

Chapter XXV.

Of The Grounds Of Disbelief.

§ 1. The method of arriving at general truths, or general propositions fit to be believed, and the nature of the evidence on which they are grounded, have been discussed, as far as space and the writer's faculties permitted, in the twenty-four preceding chapters. But the result of the examination of evidence is not always belief, nor even suspension of judgment; it is sometimes disbelief. The philosophy, therefore, of induction and experimental inquiry is incomplete, unless the grounds not only of belief, but of disbelief, are treated of; and to this topic we shall devote one, and the final, chapter.

By disbelief is not here to be understood the mere absence of belief. The ground for abstaining from belief is simply the absence or insufficiency of proof; and in considering what is sufficient evidence to support any given conclusion, we have already, by implication, considered what evidence is not sufficient for the same purpose. By disbelief is here meant, not the state of mind in which we form no opinion concerning a subject, but that in which we are fully persuaded that some opinion is not true; insomuch that if evidence, even of great apparent strength (whether grounded on the testimony of others or on our own supposed perceptions), were produced in favor of the opinion, we should believe that the witnesses spoke falsely, or that they, or we ourselves if we were the direct percipients, were mistaken.

That there are such cases, no one is likely to dispute. Assertions for which there is abundant positive evidence are often disbelieved, on account of what is called their improbability, or impossibility. And the question for consideration is what, in the present case, these words mean, and how far and in what circumstances the properties which they express are sufficient grounds for disbelief.

§ 2. It is to be remarked, in the first place, that the positive evidence produced in support of an assertion which is nevertheless rejected on the score of impossibility or improbability, is never such as amounts to full proof. It is always grounded on some approximate generalization. The fact may have been asserted by a hundred witnesses; but there are many exceptions to the universality of the generalization that what a hundred witnesses affirm is true. We may seem to ourselves to have actually seen the fact; but that we really see what we think we see, is by no means a universal truth; our organs may have been in a morbid state; or we may have inferred something, and imagined that we perceived it. The evidence, then, in the affirmative being never more than an approximate generalization, all will depend on what the evidence in the negative is. If that also rests on an approximate generalization, it is a case for comparison of probabilities. If the approximate generalizations leading to the affirmative are, when added together, less strong, or, in other words, farther from being universal, than the approximate generalizations which support the negative side of the question, the proposition is said to be improbable, and is to be disbelieved provisionally. If, however, an alleged fact be in contradiction, not to any number of approximate generalizations, but to a completed generalization grounded on a rigorous induction, it is said to be impossible, and is to be disbelieved totally.

This last principle, simple and evident as it appears, is the doctrine which, on the occasion of an attempt to apply it to the question of the credibility of miracles, excited so violent a controversy. Hume's celebrated doctrine, that nothing is credible which is contradictory to experience, or at variance with laws of nature, is merely this very plain and harmless proposition, that whatever is contradictory to a complete induction is incredible. That such a maxim as this should either be accounted a dangerous heresy, or mistaken for a great and recondite truth, speaks ill for the state of philosophical speculation on such subjects.

But does not (it may be asked) the very statement of the proposition imply a contradiction? An alleged fact, according to this theory, is not to be believed if it contradict a complete induction. But it is essential to the completeness of an induction that it shall not contradict any known fact. Is it not, then, a *petitio principii* to say, that the fact ought to be disbelieved because the induction opposed to it is complete? How can we have a right to declare the induction complete, while facts, supported by credible evidence, present themselves in

opposition to it?

