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Chance

INTRODUCTION

ONE sense in which we use the word "chance" does not exclude the operation of causes. The chance event, in this sense, is not uncaused. But within this meaning of chance, there is the question of *how* the chance event is caused.

On one view, what happens by chance is distinguished from what happens by nature in terms of a difference in manner of causation—the difference between the contingent and the necessary. On another view, the chance event does not differ causally from that which happens regularly or uniformly. The difference lies not in the pattern of causes, but in our knowledge of them. The chance event is unpredictable or less predictable because of our ignorance of its causes, not because of any real contingency in the order of nature.

There is still a third sense of "chance" in which it means that which happens totally without cause—the absolutely spontaneous or fortuitous.

These three meanings of *chance* at once indicate the basic issues in which the concept is involved. The third meaning is the most radical. It stands in opposition to the other two. Their opposition to one another can be considered after we examine the sense in which chance excludes every type of cause.

THE DOCTRINE OF absolute fortuitousness is indeterminism in its most extreme form. The familiar phrase, "a fortuitous concourse of atoms," indicates the classical statement of this doctrine and identifies it in the great books with the theory of atomism. It would be more precise to say "with Lucretius' version of that theory," because it is with regard to chance that he departs from the teachings of Democritus and Epicurus and adds an hypothesis of his own.

The swerve of the atoms, according to Lucretius, accounts for the origin of the world, the motions of nature, and the free will of man. But nothing accounts for the swerve of the atoms. It is uncaused, spontaneous, fortuitous.

> . . . while these particles come mostly down,
> Straight down of their own weight through void, at times—
> No one knows when or where—they swerve a little,
> Not much, but just enough for us to say
> They change direction. Were this not the case,
> All things would fall straight down, like drops of rain,
> Through utter void, no birth-shock would emerge
> Out of collision, nothing be created.

Since the atoms differ in shape, size, and weight, it might be supposed that the heavier atoms, falling straight yet more rapidly, would overtake and hit the lighter atoms, thus bringing about their grouping or interlocking. But this supposition, says Lucretius, is contrary to reason. It may hold for things falling through water or thin air, but through the empty void "all things, though their weights may differ, drive/Through unresisting void at the same rate." Therefore heavier things will never be able to fall on the lighter from above nor of themselves bring about the blows sufficient to produce the varied motions by which nature carries things on. Wherefore, Lucretius concludes, the atoms "swerve a little."

Once the atoms have collided, the way in which they are locked together in the patterns of composite things, and all the subsequent motions of these things, can be accounted for by reference to the natural properties of the atoms. The atomic sizes, shapes, and weights

determine how they behave singly or in combination. But the swerve of the atoms is not so determined. It is completely spontaneous.

"If cause forever follows after cause," asks Lucretius,

In infinite, undeviating sequence
And a new motion always has to come
Out of an old one, by fixed law; if atoms
Do not, by swerving, cause new moves which break
The laws of fate; if cause forever follows,
In infinite sequence, cause—where would we get
This free will that we have, wrested from fate,
By which we go ahead, each one of us,
Wherever our pleasures urge? Don't we also swerve
At no fixed time or place, but as our purpose
Directs us?

The answer he gives is that there must be in the atoms "some other cause for motion beyond extrinsic thrust or native weight, and this third force is resident in us since we know *nothing can be born of nothing.*"

BEING ABSOLUTELY fortuitous, the swerve of the atoms is absolutely unintelligible. There is no answer to the question why they chance to swerve at undetermined times and places. This unintelligibility may not, however, make the fortuitous unreal or impossible. It can be argued that chance may exist even though, for our limited understanding, it remains mysterious.

The same problem of intelligibility arises with respect to that meaning of chance wherein it is identified with coincidence or contingency. Here, as in the case of the absolutely fortuitous, chance belongs to reality or nature. "Some things always come to pass in the same way, and others for the most part," writes Aristotle as an observer of nature, but there is also "a third class of events besides these two—events which all say are 'by chance.'" Things of this last kind, he goes on to say, are those which "come to pass incidentally"—or accidentally.

