and to the same extent as the other is an existing substance. All the conditions being

satisfied, we may therefore predicate a relation of causation between these two existing substances; but now our difficulties begin, for I cannot understand whether the fact that Brutus killed Cæsar caused them to live at the same time, or whether the fact that they were contemporaries caused Brutus to kill Cæsar. If the latter, why did not all his other contemporaries kill Cæsar? and why did not Cæsar kill Brutus? If the former, what caused Brutus and Cæsar to have so many other contemporaries? I have puzzled over these problems till my brain is almost turned, and I am no nearer a solution, and am obliged to give them up. I doubt whether anyone but Dr. McTaggart could solve them; and a method which is useless in the hands of everyone but its inventor is never likely to become popular.

Dr. McTaggart arrives at certain other conclusions that are interesting. He decides that there is no reason to believe 'that a cause exerts an activity or an effect.' What is meant by a cause exerting an effect I do not know, and another definition would be useful here; but if Dr. McTaggart means that a cause does not produce an effect, then I respectfully submit that it is not a cause. Moreover, if a cause does not exert an activity, it is only because it *is* an activity, or more properly an action. Cause and activity can no more be divorced than heat and motion, or solidity and resistance. Dr. McTaggart decides that cause and effect are not identical, a discovery that will not, I think, startle anyone but Mr. Welton; that the effect is not necessarily subsequent to the cause, and, indeed, he is not quite sure that the effect may not sometimes come first, and the cause follow after it; and at last he declares, in despair it seems to me, that though cause and effect are not identical, yet there is no means of knowing which is which, or at any rate, there is no clear distinction between them; and therefore, though we may speak of causal relations as existing between two terms, yet we ought not to speak of one of those terms as cause, and of the other as effect. I think we may legitimately complain that Dr. McTaggart does not tell us what we ought to call them. Ought we to call them both X, or the one X and the other Y? Ought we to call the one beef, and the other Yorkshire pudding? Or ought we to call the one petticoat and the other trousers? Dr. McTaggart gives us no guidance, and the reader must choose for himself.

The lecture in which Dr. McTaggart expounded these views was delivered at Newnham College, presumably to an audience of young women, and I trust he developed to them his views of the impropriety of naming the related terms when describing relations. He convinced them, I trust, that it is convenient to speak of the relation of marriage, but inconvenient (and perhaps improper), to speak of bride and bridegroom, or of husband and wife; that it is convenient to speak of parentage, but not of parents or of children; that it is convenient to speak of the relation of cousinhood, but that they should never allow themselves to use such expressions as Harry or Mary.

In concluding this survey of certain theories of causation, I beg to assure the reader that they are stated with accuracy, in the *ipsissima verba* of their authors. They are not garbled, altered, or modified in any way. Everything material has been stated, and nothing has been mis-stated. They are not the theories of Laputa, nor are they the ravings of Bedlam. They are not jokes, nor are they intended for caricatures. They are the serious attempts of philosophers of position and repute to solve a simple problem that every ploughman and artizan, though he may not be able to put his solution into words, has solved in practice for ages. Carlyle, in his genial way, characterised a certain philosophy as pig-philosophy. I should qualify the philosophers' treatment of causation with the name of another domestic animal, unlike a pig in that its hoofs are not cloven, nor its long ears drooping.

My view is that when we common people who are not philosophers speak of causation, and, as we do in spite of Dr. McTaggart's warning, of cause and of effect, we attach to these words very positive and downright meanings. We feel and know that in seeking for causes, in noting effects, in trying to identify causation, endeavours that occupy the greater part of our lives, we are not pursuing an *ignis fatuus*, but we are doing that without which it is impossible for men to live profitably, nay, it is impossible for them to live at all. If we have no very clear notion of what we mean by cause, effect, and causation, this want of precision, which is largely due to the fog in which they have been enveloped by philosophers, does not interfere with our practical pursuit of them. If the plain man, immersed in practical affairs, cannot precisely define what he means by these terms, neither can he define precisely the

meaning of capital, of labour, of rent, of interest, of life, of death, of disease, or of hundreds of other terms that he uses in his daily work, and that represent things of the utmost moment to his welfare, his happiness, and his life. But because he cannot define them, is he therefore to say that the things they stand for have no existence? that they are empty words, that represent nothing outside his own misguided imagination? This is the conclusion to which philosophers are driven by their inability to define cause and effect. On the same ground, and for the same reason, they should deny the existence of life and death. This is the result of living in the moon, and ignoring all the efforts of the toiling millions of mankind. The only way to discover the meaning of cause and effect is—to find out what men mean by them; and we shall not do this by word-spinning; by pretending a difference between connection and conjunction; by denying the existence of force; by contradicting ourselves twenty times over; by calling sequence simultaneity, and simultaneity identity; by posing oracularly as embodied science; by ingenious puzzles about the divisibility or indivisibility of time; or by defining that which is easy to understand by that which is impossible to understand. No. To find the meaning of cause and effect, and of cognate terms, we must come out of the moon, and go, not merely into the laboratory and the observatory, but into the home, the kitchen, the workshop, the factory, the garden, the field, and all the busy haunts in which men and women are all day long seeking causes, studying effects, and watching the course of causation.

Summary.

Hume's denial that force or power exists, and that there is any connection between cause and effect, is based on faulty reasoning, and in the light of modern psychology cannot be sustained. He himself so defines causation as to assert a necessary connection between cause and effect.

Mill's treatment of the subject is confused, wavering and contradictory. He defines cause and causation many times over, and never adheres to one definition. Generally, he follows Hume in identifying causation with invariable antecedence and sequence, but he does not adhere to this, nor to any, opinion.

Mr. Welton denies that antecedence or sequence, or any time

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element, enters into causation. In place of the time element he asserts that contiguity in space is necessary to causation. From this he argues that cause and effect are not in sequence, but are simultaneous; and at length decides that they are identical. His reasoning is inconsequent, and his conclusions are opposed to universal experience and to common sense.

Professor Pearson follows Hume and Mill in denying any enforcement of the effect by the cause, and in regarding causation as invariable sequence. He also denies the occurrence of causation, and says it is meaningless; nevertheless, he quotes with approval the law of causation, and asserts that some sequences are inevitable. His treatment of the subject is as self-contradictory as that of Hume and Mill.

Mr. Bertrand Russell, like Prof. Pearson, denies the existence of causation, and like him formulates a law of causation, which is not a law of causation. It is so expressed as to require, before we can determine what Mr. Russell calls the cause, which is in fact not the cause, of anything, a knowledge of the whole universe.

Dr. McTaggart defines causation as a relation of implication between existing substances. Application of the definition to a test case shows that the definition is absurd, and affords no guidance in practice.*

In conclusion, it is suggested that the inability of philosophers to define causation in consistent and intelligible terms argues, not that causation is imaginary, but that philosophers are incompetent.

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* Nevertheless, a leader of the Germanised school of philosophers refers to Dr. McTaggart's essay in the following terms: "The greater part of what he says possesses, as one would expect from him, an almost convincing lucidity and vraisemblance." Lucidity and vraisemblance! Well, well! And convincing! Heavens!

CHAPTER II.

EFFECT, REASON, RESULT, CAUSE.

THE subject we are about to examine is the relation of causation, and a relation comprises three things—the two terms, and the link that relates them, and unites them in a relation. The link is usually called a relation, which thus becomes an ambiguous term, standing both for the link, and for the triple whole of term—link—term. I have therefore, in my New Logic, called the link the ratio. Mr. Bertrand Russell, in a recent publication, calls it the relating relation, which is possibly a better term, but is at any rate longer. The terms of the relation we are about to examine are Cause and Effect, and the ratio or link which binds them together and unites them in a relation is Causation or Effectuation, according to the point of view from which we regard it. It will be convenient to begin our examination with the terms, and we may select for this purpose either term we please. I shall begin with effect.

The first thing, then, to settle is what is an effect? What do we mean, what do we think of, what have we in our minds, when we use the term effect? I think it is indisputable that the idea of effect is inseparably connected with the idea of change. Changes may be contemplated in and by themselves, as changes and no more; and this is how we contemplate changes to which we are well accustomed, such as the change from day to night, and from night to day, the change from rain to sunshine, and from sunshine to rain, the changes in the face of the sky, the growth of herbage, the change from heat to cold and from cold to heat, and all the customary changes of Nature. These changes we may, and usually do, contemplate merely as changes, without feeling any compulsion or need to regard them as effects also, or to look behind them for their causes. But then these changes are, in a sense, not changes *to us*. They are parts of a routine, a changing routine, but a routine whose changes are customary, and part of the routine; a routine that, as a routine, does not change, or changes but little. In such changes the change to us is minimised, and the greater change would be if

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the regular routine should cease to change. The changes that are changes to us, that impress us as changes, are not the regular customary changes of the routine, but the breaks in the routine. But any change that impresses us as change, any break in our customary routine of changes, especially if it is rapid, and more especially if it is sudden, carries the mind irresistibly to the notion of cause, and impresses us as an effect. In such cases change is identified with effect, or, if not identified, is inevitably associated with effect. It is true that in contemplation we can separate them. We can contemplate a change either as change pure and simple, or as effect; but though separable in contemplation, in occurrence they are inseparable. Just so we may contemplate gold without taking into account its specific gravity, or we may contemplate it with reference to its specific gravity; but whether we choose so to contemplate it or not, we know that its specific gravity is inseparable from it. Whether we regard a change as simply a change, or whether we regard it also as an effect, or whether we regard it primarily as an effect, depends on the way we choose to contemplate it. How close is the association between change and effect is conspicuously displayed in the case of an unaccustomed noise. When we hear a noise, especially a sudden and loud noise, to which we are unaccustomed, the natural and inevitable reaction is What's that! And in putting to ourselves this question, we do not mean, as the form of the question seems to imply, What is the nature of that noise? That we already know. Our meaning is What is the cause of that noise? Instantly and inevitably the mind passes from change to cause, and regards the change as an effect; and so it is with every change to which we are unaccustomed, that is, with every change that impresses us as change.

On the other hand, we do not, except in special cases that will be examined directly—we do not seek for a cause for things remaining unchanged, or regard want of change as an effect. If, upon waking in the morning, or on entering a room, we find the position of the furniture and all the other objects the same as when we last saw them, we do not look upon their unchanged position as the effect of anything, or seek for a cause for it. When we come home after an absence, and find the house, the trees, the bushes, the lake, and the distant hills, all as we left them, we do not associate this want of change

with causation, nor do we regard it as an effect. It needs no accounting for, no attribution of cause.

This is the general rule. Every change may be contemplated as an effect, and will be so contemplated in proportion as it is unusual, for unusualness is what logicians would call the essence of change; that is to say, it is the element in change that attracts our attention, and impresses us. It is what to us constitutes change. A change that happens continually soon ceases to be contemplated as change. It becomes to us a continuity, and the change to us is when it stops—when the clack of the mill ceases, when the roar of the streets subsides, when the train arrives at the terminus. But if we choose so to regard it, every change is an effect.

It does not follow, however, that every effect is a change. As a rule, no cause is assumed for the want of change, or for things remaining the same; but this rule has very important exceptions, constituted by the circumstances we have just considered. There are cases in which we do assume a cause for the retention by a thing of its state unchanging, cases in which we regard the absence of change as an effect. There are two such cases.

When a change is customary, and yet does not take place, we assume that the absence of change is the effect of some cause. The weather, for instance, in this country changes so frequently, and change in the weather is become so much a part of our customary routine, that when a change in the weather takes place, we forget to regard it as an effect; but should the weather remain uninterruptedly stormy, or dry, or wet, for six months together, we should at length be driven to assume a cause for this want of change, for the want of change would be itself a change in the routine to which we are accustomed.

The second case is when we know of forces in operation tending to produce a change which yet does not take place. In such a case, if our attention is called to the operation of such forces, we inevitably assume a counter-cause for things remaining unchanged, and regard this want of change, or unchange, as an effect. If we pull the handle of a drawer, and the drawer yields and opens, we regard the change in the position of the drawer as the effect of the pull; but if we make no attempt to open the drawer, we do not regard its remaining closed as the

effect of anything. As there is no change, and nothing tending to produce change, there is no effect. But if we pull the drawer and it does not move, then the want of change, in circumstances tending to produce change, at once becomes an effect, and carries the mind irresistibly to the necessity of a cause. When the mercury in a cup remains level, we do not regard the maintenance of the level as an effect, for it is no change from the customary behaviour of mercury; but when the mercury in a Torricellian tube remains high above the level of that in the cup, we do at once assume that this is the effect of some cause; for the unchanging state, or briefly the unchange, is maintained in spite of a cause—the weight of the mercury—that we know is tending to change it.

We are driven by these considerations to regard change as a necessary element in our concept of effect, and if we first formulate the definition that

An Unchange is the maintenance of an unchanging state in spite of forces in operation tending to change it,

Then we may formulate our provisional definition of effect in the following terms:

An Effect is a change or an-unchange.

Reason.

Between these two kinds of effect there is a clear difference, which is easily distinguished, which is generally felt, and which is, in fact, embodied in language; for while we always call that which produces a change the Cause of the change, we usually do not give this title to that which opposes a change. This latter we usually call a *Reason*. The variations in the height of the barometer are *caused* by variations in the pressure of the air; but the constant pressure of the air is the *reason* why the mercury does not sink to the level of the cup. The pull we exert on the handle of the drawer is the *cause* of the drawer opening: the drawer being locked is the *reason* it does not yield to the pull. It would be quite inappropriate to say that the changes in the weather are due to some reasons: but it would be quite appropriate to say there must be some reason why the weather does not change. It would seem that the full force of effectuation is felt only when the effect is change, and that when it is unchange the effectuation is felt to be attenuated and diminished; so that we may add to our definitions the following:

The cause of an unchange is called a Reason.

The definition of an effect as a change or unchange is avowedly provisional, and needs to be completed. As already explained, the nature of a thing, as it appears to us, depends on the way in which we contemplate it. We may, if we please, contemplate a change or an unchange in and by itself, merely as change or unchange, without contemplating it as an effect. In order to constitute it an effect, a change or unchange must be contemplated from a special point of view, that is to say, with reference to its causation. To become an effect it must be associated in our minds with causation and a cause; but as we have not yet arrived at any definition of these terms, it would not be legitimate to use them in defining effect. Still, we may legitimately go as far as this: we need not, and do not, always contemplate a change as an effect, but when we do regard it as an effect we always contemplate it in relation with some antecedent action on the thing changed. We need not regard an unchange as an effect, but if we do so contemplate it, we contemplate it in relation with some action that maintains the thing unchanged. We may therefore develop our definition into this:

An Effect is a change or an unchange connected with an action on the thing changed or unchanged.

Still the definition is not complete. A cup may fall and break. The fall of the cup is a change produced on the cup, and is an effect. The impact of the cup on the floor is an action on the cup, and is connected with the fall; but the impact of the floor on the cup is not the cause of the fall; and why not? Evidently because it succeeds the fall. The cause of a change must be sought in some action that precedes the change; it is no use looking among the consequents for the cause. Most writers on causation have been able to appreciate this, and since the cause of a change must always precede the change, they have muddled up causation with antecedence, and declare that they are the same thing. They are not. Antecedence often goes with causation, but there are many cases of causation in which the cause does not precede the effect; and there are many antecedents of a change that are not its causes; and to identify causation with antecedence is a gross blunder, whether the antecedence is invariable or not.