I answer, we have that right whenever the scientific canons of induction give it to us; that is, whenever the induction *can* be complete. We have it, for example, in a case of causation in which there has been an *experimentum crucis*. If an antecedent A, superadded to a set of antecedents in all other respects unaltered, is followed by an effect B which did not exist before, A is, in that instance at least, the cause of B, or an indispensable part of its cause; and if A be tried again with many totally different sets of antecedents and B still follows, then it is the whole cause. If these observations or experiments have been repeated so often, and by so many persons, as to exclude all supposition of error in the observer, a law of nature is established; and so long as this law is received as such, the assertion that on any particular occasion A took place, and yet B did not follow, *without any counteracting cause*, must be disbelieved. Such an assertion is not to be credited on any less evidence than what would suffice to overturn the law. The general truths, that whatever has a beginning has a cause, and that when none but the same causes exist, the same effects follow, rest on the strongest inductive evidence possible; the proposition that things affirmed by even a crowd of respectable witnesses are true, is but an approximate generalization; and--even if we fancy we actually saw or felt the fact which is in contradiction to the law--what a human being can see is no more than a set of appearances; from which the real nature of the phenomenon is merely an inference, and in this inference approximate generalizations usually have a large share. If, therefore, we make our election to hold by the law, no quantity of evidence whatever ought to persuade us that there has occurred any thing in contradiction to it. If, indeed, the evidence produced is such that it is more likely that the set of observations and experiments on which the law rests should have been inaccurately performed or incorrectly interpreted, than that the evidence in question should be false, we may believe the evidence; but then we must abandon the law. And since the law was received on what seemed a complete induction, it can only be rejected on evidence equivalent; namely, as being inconsistent not with any number of approximate generalizations, but with some other and better established law of nature. This extreme case, of a conflict between two supposed laws of nature, has probably never actually occurred where, in the process of investigating both the laws, the true canons of scientific induction had been kept in view; but if it did occur, it must terminate in the total rejection of one of the supposed laws. It would prove that there must be a flaw in the logical process by which either one or the other was established; and if there be so, that supposed general truth is no truth at all. We can not admit a proposition as a law of nature, and yet believe a fact in real contradiction to it. We must disbelieve the alleged fact, or believe that we were mistaken in admitting the supposed law.

But in order that any alleged fact should be contradictory to a law of causation, the allegation must be, not simply that the cause existed without being followed by the effect, for that would be no uncommon occurrence; but that this happened in the absence of any adequate counteracting cause. Now in the case of an alleged miracle, the assertion is the exact opposite of this. It is, that the effect was defeated, not in the absence, but in consequence of a counteracting cause, namely, a direct interposition of an act of the will of some being who has power over nature; and in particular of a Being, whose will being assumed to have endowed all the causes with the powers by which they produce their effects, may well be supposed able to counteract them. A miracle (as was justly remarked by Brown)(202) is no contradiction to the law of cause and effect; it is a new effect, supposed to be produced by the introduction of a new cause. Of the adequacy of that cause, if present, there can be no doubt; and the only antecedent improbability which can be ascribed to the miracle, is the improbability that any such cause existed.

All, therefore, which Hume has made out, and this he must be considered to have made out, is, that (at least in the imperfect state of our knowledge of natural agencies, which leaves it always possible that some of the physical antecedents may have been hidden from us) no evidence can prove a miracle to any one who did not previously believe the existence of a being or beings with supernatural power; or who believes himself to have full proof that the character of the Being whom he recognizes is inconsistent with his having seen fit to interfere on the occasion in question.

If we do not already believe in supernatural agencies, no miracle can prove to us their existence. The miracle

itself, considered merely as an extraordinary fact, may be satisfactorily certified by our senses or by testimony; but nothing can ever prove that it is a miracle; there is still another possible hypothesis, that of its being the result of some unknown natural cause; and this possibility can not be so completely shut out, as to leave no alternative but that of admitting the existence and intervention of a being superior to nature. Those, however, who already believe in such a being have two hypotheses to choose from, a supernatural and an unknown natural agency; and they have to judge which of the two is the most probable in the particular case. In forming this judgment, an important element of the question will be the conformity of the result to the laws of the supposed agent, that is, to the character of the Deity as they conceive it. But with the knowledge which we now possess of the general uniformity of the course of nature, religion, following in the wake of science, has been compelled to acknowledge the government of the universe as being on the whole carried on by general laws, and not by special interpositions. To whoever holds this belief, there is a general presumption against any supposition of divine agency not operating through general laws, or, in other words, there is an antecedent improbability in every miracle, which, in order to outweigh it, requires an extraordinary strength of antecedent probability derived from the special circumstances of the case.