According to this theory, a real or objective indeterminism exists. Chance or contingency is not just an expression of human uncertainty born of insufficient knowledge. Contingency, however, differs from the fortuitousness or spontaneity of the atom's swerve, in that it is a product of causes, not their total absence. Of the contingent event, "there is no definite cause," in Aristotle's opinion, but there is "a chance cause, *i.e.*, an indefinite one."

In the chance happening, two lines of action coincide and thereby produce a single result. This is our ordinary understanding of the way accidents happen. The chance meeting of old friends who run across each other in a railroad station after a separation of many years is a coincidence—a coinciding of the two quite separate and independent lines of action which brought each of them to the same station at the same time, coming from different places, going to different places, and proceeding under the influence of different causes or purposes. That each is there can be explained by the operation of causes. That both are there together cannot be explained by the causes determining their independent paths.

So understood, the chance event exemplifies what Aquinas calls a "clashing of two causes." And what makes it a matter of chance is the fact that "the clashing of these two causes, inasmuch as it is accidental, has no cause." Precisely because it is accidental, "this clashing of causes is not to be reduced to a further preexisting cause from which it follows necessity."

The illustration is not affected by considerations of free will. Whether men have free will or not, whether free acts are caused or are, as Kant suggests, uncaused and spontaneous, the event we call a "chance meeting" remains accidental or, more precisely, a coincidence. Whatever the factors are which control the motions of each man, they operate entirely within that single man's line of action. Prior to the meeting, they do not influence the other man's conduct. If we could state the cause for the coincidence of the two lines of motion, it would have to be some factor which influenced both lines. Were there such a cause and were it known to us, we could not say that the meeting happened by chance. It would still be a coincidence in the merely physical sense of coming together, but it would not be a coincidence causally.

That free will is irrelevant to this meaning of chance can be seen from the fact that the collision of particles which produces atomic

fission is regarded as resulting from chance or coincidence in a manner no different from the accidental meeting of friends. Causes control the speeds and directions of the colliding particles, but no cause determines their collision; or, in other words, there is no cause for the coincidence of two separate lines of causation. Contemporary physics affirms a real or objective indeterminism insofar as it does not merely say that the cause of the coincidence is unknown to us, but rather holds that no such cause exists to be known.

Chance appears to be an important factor in other sciences. Biologist C. H. Waddington sees chance as one of the most important characteristics of Darwin's theory of evolution. "The basic feature of Darwinist thought . . . is its reliance on chance rather than on a simple determinist type of causation," writes Waddington. "All events that lead to the production of new genotypes, such as mutation, recombination and fertilization, are essentially random." Though Waddington admits that Darwin was probably unaware of this contribution, "it was a major service of Darwinism . . . to have broken the hold on our minds of notions of simple causation."

THE CONCEPTION OF THE chance event as an uncaused coincidence of causes is an ancient as well as a modern doctrine. In his *Physics,* Aristotle distinguishes between what happens by nature and what happens by chance in terms of different types of causality. "Chance," he writes, is "reckoned among causes; many things are said both to be and to come to be as a result of chance." But the fact that its effects cannot be "identified with any of the things that come to pass by necessity and always, or for the most part" at once distinguishes the causality of chance from that of nature.

"The early physicists," Aristotle observes, "found no place for chance among the causes which they recognized . . . Others there are who, indeed, believe that chance is a cause, but that it is inscrutable to human intelligence, as being a divine thing and full of mystery." But to Aristotle himself "it is clear that chance is an incidental cause" and "that the causes of what comes to pass by chance are infinite." For this reason, he explains, "chance is supposed to belong to the class of the indefinite, and to be inscrutable to man." Though he distinguishes between spontaneity and chance, he says that both "are causes of effects which, though they might result from intelligence or nature, have in fact been caused by something *incidentally.*"

What happens by nature happens regularly, or for the most part, through causal necessity. This necessity results from the operation of essential causes, causes in the very nature of the moving things. When the regularity fails, it is due to the intervention of some accidental cause. What happens by chance, then, or contingently, is always due to an accidental (or better, incidental) cause. As indicated in the chapter on CAUSE, an accidental as opposed to an essential cause is, in Aristotle's theory, one which does not *by itself* produce the given effect. It does so only through the conjunction of other causes. But since it does not determine these other causes to operate, the effect—*contingent on their combined activity*—is produced by chance, that is, by the contingency of several incidental causes working coincidentally.