When the mercury in a Torricellian tube remains high above the level of that in the cup, the pressure of the air, which is the

action that maintains the unchange, does not precede the maintenance of the unchange, which is the effect: it is continuous with the unchange. It is contemporaneous with it. When the action of the engine on the axles maintains the motion of the motor car or the locomotive engine in spite of the forces in action tending to arrest the motion, this action does not precede the motion of the car or of the engine, but accompanies it. The tension of a string that sustains a weight, and that is the cause that prevents the weight from falling, does not precede the suspension of the weight: it accompanies it. It begins at the instant of suspension, it lasts while the suspension continues, and it ceases the instant the string is cut and the weight falls. It is true that the drawer may be locked long before and long after it is pulled upon to open it; but it is not the drawer being locked that is the cause of the unchange: it is the resistance of the tongue of the lock; and this resistance begins and ends with the pull upon the drawer.

A time element, or time relation, of one kind or the other is therefore a necessary and indispensable element in the definition of effect, but the time relation is manifestly not the same in the two kinds of effect, and therefore effect cannot be defined in a single expression. The complete definition of effect must run something as follows:—

An Effect is a change connected with a preceding action, or an unchange connected with an accompanying action, on the thing changed or unchanged.

Result.

'Some phenomena,' says Mill, 'are in their own nature permanent; having begun to exist, they would exist for ever unless some cause intervened having a tendency to alter or destroy them . . . no object at rest alters its position without the intervention of some conditions extraneous to itself: and when once in motion, no object returns to a state of rest . . . unless some new external conditions are superinduced. It, therefore, perpetually happens that a temporary cause gives rise to a permanent effect. The contact of iron with moist air for a few hours, produces a rust which may endure for centuries; or a projectile force which launches a cannon ball into space, produces a motion which would continue for ever unless some force counteracted it.'

As usual, Mill founds a general statement upon the *enumeratio simplex*, without taking into consideration the *instantia contradictoria*. It is not true of living animals that they never alter their position without the intervention of some condition extraneous to themselves: the mere internal accumulation of energy is enough. But passing that, and making the necessary qualification, Mill's limitation of the assertion to some phenomena, as if it were not true of all, is utterly unjustifiable. If the first Law of Motion is true, if Mill's own Law of Universal Causation is true, that no event happens without a cause, it is difficult to see how any change can take place in any 'phenomenon' whatever without a cause; and it seems clear that not some phenomena only, but all phenomena whatever, are in their nature permanent, and having begun to exist will exist for ever, unless some cause intervenes to alter them. Mill adduces these instances as instances of permanent effects; but here he is evidently using the word effect, which he never defines except as an invariable consequent, in a popular sense, and in a sense which even popular usage does not always sanction. According to my definition, a permanent state is not an effect unless it is an unchange; and none of these is an unchange. Once at rest, a body needs no cause to keep it at rest, unless there is some action on it tending to move it; and without such action, its remaining at rest is neither a change nor an unchange, and is therefore not an effect. A body at rest needs a cause to set it in motion, and the setting in motion, the change from rest to motion, is an effect: but once in motion, its continuing in motion is not an effect. When iron rusts, the rusting is an effect, for it is a change from metallic iron to oxide; but once it is rusty, there is no cause in action tending to change it back again, and therefore its remaining rusty is not an effect. In none of these cases does the effect continue. None of them is a permanent effect. What Mill means by a permanent effect is that iron once rusted does not change back again, and that a man once killed does not come back to life again. It is a manifest misnomer to say that if an effect is not reversed, the non-reversal is an effect. It is true that in common speech it is a frequent practice, but by no means an invariable practice, to say that an effect continues, even when the effect is a change, and to speak of the state of death and the state of rust as effects; but these are not accurate expressions, are eschewed by accurate

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speakers, and are utterly unpardonable in philosophical writing. What persists when a body is brought to rest or set in motion, when iron is rusted, or a man is killed, is not the effect, not the change, but the changed state—the new state that has resulted from the change. A change implies a state from which and a state to which the change is made, and the state brought about by the change is a very different thing from the change itself, which alone is the effect. The changed state is not the effect, it is the *result*, and thus we arrive at a sixth definition:—

A Result is the changed state of a thing on which an effect has been produced.

Cause.

The definition of effect, as a change or unchange connected with an action, points straight to the nature of cause. I do not think it is possible to imagine any change or unchange that is not produced by the action of some agent. Of course, it may be said that things may exist or occur, although we cannot imagine them; but we are not here dealing with transcendental possibilities. We are dealing with events in this world as we know them in experience, and our experience is such that we can no more imagine change to be produced or prevented without action upon the thing changed, than we can imagine resistance without extension, force without matter, or solid without surface. In each case the one presupposes the other. The only consideration that can be plausibly advanced against this view is, I think, that we regard some changes as spontaneous. But by a spontaneous change we do not mean a change produced without action on the changing thing, we mean a change due to the action of the changing thing itself, as contrasted with change due to the action upon it of something outside the changing thing.

The only formal repudiation of this doctrine is that of Hume, which has already been examined. Hume taught that there is no such thing as force or power, which I here call action; that it exists only in our imagination; that the notion we have of it rests upon no evidence, and corresponds with nothing in the external world. His reason for this opinion was that we gain our notion of force or power not from any single individual experience, but as a generalisation from many experiences; and he thought that in this it contrasted with

our notions of resistance, extension, and motion. We now know that in this he was mistaken. All such notions are generalisations from many experiences, and the notion of force or power is not singular in this respect, does not differ in this respect from other primitives, nor is it invalidated, as a true representation of externals, by being a generalisation.

But all Hume's discussion of its origin is beside the question. Whatever its origin, it is indisputable that we have this notion of force, or power, or action, and that we regard it as having a real existence in the world outside of us; and the crucial test is this: that we act upon the assumption that it does exist, and that the consistent action, on that assumption, of the whole human race has never brought anyone up against experience that contradicts the assumption. This is the ultimate and unimpugnable test of empirical truth. This test being satisfied, it is quite out of our power to doubt that the assumption is true. We may in words express a doubt, or even a denial, for language was acquired by man in order that he might deny his beliefs; but in fact we do not and cannot doubt it. It is quite possible to deny in words that matter exists, that there is an external world to be appreciated, and that we have minds to appreciate it with; it is quite possible to deny that things that are equal to the same thing are equal to one another; but the test of belief is action; and when we come to act, we act in conformity with the beliefs which we deny, and prove by so doing that our denial is a sham and an imposture—an imposture that does not impose even upon ourselves.

We may take, therefore, as our first provisional definition of a cause:

A Cause is an action.

Though we may speak of change and of unchange in isolation and abstraction from other things, yet in thinking of change or unchange it is impossible to expel from our minds the notion of a thing that changes, or that is prevented from changing. Change and prevention of change alike imply a changeable thing. That which produces change in a thing cannot be thought of otherwise than as an action on that thing either from without or from within. That which keeps a thing unchanged in spite of something that is trying or tending to change it, cannot be thought of otherwise than as an action on

or by the unchanging thing. Hence, by a cause not only do we always mean an action, but we always mean an action on a thing. It is quite possible to entertain the notion of action without taking into account anything acted on, as when we contemplate the rotary action of the arms of a windmill; but when we so contemplate an action we exclude from our minds the notion of cause. Cause always carries with it the notion, not merely of action, but of the transference of action from the acting agent to the thing acted on, or the initiation of action by the changing or unchanging thing; and the notion of cause is not complete unless this transference or initiation of action is taken into account. Hence we arrive at a further stage in our provisional definition of cause:

A Cause is an action upon a thing.

But not yet is our notion of cause complete. We may contemplate an action upon a thing in and by itself, without letting our contemplation run forward to the consequent change or prevention of change in the thing acted on; and unless we do thus extend our contemplation, our notion of cause is incomplete and unformed. When we contemplate the action of a breeze blowing upon a rock, we do not, or need not, regard this action as the cause of any change or unchange in the thing acted on. To complete our concept of cause, we must add to the provisional definition a reference to the change or unchange that is connected with the action on the thing, and develop our definition of cause as follows:

A Cause is an action connected with a change or unchange in the thing acted on.

The pressure of steam in a boiler is an action on the boiler: the rise in temperature of the boiler is a change in the boiler—the thing acted on—and is connected with the steam pressure; but the pressure of steam is not the cause of the rise in the temperature of the boiler: it is the other way about. The pressure of the air is an action on the locomotive engine, and it is connected with the unchange—the running of the locomotive—for it increases with the speed; but it is not the cause of the unchange. Evidently some further qualification is required in the definition. Why cannot the pressure of steam in the boiler be the cause of the rise in temperature of the boiler? Manifestly because the steam-pressure does not precede, but follows the rise of temperature. Why is not the

pressure of the air the cause of the running of the locomotive? Manifestly because, the running being an unchange, the pressure of the air is not contemporanous with it. The pressure exerted its action before the running began, and continued after the running had ceased. In order, therefore, to accommodate our definition to these considerations we must modify it as follows:

A Cause is an action connected with a following change or a contemporaneous unchange in the thing acted on.

There are some usages that conflict with this doctrine. One of these is that we often give the name of cause to that which is not an action. We say the cause of the stoppage of a motor car is a broken sparking plug, a leak in the water circulation, grease in the commutator, dirt in the carburettor, and so forth. Similarly, we say the cause of a man's death is failure of his heart to act; the cause of the stoppage of the machinery is the the stoppage of the engine; the cause of the stoppage of the engine is the fire going out; and so forth. In each the cause is not an action, but is the cessation of action, or the agent which produces cessation of action; and in every such case, the change, which is the effect, is the cessation of an unchange. Now an unchange is the maintenance of a continuous state in spite of the operation of forces tending to change it: and that which we call the cause of the cessation of the unchange, or the destruction of this continuous state, is not an actual cause, not an action, but the removal or cessation of the cause of the unchange. In each of the foregoing cases, what we call a cause is really the removal or cessation of a cause. The unchanged motion of the car is caused by the action of the sparking plug, of the water circulation, of the commutator, of the carburettor; arrest any of these actions, and the running of the car ceases, and ceases by the operation of causes—friction, etc.—that were all along tending to stop it, and are now permitted, by the cessation of the causes of the unchange, to become effectual. Similarly, the life of man is an unchange, maintained by the action of the heart in spite of causes in action tending constantly to bring life to an end. Cessation of the heart's action does not kill the man, but allows him to die. The movement of the machinery is an unchange, maintained, in spite of causes tending to end it, by the action of the engine. The stoppage of the engine does not stop the machinery, but allows it to be brought to rest by friction and other resistances.

It is scarcely consonant with our notion of cause to call the cessation of action a cause, but, undoubtedly, in individual cases that occur in experience, such as those that have been instanced above, we do in fact regard the cessation of action as a cause, although a stricter logic would compel us to look upon it as the removal of a cause. If the latter view is to prevail, the last definition will stand as the final definition of Cause, but if we are to fall in with current usage, our definition will run:

A Cause is an action, or cessation of action, connected with a sequent change or accompanying unchange in the thing acted on.

Another usage that conflicts with both of these definitions is that of Mill and the logicians, as well as of other writers who should know better, in speaking of things which are not actions nor cessations of action as causes. It is fruitless to try to fix responsibility for the practice, but I am afraid that ultimately it might be traced to writers on Causation. A flagrant example is afforded by writers on medicine, who still divide the causes of disease into predisposing causes and exciting causes. Among the predisposing causes it is usual to enumerate the age and sex of the patient, the climate and locality of his residence, his occupation, and so forth; and none of these is an action, nor is any of them a cessation of an action. Occupation is indeed action, but it is not action upon the thing changed—upon the patient. It is action by the patient, a very different thing. It is evident that in calling these passive states causes of disease, we are using the word cause in a very strained and unnatural sense, and this is often acknowledged even by medical writers themselves. Yet it is beyond doubt that these states have an influence upon the effect. Certain diseases are limited to a certain age; others are limited to one sex; others are found to attack those only who live in certain localities or pursue certain occupations; and yet there is a felt and acknowledged incongruity in calling them causes. No one has ever specified what it is that arouses this feeling of incongruity, but I think there can be no doubt that it arises from the recognition that they are neither actions nor cessations of action, and that it is only to actions, and perhaps to cessations of action, that the term cause can be properly applied. The connection that these passive circumstances have with the effect, a connection which is undoubted, and cannot be questioned for a moment,

is that they are *Conditions* of the effect; and this leads us to inquire into the meaning of Condition, and to ascertain in what it differs from Cause.

Summary.

This Chapter is an examination of the relation of which the two terms are Cause and Effect, and the ratio, or relating relation, is Causation.

Effect is inseparably connected with the idea of change, and every effect is that which impresses us as change or as the prevention of change. The latter is called an unchange. By successive approximations we reach the definition that an Effect is a change connected with a preceding action, or an unchange connected with an accompanying action, on a thing.

The cause of an unchange is often called a Reason.

The changed state that is left when an effect has been produced is called a Result.

By successive approximations we reach the definition that a Cause is an action (or cessation of action) connected with a sequent change or accompanying unchange of the thing acted on.

CHAPTER III.

CONDITION.

WHILE it is generally understood that a cause and a condition are different things, and stand in different relations to the effect, yet even in common speech and in practice they are often confused, and writers on causation admit no distinction whatever between them. Mill was the worst offender in this respect, and his evil example has corrupted all subsequent writers. I do not know of any writer on the subject who formally distinguishes between cause and condition, though all writers use both terms; but they jumble them up together, sometimes using them interchangeably, and sometimes assuming a difference without ever distinguishing them.

Whenever a distinction is made in common speech, we may be pretty sure that it represents and indicates a distinction in thought which the common user feels and appreciates, though he is usually unable to formulate and define it. Not one person in a thousand makes a mistake in the use of the phrases 'I did it' and 'I have done it,' and not one person in a thousand could formulate and explain the precise difference in the meanings of the two. Whenever two different words or phrases are used to express nearly the same thought, it will always be found that they never express quite the same thought. It is, in fact, impossible to keep two commonly used words in the same language synonymous. They soon begin to take on different meanings and to be used on different occasions, and gradually the meanings diverge more and more. A familiar instance is in the different meanings that now attach to large, big, great, and gross. In the face of such common usage, the proper attitude of a careful student of language and thought is not to assume a haughty superiority to the commonalty who have made the distinction; not to assume, as Mill does, that it is the mere confusion of ignorance and illiteracy, pretending a difference where no distinction exists; but to examine, probe, penetrate, and realise the thought that underlies the practice, to discover the difference, and to clothe it in an appropriate definition. Cotton stuffs are often confounded with woollen

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stuffs, to the disadvantage of the purchaser; but not on that account ought the expert to persuade the purchaser that there is no difference between cotton and woollen, and that he has been all his life calling one thing by two names. A sure, though not a clear, discernment has convinced him that there is a difference, though he cannot say in what the difference consists. A helpful guide would teach him how they are to be distinguished. Mill, however, and every subsequent logician, finding that the populace makes a distinction between cause and condition, but is not very clear as to the nature of the distinction, seek, not to find and formulate the difference between them, but to persuade us that no difference exists.