§ 3. It appears from what has been said, that the assertion that a cause has been defeated of an effect which is connected with it by a completely ascertained law of causation, is to be disbelieved or not, according to the probability or improbability that there existed in the particular instance an adequate counteracting cause. To form an estimate of this, is not more difficult than of other probabilities. With regard to all *known* causes capable of counteracting the given causes, we have generally some previous knowledge of the frequency or rarity of their occurrence, from which we may draw an inference as to the antecedent improbability of their having been present in any particular case. And neither in respect to known nor unknown causes are we required to pronounce on the probability of their existing in nature, but only of their having existed at the time and place at which the transaction is alleged to have happened. We are seldom, therefore, without the means (when the circumstances of the case are at all known to us) of judging how far it is likely that such a cause should have existed at that time and place without manifesting its presence by some other marks, and (in the case of an unknown cause) without having hitherto manifested its existence in any other instance. According as this circumstance, or the falsity of the testimony, appears more improbable--that is, conflicts with an approximate generalization of a higher order--we believe the testimony, or disbelieve it; with a stronger or a weaker degree of conviction, according to the preponderance; at least until we have sifted the matter further.

So much, then, for the case in which the alleged fact conflicts, or appears to conflict, with a real law of causation. But a more common case, perhaps, is that of its conflicting with uniformities of mere co-existence, not proved to be dependent on causation; in other words, with the properties of Kinds. It is with these uniformities principally that the marvelous stories related by travelers are apt to be at variance; as of men with tails, or with wings, and (until confirmed by experience) of flying fish; or of ice, in the celebrated anecdote of the Dutch travelers and the King of Siam. Facts of this description, facts previously unheard of, but which could not from any known law of causation be pronounced impossible, are what Hume characterizes as not contrary to experience, but merely unconformable to it; and Bentham, in his treatise on Evidence, denominates them facts disconformable *in specie*, as distinguished from such as are disconformable *in toto* or *in degree*

In a case of this description, the fact asserted is the existence of a new Kind; which in itself is not in the slightest degree incredible, and only to be rejected if the improbability that any variety of object existing at the particular place and time should not have been discovered sooner, be greater than that of error or mendacity in the witnesses. Accordingly, such assertions, when made by credible persons, and of unexplored places, are not disbelieved, but at most regarded as requiring confirmation from subsequent observers; unless the alleged properties of the supposed new Kind are at variance with known properties of some larger kind which includes it; or, in other words, unless, in the new Kind which is asserted to exist, some properties are said to have been found disjoined from others which have always been known to accompany them; as in the case of Pliny's men, or any other kind of animal of a structure different from that which has always been found to co-exist with animal life. On the mode of dealing with any such case, little needs be added to what has been

said on the same topic in the twenty-second chapter.(203) When the uniformities of co-existence which the alleged fact would violate, are such as to raise a strong presumption of their being the result of causation, the fact which conflicts with them is to be disbelieved; at least provisionally, and subject to further investigation. When the presumption amounts to a virtual certainty, as in the case of the general structure of organized beings, the only question requiring consideration is whether, in phenomena so little understood, there may not be liabilities to counteraction from causes hitherto unknown; or whether the phenomena may not be capable of originating in some other way, which would produce a different set of derivative uniformities. Where (as in the case of the flying fish, or the ornithorhynchus) the generalization to which the alleged fact would be an exception is very special and of limited range, neither of the above suppositions can be deemed very improbable; and it is generally, in the case of such alleged anomalies, wise to suspend our judgment, pending the subsequent inquiries which will not fail to confirm the assertion if it be true. But when the generalization is very comprehensive, embracing a vast number and variety of observations, and covering a considerable province of the domain of nature; then, for reasons which have been fully explained, such an empirical law comes near to the certainty of an ascertained law of causation; and any alleged exception to it can not be admitted, unless on the evidence of some law of causation proved by a still more complete induction.