A world in which chance really exists is remarkably different from a world in which necessity prevails, in which everything is determined by causes and there are no uncaused coincidences. William James vividly epitomizes their difference by calling the world of absolute necessity or determinism—the world of Spinoza or Hegel—a "block universe" in contrast to what he describes as a "concatenated universe." Voltaire before him, in his *Philosophical Dictionary,* had used the phrase "the concatenation of events" to express the meaning of chance.

The phrase evokes the right image, the picture of a world in which many concurrent lines of causality, exercising no influence upon one another, may nevertheless concatenate or be joined together to produce a chance result. The block universe presents the contrasting picture of a world in which each motion or act determines and is determined by every other in the fixed structure of the whole.

Spinoza claims, for example, that "in nature there is nothing contingent, but all things are determined from the necessity of the divine nature to exist and act in a certain manner." Chance, in other words, does not exist in nature. A thing is said to be contingent, Spinoza writes, only "with reference to a deficiency in our knowledge. For if we do not know that the essence of a thing involves a contradiction, or if we actually know that it involves no contradiction, and nevertheless we can affirm nothing with certainty about its existence because the order of causes is concealed from us, that thing can never appear to us either as necessary or impossible, and therefore we call it either contingent or possible."

Hence, for Spinoza, contingency or chance is illusory rather than real—a projection of the mind's ignorance or of its inadequate knowledge of causes. The uncertainties involved in modern quantum mechanics would become for him indeterminabilities, not indeterminacies.

For a quite different reason, Calvin agrees that nothing happens fortuitously or by chance, saying that "if all success is blessing from God, and calamity and adversity are his curse, there is no place left in human affairs for Fortune and chance."

The issue between real indeterminism and absolute determinism—further discussed in the chapters on FATE and NECESSITY AND CONTINGENCY—inevitably raises theological questions. Just as the theologian must reconcile man's free will with God's predestination, so must he, if he accepts its reality, also reconcile chance with divine providence, apart from which nothing can happen either necessarily or contingently.

For Augustine it would seem that divine providence leaves no room for chance among natural things. After noting that causes are sometimes divided into a "fortuitous cause, a natural cause, and a voluntary cause," he dismisses "those causes which are called fortuitous" by saying that they "are not a mere name for the absence of causes, but are only latent, and we attribute them either to the will of the true God, or to that of spirits of some kind or other."

In certain places Aquinas seems to talk in much the same fashion—as though chance existed only for our limited intellects and not for God. "Nothing," he declares, "hinders certain things from happening by luck or chance, if compared to their proximate causes; but not if compared to divine providence, according to which 'nothing happens at random in the world,' as Augustine says." The example he uses to illustrate his point is that of two servants who have been sent by their master to the same place: "the meeting of the two servants, although to them it appears a chance circumstance, has been fully foreseen by their master, who has purposely sent them to meet at one place, in such a way that one has no knowledge of the other." In such a way also "all things must of necessity come under God's ordering," from which it follows that God directly causes the action of even accidental causes, and their coincidence. The chance event would then be necessitated by God. It would be determined by His will, however indeterminate it might appear to us.

Yet in other places Aquinas writes that "God wills some things to be done necessarily, some contingently . . . To some effects He has attached unfailing necessary causes, from which the effects follow necessarily; but to other defectible and contingent causes, from which effects arise contingently." For some minds this may only deepen the mystery rather than solve it. At least it leaves many questions unanswered.

Does Aquinas mean that coincidence of causes is not itself uncaused? Does he mean that God causes the concatenation of events, and that a sufficient reason for every contingency exists in God's will? If so, is chance an illusion, a function of our ignorance of divine providence? May chance be quite real on the level of nature where no natural causes determine the coincidence, while not real—at least not in the same sense—for God? Or does the statement that what "divine providence plans to happen contingently, happens contingently" mean that chance remains a real feature of the universe even for God?