That Mill did dimly, and in his fumbling manner, feel, rather than recognise, that there is a difference between cause and condition appears from his treatment of them. He says 'It is very common to single out one only of the antecedents under the denomination of Cause, calling the others merely Conditions. . . . The real Cause is the whole of these antecedents: and we have, philosophically speaking, no right to give the name of cause to one of them, exclusively of the others.' This, it may be observed, is his sixth definition of cause, different from all the previous five. 'What, in the case we have supposed [that of eating a particular dish and dying in consequence], disguises the correctness of the expression, is this: that the various conditions, except the single one of eating the food, were not *events*, but *states*, possessing more or less of permanency.' Supposing this were the correct distinction between causes and conditions, surely it is a distinction worth making, and entitles them to separate treatment. Again, he says 'There is, no doubt a tendency to associate the idea of causation with the proximate antecedent *event* rather than with any of the antecedent *states*.' If this is so, the obvious duty of an investigator is to discover the reason and meaning of this tendency, and this Mill seems to feel, for he gives a reason, a very inconclusive reason, which explains nothing, but still he gives one, 'the reason being that the event not only exists, but begins to exist immediately previous; while the other conditions may have pre-existed for a considerable time.' 'But though we may think proper to give the name of cause to that one condition, the fulfilment of which completes the tale, and brings about the effect without further

delay; this condition has really no closer relation to the effect than any of the other conditions has. All the conditions were equally indispensable to the production of the consequent; and the statement of the cause is incomplete unless in some shape or other we introduce them all.' 'The cause, then, philosophically speaking, is the sum total of the conditions.' Thus, after fluttering on the edge of finding a distinction between cause and condition, he makes up his mind that they are identical, and comes down with a flop on the wrong side. It would be difficult to find an argument more perverse, and the statements by which it is supported are nearly all of them erroneous.

If, as Mill says, we think proper to give the name of cause to one antecedent rather than to the rest, is it not manifest that we do so because we recognise a difference between this antecedent and the rest? Why else should we single it out for different treatment? The bestowal of a separate and different name is *primâ facie* evidence that a difference is felt to exist; and Mill, though he does not discover the true difference, yet does discover a difference, and then treats it as if it were non-existent. If a glass bottle is broken by the blow of a stick, is it true to say that the blow of the stick has no closer relation to the breaking of the bottle than the existence of the stick, or the muscles of the arm of the man who struck the blow? And is the 'statement of the cause' of the fracture of the bottle incomplete unless in some shape or other we introduce the growth of the tree from which the stick was cut, and the birth of the man who struck the blow? for they were 'equally indispensable to the production of the consequent.' 'Nothing,' says Mill, 'can better show the absence of any ground for the distinction between the cause of a phenomenon and its condition, than the capricious manner in which we select from among the conditions that which we choose to denominate the cause.' Never was assertion more unwarrantable. As well might a man who is colour blind assert that nothing can better show the absence of any ground for the distinction between red and yellow than the capricious manner in which we select from the yellows that which we choose to denominate red. The distinction is there right enough. Between cause and condition there is a distinction that is perfectly clear and very useful, and that is none the

less a clear and useful distinction because it is not always observed; because we do not always need to observe it; or because Mill and his successors are too blind to observe it.

Mill says we have a 'tendency' to associate the idea of causation with antecedent *events* rather than with antecedent *states*. If this were so, it would be a distinction of sufficient importance to warrant us in separating the events (causes) from the states (conditions) and discussing them apart; and though this is not the truth, yet it is an adumbration of the truth. Mill would have been much nearer the mark, though he would not have been within it, if he had said that we associate the idea of effect with events. An event is that which comes out of something else, and an effect is that which comes out of the cause. An event, whatever else it may be, is a change, and as we have seen, an effect is often a change, and is always associated with change. We do not necessarily associate the idea of causation with either events or antecedence, but we may associate it with an event if we contemplate the event as an effect. Nor is it true that we associate the idea of condition with 'states possessing more or less of permanency' merely because they are states and more or less permanent. The state of activity of an engine is a state possessing more or less of permanency, but we do not regard it as a condition of the movement of the train. We regard it as the cause, and rightly so regard it, because it is an action. A cause is an action, and so to regard cause points to the difference between cause and condition, for

A Condition is a passive state.

That is the true distinction between cause and condition. Cause is active: Condition is passive. A cause is an action: a condition is a passive state; not necessarily a permanent state, though as a state it must have some endurance, even if the endurance is but brief. One of the conditions of the discharge of a gun is that the hammer must be at cock. This is a passive state, but it is not a permanent state. It must, however, have some endurance, even though the endurance may be but momentary.

Clearly, however, the definition of a condition as a passive state is not a complete definition with reference to any given case of causation. There are many passive states of many

things quite unconnected with the causation of any given effect. The position of the hammer of a gun at half-cock is a passive state, but it is not a condition of the occultation of Jupiter. To complete the definition of a condition it is necessary to state the connection of the passive state with the causation of the effect. A cause is an action upon a thing, connected with a change or unchange in the thing acted on. A condition is a passive state: of what? Of the thing acted on? It would seem so, for that is the only thing admitting of a condition mentioned in the definition; and many instances can be adduced of conditions which are passive states of the thing acted on. The pulling of the trigger is the cause of the discharge of a gun: the position of the hammer at full cock, and the presence of a cartridge in the barrel, are passive states of the gun, the thing acted on, and satisfy the definition of conditions. The striking of a key on the piano is the cause of the sound of the note. The tension of the wires and the integrity of the mechanism are conditions of the occurrence of the sound: they are passive states of the thing acted on. The application of moisture to the flap of an envelope is a cause of the flap sticking. The presence of a film of gum on the flap is a condition of the flap sticking: it is a passive state necessary to the occurrence of the effect. In this case, we may regard the presence of the film of gum as a state of the envelope itself, or we may regard it, more accurately perhaps, as adjoining and in contact with the envelope, but not a part of the envelope—a passive state, not of the thing acted on, but of something about the thing acted on. In other cases the distinction becomes clear. The cause of a plant's growth is the action of heat on the plant; but the effect on the plant would not be produced but for a condition—the existence of food within reach of the roots of the plant. This condition is a passive state, not of the plant—the thing acted on—but of the soil in which the plant grows, that is, of something about the plant. The cause of the sound of a bell is the action of the tongue on the bell: but this effect would not be produced were it not that the bell is bathed in air, and the existence of the air is a passive state, not of the bell, but of something about the bell. The cause of a plant twining up a support is the action of the plant in rotating about an axis; but the effect would not be produced but for the presence of a support up which the plant could twine. The presence of

the support is a condition of the effect, and is a passive state, not of the plant, the thing which, acting on itself, produces the effect, but of something about the plant. And so we find with many other conditions, that they are passive states, not necessarily of the thing acted on, but of something about that thing. Thus we must modify our first tentative definition of a condition and say

A Condition is a passive state of or about the thing acted on by a cause.

The definition is not yet complete, however. It requires further limitation, for there are many passive states in and about a thing acted on which yet are not conditions of any effect produced by the action. The sun shines upon a wall, and by its action warms the wall; and against the north side of the wall rests a ladder. The presence of the ladder is a passive state about the thing acted on, but it is not a condition of the warming of the wall. A red-haired man takes medicine in a room with a parquet floor and a painted ceiling. The medicine produces its effect, but the red hair, the parquet floor, and the painted ceiling, though they are passive states of and about the thing acted on, are not conditions of the production of this effect. A fall of rain causes a road to be muddy: the dust on the road is a condition of the road becoming muddy, but the presence of a house by the side of the road, though it is a passive state about the thing acted on, is not a condition of the formation of mud. It is clear that a passive state of or about the thing acted on need not be a condition of the effect of that action, and is not a condition unless the existence of the state is necessary to the effect, or material to the effect. If a ship is careened by a gale, we may cause her to right herself by taking in sail. The action of taking in sail is the cause of the ship's righting. But no taking in of sail would cause this movement of the ship unless she were already careened. The careening of the ship is a passive state of the thing upon which the cause acts, and it is necessary to the result. Being a passive state, it is not a cause; and it will be admitted that it would be an absurd misnomer to speak of the careening of the ship as a cause of her righting herself. But the careening is necessary to the righting. It is a condition, an indispensable condition, of her righting herself. Hence we arrive at the following complete definition.

A Condition is a passive state of or about the thing acted on by a cause, and material to the effect.

As an example of the confusion which he attributes to people in general, but which really exists in his own mind, and scarcely anywhere else but in the minds of his followers, Mill gives the following example, which it will pay us to examine in some detail:

'A stone thrown into water falls to the bottom. What are the conditions of this event? In the first place there must be a stone, and water, and the stone must be thrown into the water, but these suppositions forming part of the enunciation of the phenomenon itself, to include them among the conditions would be a vicious tautology.' To include them all among the conditions would certainly be erroneous, for the throwing of the stone is not a passive state, but an action; and an action directly concerned, as an action, with the effect. It is therefore not a condition, but a cause. The existence of the stone and of the water are certainly conditions, and are so according to Mill's own definition, for they are included in the sum total, 'the whole of the contingencies of every description, which being realised, the consequent invariably follows.' 'The next condition is, there must be an earth: and accordingly it is often said that the fall of the stone is caused by the earth; or by a power or property of the earth, or a force exerted by the earth, all of which are roundabout ways of saying that it is caused by the earth; or, lastly, the earth's attraction; which also is only a technical mode of saying that the earth causes the motion, with the additional peculiarity that the motion is towards the earth, which is not a character of the cause but of the effect.' It would not be easy to find a better example of Mill's thorough muddleheadedness. No one with any sense of propriety in the use of words, or with any attention to the meaning of words, could possibly say that the earth was the cause of a stone thrown into water falling to the bottom; but anyone who should say that the fall of the stone was caused by a power of the earth, or by a force exerted by the earth, or by the earth's attraction, would assert precisely and accurately what the cause is. These are not roundabout ways of saying that the fall is caused by the earth: on the contrary, if anyone were inaccurate enough, and slipshod enough, to speak of the fall being caused by the earth, he would be using an elliptical

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expression, taking it for granted that his hearers would understand that he was using 'the earth' for the sake of brevity, instead of the power, or force, or attraction exerted by the earth, or briefly, the action of the earth: in short, that he was speaking of the agent as a cause when he meant the action of the agent, a mistake not infrequent with uneducated people, but one that makes us stare when we find it formally adopted by the authoritative writer on causation.

'Let us now pass to another condition. It is not enough that the earth should exist; the body must be within that distance from it, in which the earth's attraction preponderates over that of any other body.' Well, yes, so it must, for if not, there would be no water for it to sink in. At this rate a book the size of Mill's Logic would be needed to contain a list of all the conditions necessary to the sinking of the stone. We should have to go back to the geological conditions under which the stone was formed: and so back to the primordial nebula that gave rise to the solar system. 'Accordingly we say, and the expression would be confessedly correct, that the cause of the stone's falling is its being *within the sphere* of the earth's attraction.' It is cool of Mill to say that this expression would be confessedly correct. I know not who has made the confession, but I know that not the rack nor the thumbscrews would wring such a confession out of me. Being within the sphere of the earth's attraction is not an action, and therefore cannot be a cause of anything. It is a state, and for the purpose in hand a passive state, and therefore is not a cause, but a condition.

'We proceed to a further condition. The stone is immersed in water: it is therefore a condition of its reaching the ground, that its specific gravity exceeds that of the surrounding fluid, or in other words that it surpass in weight an equal volume of water. Accordingly anyone would be acknowledged to speak correctly who said, that the cause of the stone's going to the bottom is its exceeding in specific gravity the fluid in which it is immersed.' Mill might make this acknowledgment, but I doubt if anyone else would, and for my part I certainly should not. According to the rule I have laid down, the specific gravity, being a passive state and not an action, is a condition, not a cause.

Mill sinned against the light. He was not ignorant of the view here adopted: it was brought to his notice by a reviewer,

and after examination he deliberately rejects it. The reviewer says 'we always apply the word cause rather to that element in the antecedents which exercises *force*.' Thus he had the temerity to defy Hume, and he came nearer than any other writer to the view taken in this book. One of Mill's instances is 'The army was surprised because the sentinel was off his post.' He considers this as a justifiable and proper expression, which no doubt it is, and that it means 'The cause of the army being surprised was the sentinel's being off his post,' which it does not, or does not necessarily. Mill, though he always expresses himself clearly, rarely expresses himself accurately, and here he is inaccurate. 'Because' may indicate a cause, a condition, or a reason. What Mill is contending for is that it is correct to use the second expression about the surprise of the army. The reviewer says, and I agree with him, that it is incorrect, and I add that it is incorrect because the sentinel's being off his post is not an action, but a passive state, and therefore a condition. The reviewer says, and again I agree with him, that the allurement or force which drew the sentinel off his post may rightly be called the cause of the surprise of the army, and to this Mill objects that it can scarcely be wrong to say the surprise took place *because* the sentinel was absent; and right to say it took place *because* he was bribed to be absent. This is *ignoratio elenchi*. We are dealing with causes only, and 'because' may refer to causes, conditions, or reasons, and Mill, like other logicians, never uses a univocal word if he can find an ambiguous word to serve his purpose. Let us put it into accurate language. It is wrong to say the cause of the surprise was the sentinel's *being* off his post, for that implies a passive state and a condition. It is right to say the cause of the surprise was the sentinel's *going* off his post, or *deserting* his post, for these imply action; and for the same reason the bribing of the sentry may properly be called a cause of the surprise.

In every book on medicine we find age, sex, race, time of year, climate, and so forth enumerated among the causes of diseases. It is clear that none of these is an action. None of them therefore can be a cause of disease. Occupation also is called a predisposing cause of disease; but though the occupation of the patient is an action, it is an action not on the patient, the thing changed, but by the patient, which is

a very different thing. When occupation is a factor in producing disease it is therefore usually a condition, not a cause; but there are some cases in which it may properly be called a cause. Dry grinding produces a quantity of irritating dust, which is inhaled by the dry grinder, and irritates the delicate walls of the air-cells of the lungs, in such a way as to produce inflammation in them, which is called grinder's phthisis. In this case the occupation of the patient is an indirect cause of the disease. It causes a result—the presence of dust in the air—which is a condition of the disease.

A condition has been defined as a passive state . . . material to the effect, or such that without it the effect would not have been produced; and according to this definition, every condition must be necessary to the effect; yet we often speak of favouring conditions, with the implication that they favour or assist the production of the effect, which yet might be produced without them. The expression 'favouring condition' is a convenient expression, and is not inaccurate if it is properly understood and defined. Under given conditions a seed will germinate, and the plant will grow to maturity, flower, and seed. All the conditions necessary to its life and growth to maturity must therefore have been present; but under other conditions of aspect, moisture, soil, and so forth, it might have reached maturity sooner, might have attained a larger growth, might have produced more flowers and more seed, and might have lived longer. These other conditions were not necessary to the life, growth, and maturity of the plant; but they favoured its life, growth and maturity; and though not necessary to the production of some effect, they were necessary to the full or extra effect over and above that produced in the first set of conditions. A favouring condition is, therefore, a condition without which some effect will be produced on a given thing by a given cause, but with which more of that effect will be produced, or the effect will be produced more speedily by the operation of the same cause, or both. With respect to the production of some effect, the second condition is a favouring condition: with respect to the production of the extra effect, or the earlier effect, it is a necessary condition.