Such uniformities in the course of nature as do not bear marks of being the results of causation are, as we have already seen, admissible as universal truths with a degree of credence proportioned to their generality. Those which are true of all things whatever, or at least which are totally independent of the varieties of Kinds, namely, the laws of number and extension, to which we may add the law of causation itself, are probably the only ones, an exception to which is absolutely and permanently incredible. Accordingly, it is to assertions supposed to be contradictory to these laws, or to some others coming near to them in generality, that the word impossibility (at least *total* impossibility) seems to be generally confined. Violations of other laws, of special laws of causation, for instance, are said, by persons studious of accuracy in expression, to be impossible *in the circumstances of the case*; or impossible unless some cause had existed which did not exist in the particular case.(204) Of no assertion, not in contradiction to some of these very general laws, will more than improbability be asserted by any cautious person; and improbability not of the highest degree, unless the time and place in which the fact is said to have occurred, render it almost certain that the anomaly, if real, could not have been overlooked by other observers. Suspension of judgment is in all other cases the resource of the judicious inquirer; provided the testimony in favor of the anomaly presents, when well sifted, no suspicious circumstances.

But the testimony is scarcely ever found to stand that test, in cases in which the anomaly is not real. In the instances on record in which a great number of witnesses, of good reputation and scientific acquirements, have testified to the truth of something which has turned out untrue, there have almost always been circumstances which, to a keen observer who had taken due pains to sift the matter, would have rendered the testimony untrustworthy. There have generally been means of accounting for the impression on the senses or minds of the alleged percipients, by fallacious appearances; or some epidemic delusion, propagated by the contagious influence of popular feeling, has been concerned in the case; or some strong interest has been implicated--religious zeal, party feeling, vanity, or at least the passion for the marvelous, in persons strongly susceptible of it. When none of these or similar circumstances exist to account for the apparent strength of the testimony; and where the assertion is not in contradiction either to those universal laws which know no counteraction or anomaly, or to the generalizations next in comprehensiveness to them, but would only amount, if admitted, to the existence of an unknown cause or an anomalous Kind, in circumstances not so thoroughly explored but that it is credible that things hitherto unknown may still come to light; a cautious person will neither admit nor reject the testimony, but will wait for confirmation at other times and from other unconnected sources. Such ought to have been the conduct of the King of Siam when the Dutch travelers affirmed to him the existence of ice. But an ignorant person is as obstinate in his contemptuous incredulity as he is unreasonably credulous. Any thing unlike his own narrow experience he disbelieves, if it flatters no propensity; any nursery tale is swallowed implicitly by him if it does.

§ 4. I shall now advert to a very serious misapprehension of the principles of the subject, which has been

committed by some of the writers against Hume's Essay on Miracles, and by Bishop Butler before them, in their anxiety to destroy what appeared to them a formidable weapon of assault against the Christian religion; and the effect of which is entirely to confound the doctrine of the Grounds of Disbelief. The mistake consists in overlooking the distinction between (what may be called) improbability before the fact and improbability after it; or (since, as Mr. Venn remarks, the distinction of past and future is not the material circumstance) between the improbability of a mere guess being right, and the improbability of an alleged fact being true.

Many events are altogether improbable to us, before they have happened, or before we are informed of their happening, which are not in the least incredible when we are informed of them, because not contrary to any, even approximate, induction. In the cast of a perfectly fair die, the chances are five to one against throwing ace, that is, ace will be thrown on an average only once in six throws. But this is no reason against believing that ace was thrown on a given occasion, if any credible witness asserts it; since though ace is only thrown once in six times, *some* number which is only thrown once in six times must have been thrown if the die was thrown at all. The improbability, then, or, in other words, the unusualness, of any fact, is no reason for disbelieving it, if the nature of the case renders it certain that either that or something equally improbable, that is, equally unusual, did happen. Nor is this all; for even if the other five sides of the die were all twos, or all threes, yet as ace would still, on the average, come up once in every six throws, its coming up in a given throw would be not in any way contradictory to experience. If we disbelieved all facts which had the chances against them beforehand, we should believe hardly any thing. We are told that A. B. died yesterday; the moment before we were so told, the chances against his having died on that day may have been ten thousand to one; but since he was certain to die at some time or other, and when he died must necessarily die on some particular day, while the preponderance of chances is very great against every day in particular, experience affords no ground for discrediting any testimony which may be produced to the event's having taken place on a given day.