One thing is clear. In one sense of the word, the Christian theologians completely

deny chance. If "chance" means something which God does not foresee, something unplanned by His providence, then according to their faith nothing happens by chance. It is in this sense also that what happens by chance is opposed to what happens on purpose, or has a final as well as an efficient cause. As the chapter on CAUSE indicates, those who deny final causes in nature sometimes use the word "chance" to signify not lack of cause, nor even contingency, but only the blindness of causality—working to no end.

The controversy discussed in the chapter on WORLD—between those who see in the structure of the universe the grand design of a divine plan and those who attribute whatever order there is in nature to blind chance—further indicates the sense in which theologians like Augustine and Aquinas deny chance. But if "chance" means no more than *contingency,* then to affirm chance excludes, not providence, but fate, at least that sense of "fate" according to which everything is blindly necessitated. Here it is Spinoza's statement that "in nature there is nothing contingent, but all things are determined from the necessity of the divine nature" which opposes the statement of Aquinas that "the mode both of necessity and contingency falls under the foresight of God."

THE THEORY OF chance has obvious bearings on the theory of knowledge, especially with regard to the distinction between knowledge and opinion and between certainty and probability.

On any view of chance—whether it is real or illusory—when men call a future event contingent they mean that they cannot predict it with certitude. So far as human prediction goes, it makes no difference whether the future event is necessarily determined and we lack adequate knowledge of its causes, or the event has a genuine indeterminacy in the way it is caused or uncaused. Regardless of what the objective situation is, the assurance with which we predict anything reflects the state of our knowledge about it.

The ancients who, for the most part, regard chance as real and objective, treat probability as subjective. For them, the different degrees of probability which men attach to their statements measure the inadequacy of their knowledge and the consequent uncertainty of their opinions about matters which cannot be known but only guessed. Holding different theories of the distinction between knowledge and opinion, both Plato and Aristotle exclude the accidental and the contingent, along with the particular, from the objects of science. Since in their view certitude belongs to the essence of science—or of knowledge as contrasted with opinion—science for them deals not only with the universal but with the necessary.

In *The Republic* Socrates assigns opinion to the realm of becoming—the realm of changing and contingent particulars. Unlike Plato, Aristotle does not restrict knowledge to the realm of eternal and immutable being, but he does insist that physics, as a science of changing things, preserve the certitude of science by concerning itself only with the essential and the necessary. "That a science of the accidental is not even possible," he writes, "will be evident if we try to see what the accidental really is." It is a matter of chance that cold weather occurs during the dog days, for "this occurs neither always and of necessity, nor for the most part, though it might happen sometimes. The accidental, then, is what occurs, but not always nor of necessity, nor for the most part. Now . . . it is obvious why there is no science of such a thing."

Though he disagrees with Aristotle and Aquinas about the reality of chance or contingency, Spinoza agrees with them that knowledge—at least adequate knowledge—has the necessary for its object. Of individual things, he says, "we can have no adequate knowledge . . . and this is what is to be understood by us as their contingency." To be true to itself and to the nature of things, reason must "perceive things truly, that is to say, as they are in themselves, that is to say, not as contingent but as necessary."

The position of Aquinas is worth stating for comparison. To the question "whether our intellect can know contingent things," he replies that "the contingent, considered as such, is known directly by sense and indirectly by

the intellect, while the universal and necessary principles of contingent things are known by the intellect. Hence," he goes on, "if we consider knowable things in their universal principles, then all science is of necessary things. But if we consider the things themselves, thus some sciences are of necessary things, some of contingent things."

Among the sciences of contingent things, Aquinas includes not only "the sciences of nature" but also "the moral sciences," because the latter, dealing with human action, must reach down to contingent particulars. In the sphere of morals as of nature, certainty can be achieved only on the level of universal principles. Deliberation about particular acts to be done moves on the level of probable opinion. In contrast to the moral scientist, the man of action must weigh chances and make decisions with regard to future contingencies. It would be as foolish, Aristotle says, to expect the certitude of scientific demonstration from an orator or a judge, as "to accept probable reasoning from a mathematician."

IT IS NOT SURPRISING that the modern theory of probability—or, as it was later called by George Boole, John Venn, and others, the "logic of chance"—should have its origin in the sphere of practical problems. Pascal's correspondence with Pierre de Fermat illustrates the early mathematical speculations concerning formulas for predicting the outcome in games of pure chance. For Pascal the logic of chance also has moral implications. If we are willing to risk money at the gaming table on the basis of calculated probabilities, how much more willing should we be to act decisively in the face of life's uncertainties, even to risking life itself on the chance of eternal salvation.