There is another sense in which the terms necessary condition and favouring condition are contrasted. If in certain con-

ditions a certain amount of an action is necessary to produce a certain effect, and if, when a new condition is introduced, less of that action will produce that effect, then this new condition is called a favouring condition. It is not necessary to the production of the effect by a given intensity of action, but it is necessary to the production of the effect by a less intensity of action. Thus, though a condition is always necessary for the production of an effect by a given action, yet it is convenient and justifiable to distinguish between necessary and favouring conditions if we bear in mind the conventional meanings of 'favouring.'

Frost, if sufficiently intense, will infallibly kill the blossom of pepin fruits. A less degree of frost will not kill the blossom if it is dry, but will infallibly kill it if it is wet. Wetness of the blossom is a necessary condition to the destruction of the blossom by this less degree of frost, but it is not a necessary condition to the destruction of the blossom by frost in general. It is called, and may justifiably be called, a favouring condition of the killing of the blossom by frost.

Summary.

A condition has never hitherto been satisfactorily distinguished from a cause. The true distinction is that a cause is an action, a condition a passive state.

By successive approximations we reach the definition that a condition is a passive state of or about the thing acted on by the cause, and material to the effect.

The difference between a necessary and a favouring condition is verbal. A condition is always necessary to the production of a given effect by a given action; but, if, under an additional condition, the effect would be produced sooner, or more of the effect would be produced, or the same effect would be produced by less of the action, then that additional condition may be termed a favouring condition with respect to the general causation of that effect, though it is a necessary condition with respect to particular cases.

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CHAPTER IV.

CAUSATION.

We may now turn to the consideration of the third constituent in the relation. We have considered the terms—Cause and Effect—and we now turn to the consideration of the link, or 'relating relation' which binds them together, and which I call the ratio. The question we now have to discuss is What is the nexus between cause and effect? or, Given an action on a thing, and a following change or contemporaneous unchange in that thing, what is it that converts this time relation into a relation of causation? in short, What is the mark or character of Causation?

Hume, after arguing at length that there is no connection at all between cause and effect, astounds us by defining their relation as 'if the first object (the cause) had not been, the second (the effect) had never existed,' and thus declares not merely connection, but necessary connection, between them. Mill, as we have seen, proposes one definition after another, not as successive approximations to a final clarified expression, not even as alternatives of equal value, but he wanders on, giving one definition after another, not noticing that they are incompatible, aud seemingly forgetting, when he formulates a new one, that he had ever formulated one before. The two qualities on which he most insists are invariableness and unconditionalness, but he soon abandons invariableness, and he insists throughout that conditions are necessary to causation. Dr. Fowler pins his faith to invariableness of succession, but Mr. Welton denies sequence as being necessary to causation, and in this no doubt he is right; but he goes farther, and denies that sequence or any time relation enters into causation, and in this he is unquestionably wrong. According to him, 'the relation of causation is found in the securing of those conditions, which are, consequently, at once both cause and effect,' not a very illuminating statement, and not quite consistent with his definition of cause as 'a totality of conditions whose existence secures the effect'—causes it, in fact. Professor Carveth Read,

whose pronouncements always deserve consideration, enumerates five marks of causation, which it will be well to examine, since one or more of them are adopted by most other writers. 'The Cause of any event, then, when exactly ascertainable, has five marks: it is (quantitatively) *equal* to the effect, and is (qualitatively) its *immediate, unconditional, invariable antecedent.*'

The quantitative equality of cause and effect is frequently assumed and asserted, but it seems to me to rest upon a very insecure foundation, and to be based upon very misty notions of what a cause is, and of what an effect is. The instances given are almost always chemical combinations, and it is said 'When oxygen combines with hydrogen to form water, or with mercury to form red precipitate, the weight of the compound is exactly equal to the weight of the elements combined in it.' No doubt it is, but what are equated here are two weights, and I do not see how it can be maintained that the weight of the elements is the cause, or the weight of the compound the effect, of the combination. The causes of the combination of oxygen and hydrogen are first, the mixing of them, and second, the passage of an electric spark through them; and I cannot see that the mixing is equal to the effect, or that the spark is equal to the effect, which is not the weight of the water, but the formation of water. The effect in this case is a change—the change from a mixture of gases to a liquid; and there is nothing in this change that is equal to the spark. The cause of the maintenance of the mercury in a Torricellian tube is the weight of the air, and the weight of the air is certainly equal to the weight of the mercury; but the effect is not the weight of the mercury, but the maintenance of the height of the mercury, and this cannot equal the weight of the air. As another instance of equality of cause and effect, Professor Carveth Read says the numbers of any species of plant or animal depend on the food supply, and no doubt they do in part, but the numbers are not equal to the food supply. The number of lions in a district is not necessarily equal to the number of antelopes in that district; and if they were, the antelopes are not the cause of the lions. Another instance of causation adduced by Professor Carveth Read is still more to seek. 'How learn to play the fiddle? Go to a good teacher (then, beginning young enough, with natural ability and great diligence, all may be well).' I am at a loss to discover how the cause in this case can be quantitatively

equal to the effect. No. I think the quantitative equality of cause and effect is as idle a dream as the identity of cause and effect: it is founded upon misapprehensions, and is not true, nor even is it sense.

The next mark or character of causation is *immediacy*. The relation of causation is said to be immediate, by which is meant immediate sequence. Mr. Welton, as we have seen, confuses immediate sequence with simultaneity. He takes it that an effect which immediately follows a cause is simultaneous with the cause, and from this he jumps to the further conclusion that simultaneity means identity, so that an effect that immediately follows the cause must needs be identical with the cause. I do not think that either of these views needs serious refutation; but the assumption that an effect must necessarily follow immediately on a cause does require careful examination. Certainly in common speech, and in the light of that common sense which philosophers so much and so universally despise, there is no such necessity; nor is there any necessity in law. If a man wounds another, and if that other dies of the wound at any time within a year and a day of the assault, the assault is in law the cause of the death, and the assailant may be guilty of murder. Of course, philosophers are not bound to make their definitions conform to the definitions of law; but it is very desirable that philosophers should not live wholly in a balloon of speculation, out of all touch with mundane and practical affairs. The use of opinion is to be a guide to conduct, a truth that philosophers rarely recognise; and lawyers have this advantage over philosophers, that their definitions are perpetually being put to the test of practical use; and if they are found to be faulty from this point of view, the definition must be discarded or amended. Philosophers are under no such obligation. They can, if they please, define 'the Knave of Hearts as the Jackovarts,' or that which depends on conditions as unconditional, or sequence as simultaneity, or simultaneity as identity, or causation as implication, or that which cannot be perceived as a product of perception, or a battle as a substance, and no one can prevent them; nor are they under any obligation to make their definitions square with their practice; but when one is immersed in practical affairs, and is writing for the guidance of those whose business it is to discover and record the causes of actual occurrences, it is prudent to

take into account the notions that are prevalent among men of affairs, and not lightly to reject them.

The General Register Office is a department of the State maintained at considerable expense, and engaged in collecting and presenting to Parliament immense statistics of the causes of death; and the Registrar General has no hesitation in admitting into his Tables, and presenting to Parliament, causes of death that may have preceded the effect by weeks, months, and years. Neither he, nor his staff of officials, nor the tens of thousands of medical men who furnish him with items, nor the High Court of Parliament, nor any of the multitude of scientific men who have used these tables, have ever made any objection to them on the score that the alleged causes of death are not causes of death because the result does not immediately follow on the cause. The Tables are not immaculate: they are open to objection, as I shall presently show; but they are of very great value to Officers of Health and others in the prevention of disease, even though it is from time to time found that some of the alleged causes of death are, after all, not causes; but if immediacy is a necessary element of causation, the alleged cause of death would be the true cause in scarcely one of the millions of instances which the General Register Office has recorded; and if the alleged cause were in every case false, then the usefulness of the Tables would be destroyed, and they would be of no value at all, either to Officers of Health or to any other human being. The *primâ facie* presumption against immediacy as a quality or mark of causation is therefore very strong.

As I have shown in the previous discussion, immediacy in the strict sense of the term cannot obtain in any case of effectuation, for an effect is a change or an unchange, and an unchange by its very nature implies duration, and cannot be immediate; while in experience every change takes time, however short that time may be. Perhaps the nearest approach to immediacy that we know is the effect of lightning upon our mind the instant the flash passes; but this we know takes time—time for the light to travel to our eyes, time for it to traverse the media, time for a change to take place in the retina, time for an impulse to travel to the brain, time for it to produce its effect there. Strict immediacy between cause and effect is unknown to us; but is not this pushing matters too

far? May there not be a practical immediacy that is required for causation, although immediacy in the pedantically accurate sense there cannot be? In other words, ought we not to limit our notion of causation to that change which appears to our senses to follow immediately upon an action, even though in strict accuracy some infinitesimal fraction of a second may separate them? Well, as has already been shown, even in such a restricted sense immediacy is not required in the current and accepted meaning of causation; and if it is to be imported into the philosophical meaning, then philosophy cuts herself off, in this respect, finally and for all from utility and common sense; and this is inadvisable if it can be avoided. But there is no earthly reason why philosophy should thus make a fool of herself. One of the favourite maxims of logic is *Nota notæ, nota rei ipsius.* As a logical maxim it is of little or no value, but in the present connection it has this value, that it effectually estops logicians from objecting to the maxim that I here present to them:—*Causa causæ, causa rei ipsius.* The cause of a cause is the cause of the effect.

Πάντα ῥεῖ: all things flow. The universe is a series of continuous change. In this continuous series we may take, anywhere we please, a longitudinal section of any length we please, and call the first change the cause of all or any that follow, and the last the effect of all or any that have gone before: or we can call the first the cause of the last, and the last the effect of the first. The process is familiar with us from childhood, and was solved for us long before our infantine minds were sophisticated by reading books on logic. If the cat began to catch the rat, the rat began to gnaw the rope, the rope began to hang the butcher, and so on until the pig began to get over the stile, and the old woman reached her destination, then the action of the cat was the cause of the rope being gnawed, of the butcher being in peril of death, and of all the other events in succession down to the old woman getting home in time. The cat's action was the cause, immediately or mediately, of each effect, and it was not less efficacious when it acted mediately than when it acted immediately. It is just as scientific, and just as philosophical, to attribute one man's death to the bite of a mosquito twenty years before, as to attribute the death of another to the explosion of a shell which blew him to bits in a moment.

The third distinguishing mark of causation is *unconditional-*

ness. Mill invented the term, and gives, as is his custom, several definitions of it, each different from the rest. It is synonymous with necessity; it means whatever supposition we make about all other things; it means subject to no other than negative conditions; it means as long as the causes do not vary; it means, in short, pretty much what you please. Mill's discussion of unconditionalness is a striking example of his utter muddle-headedness. Invariable sequence, he says, is not synonymous with causation, unless the sequence, besides being invariable, is also unconditional, and this he says immediately after he has defined the cause as 'philosophically speaking' the sum total of the conditions! It is therefore philosophically speaking conditional, and speaking otherwise unconditional. This, however, is only a beginning. His fifth or sixth definition of a cause 'confines the meaning of the word cause to the assemblage of positive conditions without the negative, and then, instead of "unconditionally" we must say "subject to no other than negative conditions."' So that in the first place the cause is the sum of the conditions, both positive and negative; in the second place, it is the positive conditions without the negative; and in the third place it is the negative conditions without the positive. There is only one other possible alternative, that the cause is neither the positive nor the negative conditions, and this, which is the correct view, is the only one that Mill does not give. Hume is inconsistent enough, goodness knows, but Hume is a miracle of consistency in comparison with Mill.

Professor Carveth Read adopts unconditionality as a mark of causation, and his meaning of the term is quite different from any of Mill's, though he says it is what Mill means. When Mill defines the cause of any effect as its unconditional antecedent, he means, according to Professor Carveth Read, that it is that group of conditions which, without any further condition, is followed by the event in question. According to this, when Mill said unconditional he meant un-further-conditional; and it is possible that Mill may have had sometimes in his mind some such meaning as this; but the only thing we can be sure of is that what he meant at one time was not what he meant at another time, and there is no evidence or indication that he had any definite meaning at all. However, there are few writers on causation who do not adopt Mill's assertion

that it is unconditional, and all of those who assert that it is unconditional assert, as Mill does, that it is conditional, and never recognise the contradiction. They all identify or confuse causes with conditions; they most of them speak of the cause as the sum-total of the conditions; and even a writer who owes so little allegiance to Mill as Mr. Welton calls it the totality of the conditions; and how that which depends upon conditions can be unconditional, I confess I do not understand. I suppose Mill must have had something in his mind when he said that to constitute a cause the conditions must be unconditional, but what it was we do not know, and whether Professor Carveth Read is correct in his surmise that it was un-further-conditional cannot now be known. Anyhow, to speak of that as unconditional which is on all hands admitted and proclaimed to be subject to conditions seems to me an inadmissible abuse of language.

The fourth of Professor Carveth Read's stigmata of causation is *invariability*. Mill adopted the notion from Hume, and every writer of that school pins his faith to invariability; but when we seek the meaning that they attach to the term, we find ourselves in wandering mazes lost. Does it mean that the cause is invariable? or that the effect is invariable? or that the cause is invariably followed by the effect? or that the effect invariably follows the cause? As far as I can make out, sometimes one and sometimes another, but most often none of these meanings is intended. Mill varies in his statements about invariability as in those about everything else. The most definite opinion he gives is this: 'That we should believe not only that the antecedent always *has* been followed by the consequent, but that so long as the present constitution of things endures, it always *will* be so.' It seems from this passage that 'invariably' means, with Mill, 'always,' and I believe that this is the meaning that his followers attach to it when they mean anything at all; but like their leader, they never keep long to the same meaning of any important word or doctrine, and Mill himself, on the very next page, says, 'Invariable sequence . . . is not synonymous with causation unless the sequence, besides being invariable, is unconditional.'

When it is said that the cause is the invariable antecedent, what ought to be meant, though I doubt very much if it is meant, is that the cause is that antecedent which does not vary.

If this is the meaning, it is doubly wrong, for in the first place, a cause need not be an antecedent, and in the second, if it is an antecedent it may vary, and usually does vary. If the antecedent must not vary, then the pressure of the gas of an exploding cartridge is not the cause of the propulsion of the projectile, for the pressure of gas varies from moment to moment as the projectile travels along the bore of the gun.

When it is said that the effect is the invariable consequent, what ought to be meant, though I believe it never is meant, is that the effect is that consequent which does not vary. If this is the meaning, it is undoubtedly wrong, for an effect need not be a consequent, and when it is a consequent, it may vary. If the consequent must not vary, then the movement of a motor car is not due to the action of the engine, for the speed varies with the gradient, and with the surface of the road.