Yet it has been considered by Dr. Campbell and others, as a complete answer to Hume's doctrine (that things are incredible which are *contrary* to the uniform course of experience), that we do not disbelieve, merely because the chances were against them, things in strict *conformity* to the uniform course of experience; that we do not disbelieve an alleged fact merely because the combination of causes on which it depends occurs only once in a certain number of times. It is evident that whatever is shown by observation, or can be proved from laws of nature, to occur in a certain proportion (however small) of the whole number of possible cases, is not contrary to experience; though we are right in disbelieving it, if some other supposition respecting the matter in question involves, on the whole, a less departure from the ordinary course of events. Yet on such grounds as this have able writers been led to the extraordinary conclusion, that nothing supported by credible testimony ought ever to be disbelieved.

§ 5. We have considered two species of events, commonly said to be improbable; one kind which are in no way extraordinary, but which, having an immense preponderance of chances against them, are improbable until they are affirmed, but no longer; another kind which, being contrary to some recognized law of nature, are incredible on any amount of testimony except such as would be sufficient to shake our belief in the law itself. But between these two classes of events, there is an intermediate class, consisting of what are commonly termed Coincidences: in other words, those combinations of chances which present some peculiar and unexpected regularity, assimilating them, in so far, to the results of law. As if, for example, in a lottery of a thousand tickets, the numbers should be drawn in the exact order of what are called the natural numbers, 1, 2, 3, etc. We have still to consider the principles of evidence applicable to this case: whether there is any difference between coincidences and ordinary events, in the amount of testimony or other evidence necessary to render them credible.

It is certain that on every rational principle of expectation, a combination of this peculiar sort may be expected quite as often as any other given series of a thousand numbers; that with perfectly fair dice, sixes will be thrown twice, thrice, or any number of times in succession, quite as often in a thousand or a million throws, as any other succession of numbers fixed upon beforehand; and that no judicious player would give greater odds

against the one series than against the other. Notwithstanding this, there is a general disposition to regard the one as much more improbable than the other, and as requiring much stronger evidence to make it credible. Such is the force of this impression, that it has led some thinkers to the conclusion, that nature has greater difficulty in producing regular combinations than irregular ones; or in other words, that there is some general tendency of things, some law, which prevents regular combinations from occurring, or at least from occurring so often as others. Among these thinkers may be numbered D'Alembert; who, in an Essay on Probabilities to be found in the fifth volume of his *Mélanges*, contends that regular combinations, though equally probable according to the mathematical theory with any others, are physically less probable. He appeals to common sense, or, in other words, to common impressions; saying, if dice thrown repeatedly in our presence gave sixes every time, should we not, before the number of throws had reached ten (not to speak of thousands of millions), be ready to affirm, with the most positive conviction, that the dice were false?

The common and natural impression is in favor of D'Alembert: the regular series would be thought much more unlikely than an irregular. But this common impression is, I apprehend, merely grounded on the fact, that scarcely any body remembers to have ever seen one of these peculiar coincidences: the reason of which is simply that no one's experience extends to any thing like the number of trials, within which that or any other given combination of events can be expected to happen. The chance of sixes on a single throw of two dice being $1/36$, the chance of sixes ten times in succession is 1 divided by the tenth power of 36; in other words, such a concurrence is only likely to happen once in 3,656,158,440,062,976 trials, a number which no dice-player's experience comes up to a millionth part of. But if, instead of sixes ten times, any other given succession of ten throws had been fixed upon, it would have been exactly as unlikely that in any individual's experience that particular succession had ever occurred; although this does not *seem* equally improbable, because no one would be likely to have remembered whether it had occurred or not, and because the comparison is tacitly made, not between sixes ten times and any one particular series of throws, but between all regular and all irregular successions taken together.