When we act "on an uncertainty, we act reasonably," Pascal writes, "for we ought to work for an uncertainty according to the doctrine of chance." If the chance of there being an after-life is equal to the chance of there being none—if the equiprobability reflects our equal ignorance of either alternative—then, Pascal argues, we ought to wager in favor of immortality and act accordingly. "There is here the infinity of an infinitely happy life to gain, a chance to gain against a finite number of chances of loss, and what you stake is finite."

Like Pascal, Hume thinks that we must be content with probability as a basis for action. "The great subverter of *Pyrrhonism* or the excessive principles of skepticism," he writes, "is action, and employment, and the occupations of common life." But unlike the ancients, Hume also thinks we should be content with probabilities in the sphere of the natural sciences. Certitude is attainable only by the mathematician who deals with the relations between ideas. Since the natural sciences deal with matters of fact or real existence, and since to know such things we must rely entirely upon our experience of cause and effect, we cannot reach better than probable conclusions.

The scientist, according to Hume, "weighs opposite experiments. He considers which side is supported by the greater number of experiments; to that side he inclines, with doubt and hesitation; and when at last he fixes his judgment, the evidence exceeds not what we properly call *probability*. All probability, then, supposes an opposition of experiments and observations . . . A hundred instances or experiments on one side, and fifty on another, afford a doubtful expectation of any event; though a hundred uniform experiments, with only one that is contradictory, reasonably beget a pretty strong degree of assurance."

Hume applies the logic of chance to weighing the evidence against and the testimony in favor of miracles, as well as to contrary hypotheses in science. As much as Spinoza, he denies the existence of chance or contingency in the order of nature. Chance is entirely subjective. It is identical with the probability of our opinions. In the throw of dice, the mind, he says, "considers the turning up of each particular side as alike probable; and this is the very nature of chance, to render all the particular events, comprehended in it, entirely equal." But there may also be "a probability, which arises from a superiority of chances on any side; and according as this superiority increases, and surpasses the opposite chances,

the probability receives a proportionate increase . . . The case," Hume asserts, "is the same with the probability of causes, as with that of chance."

Since Hume's day, the theory of probability has become an essential ingredient of empirical science. The development of thermodynamics in the 19th century would have been impossible without it. This is also true of the quantum mechanics and atomic physics of our own time. But like the doctrine of chance, the theory of probability tends in one of two directions: *either* toward the subjective view that probability is only a quality of our judgments, measuring the degree of our ignorance of the real causes which leave nothing in nature undetermined; *or* toward the objective view that there is genuine indeterminism in nature and that mathematical calculations of probability estimate the real chance of an event's occurring.

THE ELEMENT OF chance also has a bearing on the general theory of art. The hypothesis of the melody which a kitten might compose by walking on the keyboard is obviously intended to contrast a product of chance with a work of art. The competent musician knows with certainty that he can do what the meandering kitten has only one chance in many millions of ever accomplishing.

In proportion as an art is developed, and to the degree that its rules represent a mastery of the medium in which the artist works, chance is excluded from its productions. This point is strikingly exemplified in the history of medicine. "If there had been no such thing as medicine," Hippocrates suggests, "and if nothing had been investigated or found out in it," all practitioners "would have been equally unskilled and ignorant of it, and everything concerning the sick would have been directed by chance." On the same principle, Galen distinguishes the physician from the empiric, who, "without knowing the cause," pretends that he is "able to rectify the failures of function." The empiric works by trial and error—the very opposite of art and science, for trial and error can succeed only by chance. The physician, learned and skilled in medicine, works from a knowledge of causes and by rules of art which tend to eliminate chance.

Augustine reports a conversation with the proconsul concerning the relative merits of medicine and astrology. When the proconsul tells him that, as compared with medicine, astrology is a false art, Augustine, at this time himself "an enthusiast for books of astrology," asks how it can be explained that "the future was often correctly foretold by means of astrology." The proconsul answered, "it was all due to the power of chance, a force that must always be reckoned with in the natural order." Thus, Augustine says later, "when the astrologers were found to be right, it was due to luck or pure chance and not to their skill in reading the stars."