When it is said that causation is invariable sequence, what ought to be meant is that the time and manner in which the cause precedes the effect, or in which the effect follows the cause, do not vary. But in the first place, causation need not be sequence, and in the second, when it is sequence, it may be variable. The time at which the report of a gun reaches us does vary with our distance from the gun; and the remittent manner in which the light from the fixed stars reaches us varies from the steady manner in which the light from the planets reaches us.

But suppose, what I believe is the case, that writers on causation express their meaning in this matter, as in other matters, inaccurately, and when they say invariably they mean always; is it true that there is no causation unless the cause is always followed by the effect, and the effect is always preceded by the cause? Then how if cause and effect are contemporaneous, as they are in the causation of an unchange? If sequence is always necessary to causation, then such unchanges as the maintenance of the motion of a locomotive, or the maintenance of animal life, or the suspension of a weight by a cord, or the prolonged boiling of water, are not caused. They are not effects, nor instances of causation. But even supposing there is no causation except the sequence of change on action, is it true that there is no causation unless this sequence always happens? Then how if it happens once only? Once, as the boy said to the man who declared that he was once

as active as the boy, 'Once ain't often.' Still less is it always. If I see a bottle of wine fall on a stone floor and smash, am I to deny that the fall of that bottle on to the floor was the cause of the smash? It has happened only once and can never happen again. 'Oh, but,' says the logician, 'when similar bottles have fallen on stone floors they have always broken.' Indeed? I have it in mind that this very bottle had previously slipped out of my hand and fallen a.sixteenth of an inch on to the very same stone floor, and yet was not broken. 'But then the cause was not the same, for the bottle did not fall so far.' Granted, but your definition says nothing about the same cause, it says the cause is always followed by the effect; and you now say that the cause of the bottle breaking was its fall for a certain distance; but I had previously let that bottle fall the very same distance on to a truss of straw, and the bottle did not break. 'Ah yes, but when I say the same cause I mean the same cause acting in the same conditions.' But if the same cause had acted in the same conditions the bottle would have smashed before, and you cannot be always smashing the same bottle, you know. It seems to me that *cadit ampulla, cadit quæstio.* But may we never predicate causation until an event has occurred repeatedly? Then how often must it be repeated before we can say it always *has* happened? how often before we can say it always *will* happen? Suppose a man hits me in the eye, how many times must I get him to repeat the blow before I can be sure that it is the cause of my eye turning black? 'But,' says the logician, 'a blow on the eye always *has* been followed by the blackening of the eye, and always *will* be followed by the same phenomenon.' Has it? What do you know about black eyes amongst Mousterian or Neanderthal men? And will it? Why? 'Because the same cause is invariably followed by the same effect.'

'My friend,' I reply, 'you are a logician; did you never hear of the *circulus in probando?*'

I can imagine the tormented logician answering these objections something in this way:—

'When I say invariably, of course I don't mean invariably; I mean always. At least I don't exactly mean always. You are so confoundedly particular. You expect me always to mean precisely what I say, and to say precisely what I mean;

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and you expect me always to have a precise meaning to express. You forget that I am a logician. When I say the effect invariably follows the cause, I mean of course that it follows unconditionally, that is to say, in certain conditions.'

'That,' I should answer, 'is a curious meaning for unconditionally; but waiving that, what are these conditions?'

'Why, of course, the same conditions in which it happened before.'

'But, *ex hypothesi*, it never has happened before.'

'Well then, the same conditions in which it would have happened before if it had happened before.'

'Thank you very much, but on your own showing, the same conditions never are, and never can be repeated.'

'Really, sir, I cannot bandy words further with a person who knows nothing of logic. Allow me to bring to your notice the well-known philosophical principle, of which you have never heard, that all reasoning is through a universal. I wish you a very good morning, and take my leave of you.'

It would be difficult for me to suppress Hamlet's answer—You cannot, sir, take from me anything that I more willingly will part withal.

No, I am afraid invariability must go after equality and immediacy and the rest of the marks that are supposed to characterise causation, and with them must go the last of Professor Carveth Read's distinguishing marks of cause, that of *antecedence*. It is manifest to everyone who is not wilfully blind, that the cause of a change must be antecedent to the effect, even when cause and effect are apparently simultaneous. The fracture of a glass bottle by the blow of a stick seems to be instantaneous, and no doubt the time consumed is very short. But if the operation were photographed by a rapidly moving kinematograph, and the film was to be put through the lantern very slowly, we should see the glass yield and bend before the pressure of the stick, and give way first on the surface remote from the stick, and gradually spread until it involved the whole thickness. We should see the splinters separate, not simultaneously, but successively, and that the whole operation took time. This, I think, is one answer to Mr. Bertrand Russell's contention that we can divide up the cause, or the duration of the cause, into many successive instants, of which the last only is entitled to the name of

cause; and that it is this last division only upon which the effect follows instantly, and with which the effect is virtually continuous. These are not his words, but this is the meaning of his doctrine as I understand it. It is not so. The cause has a certain duration; and during every instant of that duration it is a cause, and is in action, and is causing more and more of the effect. The effect also has a certain duration. As the cause begins to act, the change begins to occur; as the cause continues, the change increases; when the cause ceases, the effect reaches its maximum. As soon as the cause ceases to act, the effect, as an effect, that is as a progressing change, also ceases, and becomes a result. The total effect is not reached until the cause ceases to act, and it is in this sense, and in this sense only, that the effect succeeds the cause, and that cause and effect are antecedent and consequent.

But when the effect is an unchange, the cause does not and cannot precede, nor can the effect follow. In this case cause and effect are contemporaneous; the only exception, which is but an apparent exception, being the delay due to inertia in the starting and cessation of that unchange which is the motion of a body, such as a cart, a motor car, or a railway train, that owes its motion to continuous action.

What, then, is the quality which characterises and marks causation? It is not at all difficult to discover, and indeed it was discovered and assigned long before the day of Hume, but he took a violent prejudice against it, and all his successors have been afraid of it. They have avoided it as if it were an asp or a viper, and few of them even dare to mention it; and yet there is nothing frightful about it, and if the nettle is firmly grasped, it not only fails to sting, but even furnishes a grateful and sufficient support.

Daily the tide rises on our coasts, and daily thereafter men and women in this country marry; and in some respects the consequents are invariable. They invariably marry two at a time and with some sort of ceremony. Moreover, this consequence always follows the antecedent: not a rise of the tide occurs but some marriage follows it. As far as history goes back, this consequent *has* always followed this antecedent; as far as we can foresee, the consequent *will* follow the antecedent 'as long as the present constitution of things endures'; and these are the conditions that are said to convert mere time-

sequence into causation. But they don't. No one but a lunatic or a logician would regard the rise of the tide as the cause of men and women marrying; and why not? Ask the first man, woman, or child (not being a lunatic or a logician) you may come across why they do not regard the rise of the tide as the cause of marriage, and he, she, or it will answer 'Because there is no connection between them.' This is the obvious answer, and it is a very good answer as far as it goes, though it is not quite a sufficient answer.

There are two reasons why it is not quite a sufficient answer: first, because things may be connected together in sequence without being cause and effect, and second, because it does not explain the nature of the connection.

Night always follows day, and the two are connected, but yet night is not the effect of day. The flight of the projectile always follows the recoil of the gun, and is connected with it, but the recoil of the gun is not the cause of the flight of the projectile. The sinking of the stone always follows the splash, and is connected with it, but the splash is not the cause of the sinking of the stone. Although, however, these instances prove that mere connection in sequence does not constitute causation, even when the sequence is constant (which is what logicians mean by invariable) yet it is clear in each case that the connection in sequence does depend upon causation. The connection between day and night is that they have a common cause, the rotation of the earth. The connection between the recoil of the gun and the flight of the projectile is that they have a common cause, the explosion of the charge. The connection of the sinking of the stone with the splash is that they have a common cause, the fall of the stone into the water. It is evident that we are getting 'warm.' If the connection between antecedent and consequent does not itself constitute causation, yet it is evident that it is indispensable to causation, and that we may say provisionally

'*Causation is the connection between cause and effect.*

Although, however, this is true, it does not carry us much forwarder. It does not display the nature of the connection. In order to get a complete definition of causation, and to clarify the concept, we must substitute for the terms cause and effect the definitions of them at which we have previously arrived. We shall then get the following definition :—

Causation is the connection between an action and the following change or accompanying unchange in the thing acted on.

If we apply this definition to the foregoing test cases we find that it fits, and satisfactorily explains why they are not cases of causation although they are causally connected. Night always follows day, and is connected with it; but night is not the effect of day, and why not? Because, although there is a connection between them, the connection is not between an action and a change in the thing acted on. Day does not act upon anything to cause night. The recoil of the gun always precedes the flight of the projectile, and is connected with it; but the recoil of the gun is not the cause of the flight of the projectile, and the reason is manifest—the recoil of the gun does not act on the projectile, the thing in which the effect is produced. Similarly, the reason the splash is not the cause of the sinking of the stone is that the splash does not act upon the stone, the thing in which the change occurs.

The same formula satisfies all Mr. Welton's difficult cases. 'The dryness of a boy's clothes before his immersion in water is not the cause of their subsequent wetness.' It certainly is not, and I doubt if even a logician has ever suggested that it is; 'that cause can only be found in that spatial relation between the clothes and the water which we call contact.' It is true that we may speak of the contact of the water with the clothes as the cause of the wetness of the clothes, but what we mean, or ought to mean, by contact, in this case, is not being in touch, but bringing into touch. The cause of the wetness of the clothes is the action of bringing water into contact with them, and then the action of water upon them. Once the clothes are wet, the continued contact of the water with them is not the cause of their wetness, it is their wetness. The bringing of the water into contact with the clothes is the cause, the effect is not wetness, it is becoming wet. Wetness is not an effect, it is a result. Mr. Welton's statement is vitiated by two confusions. He says wetness when he means becoming wet, and he says contact when he means bringing into contact.

'A dropping of ink upon paper causes a blot, but the blot is there as soon as the contact of ink and paper is made; it *is* that contact.' Here again there is confusion. The dropping of the ink upon the paper is rightly called the cause of the blot, for the dropping of the ink is an action on the paper, and the blot

is the change in the thing acted on, and is connected with the action. It is true that the blot is there as soon as the contact is made, as every effect is there as soon as the causing action is complete; but I see no ground for asserting that the blot *is* the contact. As well might we say when a man lies in bed, that the contact of the man with the bed *is* the man. The blot is not the contact. The blot is the layer of ink adhering to the paper.

There is yet one thing wanting to the definition of causation. It is, we find, the connection between an action upon a thing and the sequent change or accompanying unchange in that thing; but we have yet to ascertain the nature of the connection. This cannot be put much better than in the words in which Hume stultifies his whole previous argument,—'where, if the first object had not been, the second had never existed.' In other words, the connection is a necessary connection. Much unnecessary verbiage has been wasted in discussing the nature of necessity, which is perfectly clear to everyone but philosophers. By necessary connection I mean that the action is so connected with the change or unchange that if the action had not taken place, the change or unchange would not have occurred; and the action taking place in the conditions in which it did, the change or unchange connected with it was unavoidable and unpreventable. That, I believe, asserts the true nature of causation, which may be finally defined thus:—

Causation is the necessary connection between an action and the sequent change or accompanying unchange in the thing acted on.

Mill boggles at the term necessary, and suggests that its meaning is not clear. 'If,' he says, 'there be any meaning which confessedly belongs to necessity, it is *unconditionalness*,' and thus he substitutes for a plain clear word which everyone understands, a word which no one else understands, and which he does not understand himself. What he means by 'confessedly' it is difficult to surmise, for no one but himself has ever defined necessity as unconditionalness, and not even his followers confess that they mean the same thing. It is another of his wandering and unwarrantable assertions, adopted, apparently, on the spur of the moment, without consideration or justification. No one has ever confessed that necessity means unconditionalness; and it doesn't. Whichever of Mill's various definitions of unconditionalness we adopt, it bears no resemblance to necessity.

But is causation the necessary connection that I have asserted it is? It may be said that if the severing of an artery which causes a man's death had not taken place, the death would still have occurred sooner or later, and therefore the connection between the cause and the effect was not necessary. The obvious answer is that though the connection between the severing of the artery and the death of the man was not necessary, the connection of the severing of the artery with his death by hæmorrhage at that time and place was necessary. It was necessary to that particular effect. And it may be said that the death did not necessarily follow, for if a surgeon had been present, and had tied the artery, the man would not then and there have died, so that the change was neither unavoidable nor unpreventable; and this is true, but then the conditions would not have been the same. The conditions being what they were, the change followed necessarily, in the sense in which I have defined necessarily, on the action; and it is this necessary connection between the cause and the effect that constitutes causation.*

* A doubt, I find, is felt by a reader, whether the maintenance of the motion of a locomotive can properly be called an unchange; for it may be said—Are not all parts of the machinery continuously changing in position? Animal life also is a perpetual series of changes; how then can it be called an unchange? The answer is that the nature of things as it appears to us, and as for our purposes it is, varies according to the way in which we choose to contemplate them. An unchange, as I have defined it, is a way of contemplating things, just as a class is a way of contemplating things. No such thing as a class exists except in our minds. When several individual things have some quality in common, such as hardness, or whiteness, or motion, we may mentally group them together, and contemplate them together as all possessing that quality; and by the possession of that quality they are grouped together in our minds, and consolidated into a single object of contemplation—a class of hard, or white, or moving things. They are not grouped together in fact, or outside of our minds. Both the North Pole and the South Pole are white, and may be contemplated together as adjoining white things in the class of white things; but in fact they do not adjoin, but are wide asunder. To call things a class is to contemplate them together; and to separate them, not actually, but in contemplation, from other things that have not the class-quality. Just in the same way, we may take all the successive changes of a locomotive, both the internal changes of its parts, and the changes of position of the whole with respect to its surroundings, and contemplate them all together, as grouped and consolidated into a single object of contemplation, which we call, not a class, but an unchange. We call it an unchange, or the maintenance of an unchanging state, because, as movement, it does not change to rest, although there are forces in action—friction, gravity, and so forth—tending to bring it to rest. Each movement of the parts is a change, and may be so contemplated if we choose; but we need not so contemplate it. The movement of the whole is change of place with respect to surroundings, and may be so contemplated; but it need not be so contemplated. We may, if we please, regard the movement, not in contrast with surrounding things which remain at rest, but in contrast with its own possible state of rest, or in contrast with its being brought to rest, which would be a change of another kind, but still a change. So contemplated, the state of motion is not a change, but the maintenance of the unchanging state of motion. In short, it is an unchange.

Summary.

This chapter examines the five characters or marks that are said to be characteristic of causation, viz., equality of cause and effect, immediacy, unconditionality, invariability, and antecedence; and shows that not one of them properly or necessarily pertains to causation.

By successive approximations the definition is reached that Causation is the necessary connection between an action and the sequent change or accompanying unchange in the thing acted on.

The meaning of 'necessary' in connection with causation is defined.

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CHAPTER V

SUBSIDIARY PROBLEMS.