That (as D'Alembert says) if the succession of sixes was actually thrown before our eyes, we should ascribe it not to chance, but to unfairness in the dice, is unquestionably true. But this arises from a totally different principle. We should then be considering, not the probability of the fact in itself, but the comparative probability with which, when it is known to have happened, it may be referred to one or to another cause. The regular series is not at all less likely than the irregular one to be brought about by chance, but it is much more likely than the irregular one to be produced by design; or by some general cause operating through the structure of the dice. It is the nature of casual combinations to produce a repetition of the same event, as often and no oftener than any other series of events. But it is the nature of general causes to reproduce, in the same circumstances, always the same event. Common sense and science alike dictate that, all other things being the same, we should rather attribute the effect to a cause which if real would be very likely to produce it, than to a cause which would be very unlikely to produce it. According to Laplace's sixth theorem, which we demonstrated in a former chapter, the difference of probability arising from the superior *efficacy* of the constant cause, unfairness in the dice, would after a very few throws far outweigh any antecedent probability which there could be against its existence.

D'Alembert should have put the question in another manner. He should have supposed that we had ourselves previously tried the dice, and knew by ample experience that they were fair. Another person then tries them in our absence, and assures us that he threw sixes ten times in succession. Is the assertion credible or not? Here the effect to be accounted for is not the occurrence itself, but the fact of the witness's asserting it. This may arise either from its having really happened, or from some other cause. What we have to estimate is the comparative probability of these two suppositions.

If the witness affirmed that he had thrown any other series of numbers, supposing him to be a person of veracity, and tolerable accuracy, and to profess that he took particular notice, we should believe him. But the ten sixes are exactly as likely to have been really thrown as the other series. If, therefore, this assertion is less credible than the other, the reason must be, not that it is less likely than the other to be made truly, but that it is

more likely than the other to be made falsely.

One reason obviously presents itself why what is called a coincidence, should be oftener asserted falsely than an ordinary combination. It excites wonder. It gratifies the love of the marvelous. The motives, therefore, to falsehood, one of the most frequent of which is the desire to astonish, operate more strongly in favor of this kind of assertion than of the other kind. Thus far there is evidently more reason for discrediting an alleged coincidence, than a statement in itself not more probable, but which if made would not be thought remarkable. There are cases, however, in which the presumption on this ground would be the other way. There are some witnesses who, the more extraordinary an occurrence might appear, would be the more anxious to verify it by the utmost carefulness of observation before they would venture to believe it, and still more before they would assert it to others.

§ 6. Independently, however, of any peculiar chances of mendacity arising from the nature of the assertion, Laplace contends, that merely on the general ground of the fallibility of testimony, a coincidence is not credible on the same amount of testimony on which we should be warranted in believing an ordinary combination of events. In order to do justice to his argument, it is necessary to illustrate it by the example chosen by himself.

If, says Laplace, there were one thousand tickets in a box, and one only has been drawn out, then if an eye-witness affirms that the number drawn was 79, this, though the chances were 999 in 1000 against it, is not on that account the less credible; its credibility is equal to the antecedent probability of the witness's veracity. But if there were in the box 999 black balls and only one white, and the witness affirms that the white ball was drawn, the case according to Laplace is very different: the credibility of his assertion is but a small fraction of what it was in the former case; the reason of the difference being as follows:

The witnesses of whom we are speaking must, from the nature of the case, be of a kind whose credibility falls materially short of certainty; let us suppose, then, the credibility of the witness in the case in question to be $\frac{9}{10}$; that is, let us suppose that in every ten statements which the witness makes, nine on an average are correct, and one incorrect. Let us now suppose that there have taken place a sufficient number of drawings to exhaust all the possible combinations, the witness deposing in every one. In one case out of every ten in all these drawings he will actually have made a false announcement. But in the case of the thousand tickets these false announcements will have been distributed impartially over all the numbers, and of the 999 cases in which No. 79 was not drawn, there will have been only one case in which it was announced. On the contrary, in the case of the thousand balls (the announcement being always either "black" or "white"), if white was not drawn, and there was a false announcement, that false announcement *must* have been white; and since by the supposition there was a false announcement once in every ten times, white will have been announced falsely in one-tenth part of all the cases in which it was not drawn, that is, in one-tenth part of 999 cases out of every thousand. White, then, is drawn, on an average, exactly as often as No. 79, but it is announced, without having been really drawn, 999 times as often as No. 79; the announcement, therefore, requires a much greater amount of testimony to render it credible.(205)