Neither art itself, nor skill in its practice, can ever be perfect enough to remove chance entirely, for the artist deals with particulars. Yet the measure of an art is the certainty which its rules have as directions for achieving the desired result; and the skill of the artist is measured by the extent to which he succeeds by rule and judgment rather than by chance.

When Aristotle quotes Agathon's remark that "art loves chance and chance loves art," he explains its sense to be that "chance and art are concerned with the same objects"—that which does not come to be by nature nor from necessity. Hence art sometimes fails, either from uncontrollable contingencies or from insufficient knowledge of causes. "All causes," says Hume, "are not conjoined to their usual effects with like uniformity. An artificer, who handles only dead matter, may be disappointed of his aim, as well as the politician, who directs the conduct of sensible and intelligent agents."

IN THE REALM OF human affairs—in morals, politics, and history—the factor of chance is usually discussed in terms of good and bad fortune. The word "fortune"—as may be seen in the root which it shares with "fortuitous"—has the same connotations as "chance." Aristotle treats fortune as the kind of chance that operates in the sphere of human action rather than natural change. Fortune, he thinks, can be attributed properly only to intelligent beings

capable of deliberate choice. The sense of this distinction between chance and fortune seems to be borne out in history by the fact that fortune, unlike chance, receives personification in myth and legend. Fortune is a goddess, or, like the Fates whom she combats, a power with which even the gods must reckon.

The doctrine of chance or fortune occupies an important place in moral theory. Aristotle's classification of goods tends to identify external goods with goods of fortune—the goods which, unlike knowledge and virtue, we cannot obtain merely by the exercise of our will and faculties. Considering the elements of happiness, Aquinas groups together wealth, honor, fame, and power as goods of the same sort because they are "due to external causes and in most cases to fortune."

The goods of fortune, as well as its ills, consist in things beyond man's power to command and, in consequence, to deserve. Recognizing the unpredictable operation of fortune, Epictetus, the Stoic, argues that "we must make the best of those things that are in our power, and take the rest as nature gives it." We have "the power to deal rightly with our own impressions." Hence the Stoics advise us to control our reactions to things even though we cannot control the things themselves. Yet men will always ask, as Hamlet does, "Whether 'tis nobler in the mind to suffer the slings and arrows of outrageous fortune, or to take arms against a sea of troubles, and by opposing end them?"

The fact that the goods and ills of fortune are beyond our power to control raises the further question of man's responsibility regarding them. We can hardly be held responsible for everything that happens to us, but only for those things which are subject to our will. This traditional moral distinction between the good or evil which befalls us by fortune and that which we willfully obtain or accomplish parallels the legal distinction between accidental and intentional wrongdoing.

What is true of the individual life seems to apply to history—the life of states and the development of civilization generally. For the most part, the historians—Herodotus and Thucydides, Plutarch, Tacitus, and Gibbon—find fortune a useful principle of interpretation. To Machiavelli history seems to be so full of accidents and contingencies—"great changes in affairs . . . beyond all human conjecture"—that he tries to advise the prince how to make use of fortune in order to avoid being ruined by it. Such advice can be followed because, in his opinion, "fortune is the arbiter of one half of our actions, but still leaves us to direct the other half, or perhaps a little less."

Hegel, on the contrary, does not admit chance or fortune in his view of world history as a "necessary development out of the concept of the mind's freedom alone." For Tolstoy also, either necessity or freedom rules the affairs of men. Chance, he writes, does "not denote any really existing thing," but only "a certain stage of understanding of phenomena." Once we succeed in calculating the composition of forces involved in the mass movements of men, "we shall not be obliged to have recourse to chance for an explanation of those small events which made these people what they were, but it will be clear that all those small events were inevitable."

As the contingent is opposed to the necessary, as that which happens by chance is opposed to that which is fully determined by causes, so fortune is opposed to fate or destiny. This opposition is most evident in the great poems, especially the tragedies, which depict man's efforts to direct his own destiny, now pitting his freedom against both fate and fortune, now courting fortune in his struggle against fate.