I. Plurality of Causes.

Mill is the inventor of the phrase Plurality of Causes, and he gets into his usual muddle over it, a muddle which even his followers have discovered to be a muddle, but which they have only partially cleared up. It will be remembered that one of his statements of the Law of Causation is 'that every consequent is connected in this manner [invariably] with some particular antecedent, or set of antecedents. Let the fact be what it may, if it has begun to exist, it was preceded by some fact or facts with which it is invariably connected.' It would be difficult to put the statement more positively or more strongly, and as he himself would say more unconditionally. It is an unqualified assertion; and yet in a subsequent Chapter he says 'There are often several independent modes in which the same phenomenon could have originated. . . . Many causes may produce mechanical motion: many causes may produce some kinds of sensation: many causes may produce death.' Inconsistency is, as I have said elsewhere, with other people a vice to be avoided. With logicians it is an end to be pursued for its own sake. A writer on any other subject who should thus stultify himself by self-contradiction would be discredited, but with logicians self-contradiction is rather a virtue than otherwise.

It is clear that in this use the term Plurality of Causes is wrong, and doubly wrong. In the first place it does not mean that any single instance of effect is due to more than one cause, and in the second it does not mean that more than one cause may be necessary to produce a certain effect. What is meant is that an effect of a certain kind may be due on one occasion to one cause and on another occasion to another cause. This is not Plurality of Causes: it is Alternity of Causes, or, as Professor Carveth Read calls it, Vicariousness of Causes. When an effect is said to be due to a plurality of causes, what is meant is that if several effects resemble one another in some particular,

one may be due to one cause and another to another. The death of A by drowning is due to one cause—drowning—and no more. It is not due to a plurality of causes. The death of B by shooting is due to a different cause, it is true, but then it is a different effect. It is a different effect, occurring on a different occasion, under different circumstances, to a different person. Both effects include the element or ingredient of death, but the effects are not death, but deaths; and when it is said that many causes may produce death, what is meant is that many different causes may produce many different deaths; which is not so very paradoxical.

When Mill said many causes may produce some kinds of sensation, we may suppose that what he had in his mind was sound, which is a kind of sensation. But sound in general is not an effect: it is a generalisation from many individual instances of sound, each of which was an effect, and an effect of one single cause. Mill's blunder consists in generalising the effects without generalising the causes. If we generalise many instances of sounds into the one concept of sound, and call the generalisation a single effect, we should also generalise the causes of all these sounds, and call the common ingredient in them the cause of sound. Each separate sound will then have its separate cause; and the common ingredient in them all will have its common cause in aerial vibration. Similarly, if we generalise the common ingredient in many deaths, and call it death, we must generalise the common ingredient in all the causes of these deaths and call it cessation of the heart's action. There is no such thing as Plurality of Causes in Mill's sense, unless we generalise the effects while leaving the causes particular, which is not a very legitimate logical operation.

It is of course perfectly legitimate, and may be very useful, to investigate all the cases in which effects have a common ingredient, such as deaths, or sounds, and to determine as many as we can of the combined causes and conditions by which the effects are produced that have this common ingredient: this is very proper, and may be very useful; but in such cases we are seeking the causes, not of an effect, but of a common ingredient in many effects; and the plurality of causes applies to the plurality of effects, and not to the common ingredient in them, although for the sake of brevity and con-

venience we may allow ourselves to speak as if it did. In any case, Plurality of Causes is clearly a misnomer here; what is meant is not Plurality of Causes but Alternity of Causes.

There is a sense in which plurality of causes is a perfectly justifiable expression. There is a sense in which every event has many causes, innumerable causes, and there are certain effects that admit, and others that require, the cooperation of more than one cause to bring them about. These we will examine in their turn.

II. The Regression of Causes and the Progression of Effects.

A cause is an action in certain conditions upon a thing: an effect is a change or unchange in the thing acted on, and leads to a result. In the physical world, action means the transfer or liberation of energy. It is now a commonplace that energy neither appears out of nothing nor disappears into nothing, but that every manifestation of energy is the release of energy from store or its transfer from one thing to another. If it is expended from store, then at some past time it must have been put into store by some action or other. If it is transferred from place to place, such transfer is action, and action was as necessary to put it into the place from which it comes as to put it into the place to which it goes. In short, action, which is cause, is also always either effect or result. It is always produced by previous action.

The action of the pig in getting over the stile was caused by the action of the dog in biting him. The action of the dog was caused by the action upon it of the stick. The action of the stick was caused by the action of the fire, which was caused by the action of the water, which was caused by the action of the ox, which was caused by the action of the butcher, and so back to the action of the cat. There was a continuous regression of causes from the last effect to the first action; and a continuous progression of effects from the first action to the last effect.

What is true of this dramatic and perhaps fictitious series is true of every other case of cause and effect. The actions stretch backwards in series as far as we like to trace them, or can trace them; and the effects proceed forwards down to the

present moment in which, as actions, they are carrying on the chain of effects into a futurity of indefinite duration.

The motion of a train is the effect of the action of the wheels upon the rails, which is the effect of the action of the piston-rods on the cranks, which is the effect of the expansion of steam in the cylinders, which is the effect of heat upon the water in the boiler, which is the effect of the combustion of the coal, which is the effect of the action of the fireman in lighting and stoking, which is the effect of the action of his immediate superior in giving the order, which is the effect of the action of his superior, and so back to the directors, whose action is determined by the action of the travelling public in demanding means of travelling, which is determined in the long-run by the action of their predecessors in building up the complicated structure of the nation with its needs for travel; and so we might, if we had the knowledge and patience, pursue the series of actions back to the time when men first wandered into this country, to the time when men first were, to the beginnings of life, to the beginnings of the solar system, and further back *ad infinitum*. In this long precession every action was caused by some previous action, and produced, as its effect, a subsequent action; and the same is true of every other cause of change and of every other change. Action once taken goes on producing its effects in succession for ever.

It is a commonplace that the institutions of a nation are the results of the past history of that nation. The Napoleonic wars, the Revolution, the revocation of the Edict of Nantes, the Great Rebellion, the discovery of America, the Hundred Years' War, the Norman, Saxon, Danish, and Roman invasions, have each and all contributed to making our institutions what they are, and to making us what we are. If Julius Cæsar had not invaded Britain, I should not now be writing on the Regression of Causes, and should probably never have been born.

It is evident, therefore, that although the phrase 'Plurality of Causes,' in the sense in which Mill used it, was a misnomer, and rests upon a confusion of thought, yet there is a sense in which every effect has a plurality of causes—has an indefinitely great multitude of causes, stretching back in continuous series to infinity of past time.

III. The Radification of Causes.—Indirect Causes.

There is more than this, however. The series is not the simple series that has just been sketched. It is a complicated web of infinite intricacy. To take a very simple case, the birth of every child is the effect, and the child is the result, of the actions of its two parents. Two actions were necessary to the production of the effect. The birth of each of these parents was the effect of similar actions on the part of the grandparents, and the parents are the results of these actions, so that in the second generation upwards there were four causes. In the third there were eight, in the fourth sixteen, and at every step backwards, with every preceding generation, the number of causes increases in geometrical progression until it is controlled by the intermarriage of descendants of the same pair. But for this, the number of causes, even in historical times, would be unimaginably great.

It is the same with all other effects. An effect is produced by action upon a certain thing in certain conditions; and for the production of the effect, the thing and the conditions are just as necessary as the action that is the immediate cause. This thing and these conditions are themselves the results of causes, which are therefore also necessary to the effect. In order to produce the discharge of a gun, it is necessary to pull the trigger. This action is the cause of the discharge. It is the direct and approximately immediate cause; but every action that went to build up the conditions necessary for the discharge was a cause, more or less remote, more or less indirect, of the discharge. A necessary condition of the discharge is that the hammer should be at full cock. The action of cocking the gun was the direct and immediate cause of this result, and as the result is a condition of the discharge, the cause of this condition is a cause of the discharge; an indirect cause, but still a cause, and a cause not very remote. Anyone who is accustomed to scrutinize carefully the meaning of words must feel a certain incongruity in speaking of the cocking of a gun as the cause of its discharge; but I think that the incongruity is much diminished, if indeed it is not altogether removed, but calling it an indirect cause. We may, I think, formulate the following definition:—

An Indirect Cause is a cause of a condition.

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Though the trigger is pulled with the hammer at cock, the gun will not be discharged unless it is loaded. The presence of the cartridge in the barrel is a condition of the discharge, and the action of loading the gun is the cause of the gun being loaded, a result which becomes, with respect to the discharge, a condition of the effect. The cause of this result, the loading of the gun, is therefore another indirect cause of its discharge.

It is a condition of the discharge of the gun on the pulling of the trigger that the mechanism of the lock should exist in good order: and the actions of making the lock, nay, on the same principle, all the actions involved in making the gun, are indirect causes of the discharge of the gun. There is more than this, however. The gun is made of certain materials; and the existence at hand of these materials is a necessary condition of making the gun. The actions by which these conditions were brought about, by which the materials were made, prepared, and collected, are all indirect causes of the discharge of the gun, and causes that are not only indirect, but remote also. And so we may go back to the growth of the tree of which the stock was made, to the deposit of the ore from which the metal was extracted, to the covering by alluvium of the forests which became the coal wherewith the ore was smelted, to the growth of these forests, and as much further back as we please. All these are causes, more and more remote, more and more indirect, of the discharge of the gun.

The action of pulling the trigger is a direct cause of the discharge of the gun, but it is not the only direct cause. The pulling of the trigger caused the fall of the hammer, which caused the explosion of the detonator, and each of these actions was a direct cause of the discharge of the gun. The soldier had orders to fire as soon as the enemy should come within a certain distance. The action of the officer in giving the order was a cause of his pulling the trigger, and so a direct, but a mediate cause of the discharge of the gun. The action of the enemy in coming within the stated distance was another direct cause, but a mediate cause, of the discharge; and all the actions that led up to these causes were causes of the discharge itself, direct causes, but causes more and more remote as the number of actions between the cause

and the ultimate effect increases. Thus we may carry the line of direct causes back, through the orders of intermediate officers on both sides to those of the generalissimos; to the causes of the war; to the multitudinous actions of the members of the nations at war that produced their antagonism; and so on. We have already seen that at a very early stage the line of direct causes divides into two, the actions of the soldier's superiors on the one side, and the actions of the enemy on the other; and it would be easy to show that at each step backwards the causes multiply like the ancestry of every individual man, until at length they become unimaginably multitudinous. They still remain direct causes, however remote they may become, as long as action produces action, and the line is not interrupted by the interposition of a condition.

It is manifest from these examples that both the direct and the indirect causes ramify, or rather radify (for causes are evidently rather the roots than the branches of effects), as we go backwards from the effect; and that the further back we go, the more numerous they become. The conditions may be many, and each may have many causes, depending on other conditions, which again may be many, and so on. The direct causes go back in series to an indefinitely remote past; and not in single series, but in series that spread like the spokes of a fan, and that divide and redivide and radify indefinitely.

Yet out of all these different series of innumerable causes, both direct and indirect, it is usual to select one, and to call it *the* cause. On what principle is this selection made? What, for instance, is the cause of the kettle boiling over? The action of the fire, says the master. Leaving the kettle too long on the fire, says the mistress. The neglect of the kitchenmaid, says the cook. The cook sending me upstairs, says the kitchenmaid. The cook's forgetfulness in leaving her apron upstairs, says the housekeeper. Every one of them is right. Each of these is *a* cause; but which is *the* cause?

It may seem that, strictly speaking, we should limit *the* cause to the direct immediate cause, to the action that is nearest to the effect and immediately precedes it; as for instance, in the case of the discharge of the gun to the pulling of the trigger. But we find upon trial that this will not do. In fact we very often assume, as the cause, an action that

by no means immediately precedes the effect; and in fact we often do not know the immediate cause, and when we do know it, we often do not take it into consideration. It seems at first blush that the pulling of the trigger is the immediate cause of the discharge of the gun, but a moment's thought shows that it is not. Between the immediate cause and the effect nothing can intervene, nothing can interpose; but the trigger acts through the medium of the mechanism of the lock, and if this mechanism is impaired, the discharge may not follow. After passing through the mechanism of the lock the action must reach the hammer, and cause it to fall; and the action of the hammer is more nearly immediate than that of the trigger. The fall of the hammer strikes the detonator, but even this is not quite immediate, for the detonator may not explode. The truly immediate cause of the discharge is the explosion of the detonator, but this is never spoken of as the cause of the discharge, and is rarely thought of as the cause. We may put immediacy on one side, therefore: it does not determine us in fixing on the cause. Even apparent immediacy does not determine us, for we may as legitimately look upon the order to fire as the cause of the firing as the pulling of the trigger. What then should, and what does determine us in fixing upon one among the innumerable causes of an effect, and calling it *the* cause?

It depends entirely upon the purpose in view, that is, upon the aspect of the matter in which we are interested. The master, the mistress, the cook, the kitchenmaid, and the housekeeper are each of them right about the cause of the kettle boiling over, but they all look at it from different points of view, and for different purposes. The master looks at the matter from the point of view of the physicist, and to him the cause is the physical cause, which happens also to be the immediate cause. The women all look at the matter from the point of view of responsibility, and for the purpose of fixing the responsibility. According to the mistress, the cause was such that someone was responsible. The cook seizes upon the cause that makes the kitchenmaid responsible. The kitchenmaid selects the cause that throws responsibility upon the cook; and the housekeeper chooses the cause that not only supports the kitchenmaid but throws a double measure of responsibility on the cook.

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During shooting at the butts, a trespasser gets into the line of fire, and is killed by a bullet. What is the cause of his death? That depends entirely on the point of view and the purpose of the person who makes the enquiry. To the physiologist it is arrest of the heart's action; to the pathologist it is the effusion of blood round the heart which stopped the heart's action; to the student of ballistics it is the low trajectory of the bullet; to the marksman it was the force of the wind, which deflected the bullet from the line of aim; to the ammunition expert it is the issue of the new light bullet, which yields more to the force of the wind than the men are accustomed to; to the squad instructor it was the failure of the marksman to respond promptly enough to the order 'Cease fire'; to one leader-writer it is the deplorable carelessness of the soldier; to another it is the stupidity of the civilian in crossing the line of fire; and so we could go on multiplying causes *ad infinitum*. The fact is that everyone of these may quite legitimately be considered a cause, but if we ask which is *the* cause it is evidently quite impossible to reply until we know for what purpose the question is asked. Is it to fix responsibility? Is it to prevent similar effects in future? Is it to determine the mode of flight of the new bullet? Is it to clear up a nice point in pathology? It may be any of these, and according to the purpose of the argument will be the answer to the question What was the cause?

IV. The Cooperation of Causes.

Every effect is, as we have seen, the product of a long and complicated web of causes stretching back into infinity, all of which are necessary to produce the effect; and therefore every effect is in a sense due to a cooperation of causes. There are, however, cases in which an effect is due in a special sense to a cooperation of causes. We have found that it is a frequent and a legitimate practice to single out one of the multitude of causes to which a given effect is due, and to call that *the* cause, which it is from a certain point of view, and for a particular purpose. We call it *the* cause, because it is that one of the causes in which we are for some purpose interested, and because on that account we allow our contemplation to rest upon it to the ignoring of the rest. Just in the same way, and for a purpose, we may select from a series

of causes a certain length of the series, comprising a certain number of successive causes, and limiting or extending our contemplation to them, we may regard them as in a special sense the causes of the effect; and in such a case we regard them as cooperating more closely and more specially with one another to produce the effect than the other causes, which, for the purpose in hand, we leave out of our consideration. Or two actions may simultaneously take place on one body, so that the changes they severally produce are merged and blended in a single change; and then we naturally contemplate them in association with each other, and regard them as cooperating to produce that change. Every effect is in fact due to the cooperation of many causes, direct and indirect, immediate and remote; but according to the purpose in hand we limit our contemplation to one, two, or a limited number.