To make this argument valid it must of course be supposed, that the announcements made by the witness are average specimens of his general veracity and accuracy; or, at least, that they are neither more nor less so in the case of the black and white balls, than in the case of the thousand tickets. This assumption, however, is not warranted. A person is far less likely to mistake, who has only one form of error to guard against, than if he had 999 different errors to avoid. For instance, in the example chosen, a messenger who might make a mistake once in ten times in reporting the number drawn in a lottery, might not err once in a thousand times if sent simply to observe whether a ball was black or white. Laplace's argument, therefore, is faulty even as applied to his own case. Still less can that case be received as completely representing all cases of coincidence. Laplace has so contrived his example, that though black answers to 999 distinct possibilities, and white only to one, the witness has nevertheless no bias which can make him prefer black to white. The witness did not know that there were 999 black balls in the box and only one white; or if he did, Laplace has taken care to

make all the 999 cases so undistinguishably alike, that there is hardly a possibility of any cause of falsehood or error operating in favor of any of them, which would not operate in the same manner if there were only one. Alter this supposition, and the whole argument falls to the ground. Let the balls, for instance, be numbered, and let the white ball be No. 79. Considered in respect of their color, there are but two things which the witness can be interested in asserting, or can have dreamed or hallucinated, or has to choose from if he answers at random, viz., black and white; but considered in respect of the numbers attached to them, there are a thousand; and if his interest or error happens to be connected with the numbers, though the only assertion he makes is about the color, the case becomes precisely assimilated to that of the thousand tickets. Or instead of the balls suppose a lottery, with 1000 tickets and but one prize, and that I hold No. 79, and being interested only in that, ask the witness not what was the number drawn, but whether it was 79 or some other. There are now only two cases, as in Laplace's example; yet he surely would not say that if the witness answered 79, the assertion would be in an enormous proportion less credible, than if he made the same answer to the same question asked in the other way. If, for instance (to put a case supposed by Laplace himself), he has staked a large sum on one of the chances, and thinks that by announcing its occurrence he shall increase his credit; he is equally likely to have betted on any one of the 999 numbers which are attached to black balls, and so far as the chances of mendacity from this cause are concerned, there will be 999 times as many chances of his announcing black falsely as white.

Or suppose a regiment of 1000 men, 999 Englishmen and one Frenchman, and that of these one man has been killed, and it is not known which. I ask the question, and the witness answers, the Frenchman. This was not only as improbable *a priori*, but is in itself as singular a circumstance, as remarkable a coincidence, as the drawing of the white ball; yet we should believe the statement as readily, as if the answer had been John Thompson. Because, though the 999 Englishmen were all alike in the point in which they differed from the Frenchman, they were not, like the 999 black balls, undistinguishable in every other respect; but being all different, they admitted as many chances of interest or error, as if each man had been of a different nation; and if a lie was told or a mistake made, the misstatement was as likely to fall on any Jones or Thompson of the set, as on the Frenchman.

The example of a coincidence selected by D'Alembert, that of sixes thrown on a pair of dice ten times in succession, belongs to this sort of cases rather than to such as Laplace's. The coincidence is here far more remarkable, because of far rarer occurrence, than the drawing of the white ball. But though the improbability of its really occurring is greater, the superior probability of its being announced falsely can not be established with the same evidence. The announcement "black" represented 999 cases, but the witness may not have known this, and if he did, the 999 cases are so exactly alike, that there is really only one set of possible causes of mendacity corresponding to the whole. The announcement "sixes *not* drawn ten times," represents, and is known by the witness to represent, a great multitude of contingencies, every one of which being unlike every other, there may be a different and a fresh set of causes of mendacity corresponding to each.

It appears to me, therefore, that Laplace's doctrine is not strictly true of any coincidences, and is wholly inapplicable to most; and that to know whether a coincidence does or does not require more evidence to render it credible than an ordinary event, we must refer, in every instance, to first principles, and estimate afresh what is the probability that the given testimony would have been delivered in that instance, supposing the fact which it asserts not to be true.

With these remarks we close the discussion of the Grounds of Disbelief; and along with it, such exposition as space admits, and as the writer has it in his power to furnish, of the Logic of Induction.

Book IV.

OF OPERATIONS SUBSIDIARY TO INDUCTION.