Thus regarding them, we may make several classes of cooperating causes, according, first, as the causes we consider are like or unlike, and second, as they operate successively or simultaneously.

Cooperation of Like Causes in Succession.

An instance of like causes cooperating in succession to produce a certain effect is seen when a nail is driven home by repeated blows of a hammer. Each blow produces a certain effect on the nail, and drives it further in. In a sense, and from one point of view, it is the final blow only that drives the nail home; but if it is more convenient for any purpose to contemplate the operation as a whole, then we may regard, not each blow as driving the nail for a certain distance, but the whole series of blows as causes cooperating in producing the complete effect of driving the nail home.

Actions may be like in kind though they are unlike in sign. The action of paying money into the bank is like in kind to the action of drawing money out of the bank, since they are both transfers of money with reference to the bank; but they are unlike in sign, the one kind adding to the balance and the other diminishing it; but the two causes cooperate in succession to bring about the result, the amount of the bank balance.

Simultaneous Cooperation of Like Causes.

The flow of a large body of water from the upper reaches of a tidal river may coincide with an unusually high tide to produce in the lower reaches a flood, that would not have occurred but for the simultaneous cooperation of the two causes. The simultaneous rush of all the passengers to the side of the boat may cooperate to make the boat capsize. If a bullet or a bird flies across in front of a photographic camera at the moment the shutter acts, an image of the flying object will be formed upon the plate. If the actions are not simultaneous, no such effect will be produced.

Indifferent Cooperation of Like Causes.

Like causes may cooperate to produce an effect or a result independently of whether they act successively or simultaneously. If one force acts upon a body so as to move it to the north, and another equal force acts upon it for an equal time so as to move it to the east, the effect will be that the body will reach a certain point to the north-east, which will be the same whether the forces act simultaneously or in succession. If we add the two components of a Seidlitz powder to a glass of water, the effect is the same whether we add them simultaneously or successively.

Successive Cooperation of Unlike Causes.

When unlike causes cooperate in succession to produce an effect, it is almost always necessary that they should operate in a certain order; and unless this order of succession is strictly observed, the effect will not be produced. The great majority of effects and results that are produced by human agency are of this class. When a thing is to be made, the materials must first be provided, and then one operation after another is followed in a certain order, and the effect and the result are looked upon as due to the cooperation of all these processes. When bread is to be made, the flour and water are first provided, then the dough is mixed, then it is leavened, then kneaded, then allowed to rise, divided, and baked; and these operations must follow one another strictly in this order if the effect is to

be produced. The final effect, the production of bread, is due to the cooperation of the various causes in orderly succession. If any one is omitted, or done out of its turn, or bungled, the effect is spoilt, the result is a failure. And so whenever anything is made by art of man, it is made by certain actions in orderly succession, and the whole series of actions cooperate to produce the thing made. There is actually no break in the long chain of causes, direct and indirect, stretching back indefinitely into the past; nor in the long chain of effects and results stretching forward from the moment the thing was made; but the beginning and ending of the making form convenient artificial or conventional boundaries to the section of the chain to which we limit our contemplation. We must limit the scope of our contemplation, because of the limitation of our powers, which cannot grasp an indefinite length of chain; and boundaries must be placed somewhere; and the boundaries fixed by the beginning and ending of the making of a thing are apt for our purpose. In contemplating causes, no less than in every other operation of mind and body, we have a purpose in view, and it is their indifference to purpose, and their ignoring of it, that render the speculations of the philosophers described in the first Chapter so curiously detached, irrelevant, and pointless. Our purpose in investigating how a thing is made, or comes to be, is to make it or prevent its being made, to cause it or help it to be, or to prevent or hinder it being; or in any case to get some advantage out of our knowledge, even if it is only the advantage of satisfaction in knowing more than we did before. The only causes we need take into consideration are those that answer our purpose, whatever that may be: to consider more would only lead to confusion and embarrassment. That is why, in grouping together as cooperating causes the actions whereby a thing is made, or comes to be, we fix an arbitrary limit beyond which we do not at the moment go. We stop short at that stage, not because we imagine that the causes began at that stage, but because it is among the causes subsequent to that stage that we expect to find those that we can initiate, facilitate, hinder, or destroy. For the purpose in view, the group is a natural group, and the limits are convenient limits, and none the less so because for some other purpose we may find it desirable to extend or to contract them.

Simultaneous Cooperation of Unlike Causes.

Unlike as well as like causes may cooperate simultaneously or contemporaneously to produce an effect which, but for their simultaneous or contemporaneous cooperation, would not have been produced. Plants will not thrive except under the combined action of light, warmth, and moisture. Without light they will grow, but they will not thrive. Without some degree of warmth, varying with the nature and habits of the plant, it will not thrive, or even live; neither will it thrive if desiccation is carried beyond a certain point, or live if it is carried beyond a certain further point. Iron rusts under the simultaneous cooperation of moisture and of oxygen. In dry air it will not rust, though constantly in contact with oxygen. Immersed in water free from dissolved oxygen it will not rust, although it is kept constantly wet. It requires the simultaneous operation of the two causes to produce the effect. A man who refuses to do a thing under threat of punishment for non-performance, and refuses to do it for reward, may yet be induced to do it by combining the threat of punishment with the promise of reward. When a glass tube is held horizontally in a flame until it softens, it will bend; and the bending is the effect of the cooperating action of heat and gravity acting simultaneously. The running of a motor car, the action of an engine, are the effects of numbers of causes acting contemporaneously.

Indifferent Cooperation of Unlike Causes.

Finally, unlike causes may cooperate to produce an effect when it is immaterial in what order the causes act, or whether they act simultaneously or in succession. A business firm may be ruined by the cooperation of the defalcation of a clerk and the failure, either at the same time, or before, or after, of a debtor for a large amount. A man's death may be due to the cooperation of several diseases, which would have effectually killed him in whatever order they attacked him, together or successively. Rain and frost combine to produce the fall of a mass of earth from a cliff, and in what order they act upon the cliff is immaterial.

V. The Law of Universal Causation.

We are now done with the first of Dr. Fowler's propositions, and may consider the second, that every event has a cause. This is what is known as the Law of Universal Causation, and not only do logicians commonly confuse it, as Dr. Fowler points out, with the definition of cause, and with the Uniformity of Nature, but also it comprehends within itself four distinct problems which are usually confused together. They are as follows:—Does everyone believe that every event has a cause? If so, what is the warrant for the belief? Is it true? and How do we come by it?

In the first place, what is meant by an event? I think we may say without fear of objection that an event is that which happens, and inevitably implies a change; and as we have seen, the idea of change is necessarily bound up in the idea of effect. But changes are not the only effects. The prevention of change equally demands a cause for its existence; and, with some straining of the sense of words, unchanges may be included in events. Taking this to be the meaning of event, then it is evident that events are synonymous with effects; or, if unchanges be excluded from the denotation of events, then event is synonymous with one of the two classes of effect. The first question then becomes Does everyone believe that every effect has a cause? or Does everyone believe that a particular kind of effect has a cause? It seems to me that these questions must necessarily be answered in the affirmative. Effect implies cause, as husband implies wife, or any other relative implies its correlative. They are of course separable in thought, as, indeed, they are separable in fact, but, being correlative, their constant association in fact cannot be denied.

Moreover, I think there is abundant evidence that not only human beings, but many of the lower animals also, assume causation for every change which is a change to them—which is appreciated by them as change. Horses shy, dogs bark, birds and animals of various kinds rush away, when events occur to which they are unaccustomed, that is to say, which are out of their ordinary routine, and to them imply change. And I think we may safely assume that when horses shy and dogs bark at such things they do so because they apprehend danger, which

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is as much as to say that they have causation in their minds. They apprehend the causation of harm to themselves. In the same circumstances all timid animals either bolt, or conceal themselves, or behave otherwise in a way that indicates that they apprehend danger. In all such cases the change is viewed as the effect of some cause, and the cause of that effect may produce other effects, and effects detrimental to the witness. Of all the changes in surroundings that excite in both animals and man the danger reaction, none is more potent than an unexpected noise; and no one apprehends danger from noise. The apprehension is that, as there is a noise, there must be an agent to cause the noise, and that what has caused this effect may cause other effects. I think therefore that the evidence is that every man does believe that every event has a cause.

This opinion is corroborated by considering the way by which we come into possession of it. I do not say that it is the only way, but I do not think it can be disputed that the chief source of this belief is as follows:—Man, and all his ancestors throughout an immeasurable past, have lived by action; and every act of theirs has been an instance of causation. It has been an action on something, and has produced or prevented a change in the thing acted on. It has been a cause, and has produced an effect. Hence the notion of causation is in every individual of very early origin, and with respect to his own action is inescapable and perpetual. Contemporaneous with this enormous body of positive experience, is the negative experience, equally inescapable, and equally perpetual, that we cannot produce or prevent change in anything without acting on that thing, either directly or indirectly. Hence experience, from the dawn of consciousness to its last oblivion, perpetually enforces upon us the conviction that change or prevention of change cannot occur without action of or on the thing changed; in other words, that every event has a cause. I think, therefore, that the evidence warrants us in saying that everyone who is capable of forming the notion of causation does believe that every event has a cause, and that he derives this belief from experience. It may be well to point out that though I hold the empirical origin of this belief, I do not found it upon the supposition that the will is the cause of bodily movements.

Whether this is or is not a case of causation, it does not enter into the demonstration.

The next question is, Granted that we do entertain this belief, what is our warrant for it? The warrant has already been indicated. It is in experience. It is experience repeated with incalculable frequency without a single contrary instance. When I say without a single contrary instance, I do not mean that in every case of change or prevention of change we are able to assign a particular cause, or identify the cause; that of course would be directly contrary to experience. I mean that in no case of change or prevention of change that has ever occurred in experience are we able to exclude a cause, or to be certain that no cause has acted. As I have said elsewhere, this is the conclusive test of truth for us—that conduct founded upon a supposition never brings us up against experience that contradicts the supposition. This is the highest warrant we can have. Granted that the experience is obtainable, granted that actions on the supposition are incalculably numerous and diverse, then the fact that experience has never shown the supposition to be false, not merely warrants us in believing that it is true, but compels us to believe it is true. The belief is inescapable; and however strongly we may in words deny it, the first time we act we shall prove our belief in it by acting upon it.

The third of the four questions put at the beginning of this section was Is it true? Apart from our belief in it, is it true that every event has a cause? After the foregoing discussion, this question ceases to have any meaning. If we have in support of a supposition, and based upon it, incalculably numerous experiences, not one of which has ever contradicted the supposition, then *for us* that supposition is true. It is certain. We are precluded from doubting it. We may put together the words expressing a doubt, but those words have no answering relation in our minds. That every event has a cause is true in the sense that we cannot doubt it. Whether it is noumenally true we cannot know, and it would not matter if we did. It is true for us. It is true as far as we are concerned. To ask whether it is really true is to ask whether there is a higher degree of certainty than certainty itself—whether that which is true for us may not be false in some sense which we cannot clearly conceive, and with which

we are not concerned. The importance of knowledge is its influence upon conduct; and in the influence they respectively exert upon conduct there is no appreciable difference between that which is universally true to all men, at all times, in all places, and that which is noumenally true.

VI. The Uniformity of Nature.

The Axiom of Causation.

We are now arrived at the third of those propositions which Dr. Fowler justly says few writers have not more or less confounded, that the same cause is always attended with the same effect. Dr. Fowler calls this the Law of the Uniformity of Nature, and the title may as well be retained, though other writers use it in other senses. In this case again there are four different problems comprised in the one proposition; that is to say, Do men universally believe that the same cause is always attended by the same effect? If so, How do they come to believe it? Is it true? and What is their warrant for believing it?

Does every man believe 'that the same cause is always attended by the same effect'? This is the way in which the problem is stated by Dr. Fowler, but Mill puts it differently, and few writers seem to appreciate the difference. Mill puts it that every consequent has an invariable antecedent; by which he probably means that the same effect is always due to the same cause; which is the converse of Dr. Fowler's problem; and as we have seen, Mill says this although he has a whole Chapter on the Plurality of Causes, by which he means that the same effect may be due to very different causes.

It is clear that the answers to both of these questions must depend upon the definitions that we adopt of cause and effect, and will be very different if we adopt one definition from what they will be if we adopt another; but most of all they will be influenced by our definition of the word 'same,' which most writers on this subject, I think I may say all, interpret so that it includes 'different.' It is perhaps this uncertainty about the meaning of the chief terms employed that is responsible for the differences of different writers on the subject.

Some assert that Nature is uniform; some deny that Nature is uniform; some neither assert nor deny it; some, like Mill, both assert and deny it; and few of them mean by it the same thing. In this chaos I shall follow Dr. Fowler, who does at any rate say clearly what he means in this, as in most things.

His reading of the Law of the Uniformity of Nature is that the same cause is always attended by the same effect. Is this true? As I have already said, it depends on what we mean by the chief terms employed. If a cause means the invariable antecedent of an effect, and if an invariable antecedent means an antecedent that is the same in every case, then whether or no the same effect always is attended by the same cause, it does not follow that the same cause is always attended by the same effect, and Mill's Plurality of Causes forbids us to suppose that it does. In Mill's sense of cause, therefore, Nature is certainly not uniform in Dr. Fowler's sense. Whether it is uniform in Mill's sense we cannot tell, for Mill muddles up the Uniformity of Nature with the Law of Universal Causation. To Mr. Welton, cause and effect are the same thing, and in this meaning of the word 'cause' of course Nature is Uniform, for the same cause must always be attended by itself, which is the same effect; and the same effect must always be attended by the same cause—by itself. Professor Karl Pearson denies the existence of both cause and effect, but yet his expressions 'a routine of perceptions,' 'a routine of experience,' 'a routine of sense impressions' appear, when taken with their context, to mean what other writers mean by the Uniformity of Nature. If, however, there is no cause and no effect, of course there can be no Uniformity of Nature in Dr. Fowler's sense. Mr. Bertrand Russell's statement of 'causality' includes the assertion that there is a constant relation between the state of the universe at one instant, and a certain rate of change at that instant. The constancy of the relation would seem to imply that the nature of the universe is uniform; but as Mr. Russell denies that the law of causality (whether his own or only that of others I do not know) is anything but a relic of a bygone age, it would seem that he does not admit that Nature is uniform in Dr. Fowler's sense. All that Dr. McTaggart can conclude after an exhaustive discussion is

that it is impossible to prove empirically that the law does not hold universally. Here I will leave the authorities, and discuss the matter on the basis of my own definitions.

Does the same cause always produce the same effect? That is the problem we have to solve. According to my first provisional definition, a cause is an action. Does the same action always produce the same effect? Take the blow of a hammer for instance: does the blow of a hammer produce the same effect whether it falls on the head of a nail, or the side of a bell, or a man's fingers, or a bale of wool, or a sheet of water? Clearly, in this sense of the word 'cause' the same cause does not always produce the same effect, and Nature is not uniform. But this definition of cause was provisional only. It was subsequently elaborated into this: that a cause is an action upon a thing; and the question now becomes Does the same action on the same thing always produce the same effect? Again let us take our hammer and strike with it our sheet of water. The effect is a splash. Now let the same water be frozen, and let us strike it again. The same effect is not produced. It may be objected that the thing on which the cause acts is no longer the same thing, but it is quite arguable that it is the same thing. It is certain, however, that it is not for the purpose of the argument the same thing. Then in what respect does it differ? Liquidity and solidity are, for the purpose of the argument, passive states of the thing acted on by the cause, and according to the definition already given, a passive state of the thing acted on by the cause is a condition. It is evident, therefore, that the question we are discussing, Does the same cause always produce the same effect? must be answered in the negative unless we amend it by inserting a reference to the conditions; and the question ought to be put in the form Does the same cause in the same conditions always produce the same effect? But this is an instance of the fallacy erroneously called the fallacy of many questions, which should be called, as it is called in my *New Logic*, the fallacy of the previous question. It implies that a previous question, which has not been answered, has been answered. It implies that the same action can take place for a second time upon the same thing in the same conditions; and this is not only impossible, but is acknowledged to be impossible by many of those who insist that the same cause always, or as they say invariably, produces the same effect.

Πάντα ῥεῖ, 'All existence,' says Mr. Welton for instance, 'is continuous and uninterrupted transition,' and 'uniformity itself is not to be taken to mean resemblance. It is in identity alone, not in mere resemblance, that we can find a firm basis of inference.' But if all existence is continuous and uninterrupted transition, or change, it is clear that a state of things once passed can never in all respects be reproduced, unless time should flow backwards, and of this we have no experience; and it is a commonplace that the same state of things never is reproduced. To get the same effect, the same cause must act on the same thing in the same conditions, and the cause is never the same, the thing is never the same, and the conditions are never the same. Therefore *cadit quæstio.* In this sense, there is certainly no such thing as Uniformity in Nature.

Yet the aphorism that the same cause invariably produces the same effect, clumsily though it is asserted, and untrue though it is, is the adumbration of a truth, and of a most valuable truth. It is not true in any sense that the same cause invariably produces the same effect; but if we recognise what logicians are groping after, and put it into precise and accurate language, we can assert a very important truth, upon which all our methods but one of ascertaining causes are founded, a truth without which but few causes would ever be discovered. It is this, that *Like actions on like things in like conditions produce like effects;* and *The more nearly alike the actions, the things acted on, and the conditions, the more closely alike will the effects be.* We may put the same thought more concisely in the following aphorism:—*Like causes in like conditions produce like effects.*

I do not think this aphorism needs proof. I doubt whether it is susceptible of proof. It seems to me to be an axiom. As soon as its meaning is grasped, it claims and secures our assent. Its contradictory, if not actually inconceivable, is certainly incredible. Whether its truth is manifest *a priori* or is based upon experience I do not care to speculate. The universal experience of mankind goes to show that, whether of empirical origin or not, it is empirically true; and if we like to call it an instance, or an example, or a proof, of the Uniformity of Nature, I don't know that any harm will be done—or any good. We may, if we please, call it a proof of the Uniformity of Nature, just as we may call the axiom that things that are equal to the same thing are equal to one another, and the axiom that two

straight lines cannot enclose a space, proofs or examples of the Uniformity of Nature.

Whether it is or is not the principle of the Uniformity of Nature, or an example or a proof of this principle, the aphorism is the fundamental Axiom of Causation, and upon it all our reasonings about causation are founded, and all but one of our means of ascertaining causes are based. In practice it is one of the most important guides of life, and is employed continually throughout life by everyone, either in the fundamental form in which it has been stated, or in one or other of its very numerous variants and derivatives. Of these, that which is perhaps most frequently employed is the axiom *Like effects in like conditions are due to like causes;* but as I have said, the derivatives are numerous, and every one of them is of frequent application. It would be tedious to cite them all, but the following are samples, and we may, if we please, call each of them an instance or a statement of the Uniformity of Nature.

Like causes in like conditions produce like effects.
Like causes in unlike conditions produce unlike effects.
Unlike causes in like conditions produce unlike effects.
Like effects in like conditions are due to like causes.
Unlike effects in like conditions are due to unlike causes.
If like causes produce like effects the conditions are alike.
If like causes produce unlike effects the conditions are unlike.
And so on.

Summary.

There is no such thing as Plurality of Causes in Mill's sense. What he meant was that in different cases different causes produce different effects that have some element in common, and this common element he called the effect, and said that it might have many causes. His error was in generalising the effects without generalising the causes.

But every effect is due to a series of causes stretching back into infinity.

And this series is not single, but every effect requires both a cause and conditions, and the conditions are themselves the results of causes; every effect is therefore due to an indefinitely large number of series of causes converging on the effect.

The cause of a condition is an indirect cause.

The cause of a cause is a direct, but more or less remote cause.

The cause of an effect is that cause in which for a certain purpose we are most interested.

To produce an effect, causes may cooperate in any of the following ways.

Like causes may cooperate in succession, simultaneously, or indifferently.

Unlike causes may cooperate in succession, and then must preserve a certain order; or simultaneously; or indifferently.

The Law of Universal Causation has, in the books, several incompatible meanings. It appears to be indisputable that we believe that every event has a cause, and that this belief is shared with us by many of the lower animals. This belief is founded upon the constancy of our experience, and is true, or at any rate is inescapable.

The Law of the Uniformity of Nature, as stated in the books, is nonsense. Neither the same cause nor the same effect is ever repeated. The true Axiom of Causation is that Like causes in like conditions produce like effects, and the more closely alike the causes and the conditions, the more closely alike will be the effects. On this axiom all our reasonings with respect to causation are founded.

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CHAPTER VI.

METHODS OF ASCERTAINING CAUSES.

WHEN we have discovered an action upon the thing changed or maintained unchanged, and have determined that the action precedes the change or accompanies the unchange, we have still not ascertained the cause; we have only cleared the ground in preparation for doing so. The cause is not ascertained until we have established a necessary connection between the action and the effect. This is what Mill's Methods of Experimental Enquiry are designed to secure. Mill assumed, and the assumption is adopted from him by subsequent writers on the subject, that the only way to discover causes is by experiment, and that the only aim of experiment is to discover causes. Both assumptions are manifestly and transparently false, and are contradicted by everyday experience. Some of the methods described by Mill himself as experimental are not experimental, indeed he admits that one of them is not; and some of the instances he gives of the determination of causes are instances of the determination not of the causes of things, but of their existence, or their nature.

Logicians as a rule know nothing of natural science except what they mug up for the purpose of finding instances wherewith to illustrate Mill's five methods, which he and they all call four. They have therefore no means of knowing whether these methods are used or not; but they accept Mill's confident assertion that in scientific investigations these methods and no others are used. But though logicians know nothing of natural science or of its methods except what they learn from Mill, they cannot help, in common with the rest of the world, assigning causes for the various events they meet with in their daily lives; nor can they help seeing that in thus ascertaining causes, none of Mill's methods is ever used. They naturally conclude that the methods of science and the methods of daily life are utterly and totally different; that when a man enters his observatory or his laboratory he strips himself at the door of all the methods he is accustomed to use, and employs an

entirely new set, a set of methods that are mysterious, recondite, and complicated, that logicians regard with awe, and do not venture to criticise. To these methods they give the name of the Logic of Science, and they suppose that non-scientific people have to be satisfied with a different and very inferior Logic. This is all moonshine.

I assert, and the present chapter is designed to prove, that the methods by which scientific men ascertain the causes of those phenomena that are called scientific are precisely and exactly the same as those by which the cook ascertains the cause of the dinner being spoilt, and the child ascertains the cause of its toy being broken. I assert, and will presently prove, that the methods so clumsily and uncouthly described by Mill are in fact never employed; that they never could be employed, for they are absurd, and when applied to actual cases result in futility; and I assert that when we seek to ascertain the causes of things, and when we do ascertain them, we look for an action upon the thing on which the effect is produced, that is, on the thing changed or maintained unchanged; and we are guided in our search, as well as determined in our choice, by one or more of the following considerations:—

I. Instant sequence of the effect on the action.

II. Subsumption of the case in hand under a general law.

III. Assimilation of the case in hand to a known case of causation.

IV. Association of the action with the effect.

V. Concurrent and proportional variation of the action and the effect.

VI. Common rarity of the action and the effect.

VII. Correspondence of a quality in the effect with a quality in the agent.

VIII. Coincidence in space of an action or a condition with the effect.

IX. Coincidence in time of the action with the effect.

The fifth of these methods, that of establishing an association between the action and the effect, is further divisible into four subordinate methods; so that altogether there are at least twelve methods of ascertaining causation; and these we may now proceed to examine.

I. Instant Sequence.

When an action upon a thing is instantly followed by a change in that thing, we are irresistibly driven to conclude that the action is the cause of the change.

When a china cup falls to the ground and breaks at the instant of its impact on the ground, we do not need to witness 'two or more instances in which the phenomenon occurs' or 'two or more instances in which the phenomenon does not occur' before we can make up our minds that the action of the impact was the cause of the breakage. We are driven to the conclusion that this action was the cause of this effect; and the main, if not the only reason for our conclusion is the instant sequence of the effect on the action. As already said, the writers upon causation seem to think that causes never are attributed, and that there is no need for the discovery of causes, except in the laboratory or the observatory, or in matters that are called, with more or less justice, scientific. There was never a greater mistake. We are all of us engaged daily, hourly, and almost momentarily, in the ascertainment and attribution of causes; and it is much more important to each of us in our lives to attribute causation correctly in matters that pertain to our immediate welfare, than that we should ascertain the causes of the perturbation of a planet, or of the mimicry of butterflies. Among the means by which we ascertain causes in our daily work, the instant sequence of an effect upon an action is perhaps the most frequent, and is by no means the least important. Nor is the employment of this means confined to trivial matters of daily occurrence. It is just as important and just as trustworthy in the laboratory. When the chemist adds one clear liquid to another, and a precipitate is instantly formed, he concludes at once that the addition of the reagent was the cause of the formation of the precipitate; and he forms this conclusion because of the instant sequence of the turbidity of the liquid on his action in adding the reagent.

If we see a match applied to a thing, or a blow struck upon it, and that thing instantly explodes, we attribute the explosion to the application of the match or the striking of the blow; and this we do without any need of two or more instances in which the phenomenon occurs, and two or more instances in

which it does not occur. The instant sequence of the change on the action assures us that they are effect and cause. Anyone quite ignorant of military evolutions who should see the troops alter their formation immediately on hearing a bugle call, would instantly regard the call as the cause of the movement. If we pour oil into the bearings of an engine, and the engine instantly increases its speed, or if we do the same to a foot-lathe, and the lathe instantly runs easier, we have no hesitation in attributing the change of speed, or the easier working, to the action of lubrication. If a horse's head is turned towards home, and he instantly improves his pace, we inevitably connect the improvement causally with the change of direction. If a bell rings or a whistle sounds in a factory, and the workmen all instantly drop their tools, we cannot help regarding the cessation from work as the effect of the sound; and similarly, when the air is thick with the chirruping of birds, if a gun is fired, instantly a dead silence ensues. We cannot help attributing the sudden occurrence of the silence to the report of the gun.

In some of these cases there may be other reasons which corroborate our judgment, and in fact our judgment of causation is seldom formed upon one method alone. Usually two or more methods corroborate one another, and the third method, the Method of Similarity, is seldom quite absent; but in others of the cases that have been instanced it is clear that the conclusion was based upon the instant sequence of the effect on the action, and upon no other method. One who had never before seen a galvanometer, and knew nothing of electric action, who should see the needle move the instant the key was depressed, could scarcely avoid attributing the change to the action.

Of course, the method is not infallible. In this imperfect world few methods are infallible. In some cases it needs corroboration or testing by some one or more of the other methods. But for all that, it is a method; it is a method that is constantly in use; it is a method that by itself may lead to a perfectly reliable conclusion; and it is a method that is not mentioned by any previous writer on the subject. Its fallibility is shown by the familiar instance by which a child is made to believe that he can cause the cover of a watch to fly open by blowing on it; but what is more important, the same instance shows how very early in life the conclusion is

thrust upon us, that a change that follows instantly upon an action is the effect of that action.

Mill and his commentators must each of them have used this method thousands of times, but they none of them record it, whether because it is difficult to put it into cumbrous and obscure language, or because they do not consider it sufficiently 'scientific,' I do not know.

II. Subsumption.

The second method of establishing a causal connection between an action and an effect is by subsuming the instance in hand under a general law. If this can be done, causal connection is assured, and neither Mill's Canons nor any other device is required to assure us of the necessary connection between the action and the effect.

Whether the tides were associated with the moon before the discovery of gravitation I do not know; but as soon as gravitation was discovered, and was applied to the action of the moon upon the seas, it must have become apparent at once that the moon's attraction must be the cause of tidal changes in the level of the seas; and if tides had never before been observed they would now be looked for. The action of the moon on the sea, and the sequent change in the level of the sea, are subsumed under the general causal law of gravitation, and this subsumption gives us the assurance that the action is the cause of the change.

When our waterpipes burst in winter, we find the cause at once by subsuming the case under the general law that water in freezing expands with immeasurable force; and by this subsumption the action of the frost and the bursting of the pipes are connected. When the cook goes to the cupboard for a pot of jam, and finds it is not there, she says at once 'Someone must have taken it.' She subsumes this instance under the general law that inanimate things do not move from their places without external agency. When the price of fish rises, and we hear of gales in the North Sea, we assume a causal connection between the action and the change, and we do so on the strength of the general law that, other things remaining the same, restriction of supply raises prices; and we know that gales in the North Sea do restrict the supply

of fish to this country. If the river overflows its banks, we assume, unless it is a tidal river, that there has been much rain in its catchment basin, and we make this assumption on the strength of the general law that *caeteris non mutandis*, the level of a river depends on the rainfall in the catchment area. If we find an object of gold or silver that shows signs of having been melted, we assume at once that it has been subjected to great heat, for it is a general law that great heat is necessary to the melting of gold and silver. If we find iron rusty, we assume that it must have been damp, for it is a general law that dry iron does not rust. When we are seeking the cause of a rare disease, and we find that it affects the members of several families in conformity with the laws of Mendel, we have no hesitation in concluding that the cause is hereditary transmission.

Neither in these cases do we look for two or more instances of the phenomenon, and ask if they have only one circumstance in common, nor do we look for two or more instances in which the phenomenon does not occur, and ask if they have nothing in common but the absence of the phenomenon. What we do is to subsume the case in hand as an instance under a general law applicable to such instances; and if the subsumption is good, then the causal connection is made out to our satisfaction This method, which is distinct enough in cases like the tides and the Mendelian inheritance of disease, is in other cases less pronounced, and graduates and merges into the next.

(To be continued.)

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