NECESSITY IN CAUSAL RELATIONS

by

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GENERAL INTRODUCTION

Mankind has a desire that his wishes be fulfilled. In the long history of attempts to control nature, the scientific method has been the most fruitful in producing satisfactory results. However, science is not free from error; to be reminded of this, one needs only remember discarded scientific notions such as phlogistin, the ether, Ptolemaic astronomy, and the immutability of the species. Furthermore, there are at present many areas of endeavor wherein the methods of well-established sciences have not produced such reliable theories and techniques as one has been accustomed to expect from the physical sciences. Yet the scientific method is an immensely more valuable tool for use in the investigation and manipulation of nature than are the tools of mystics, witch doctors, and divines.

All of the above tools are based upon the following belief: "If I do so-and-so, then such-and-such will result." Philosophers have given much of their attention to this belief, largely in an attempt to discover how certain we can be that such-and-such <u>will</u> result if we do so-and-so. As might be expected, their answers are divergent.

It is not the business of the philosopher to find what such-and-such and so-and-so are; that is for the scientist. The following question is for the philosopher: How can we be justified in predicting the future, for all we have seen is that in the past, so-and-so is followed by such-and-such?

The scientist will answer this question by saying that if we know the cause then we can predict the effect, and if we should make an untrue prediction, then we were mistaken in thinking that we knew the cause. Therefore the scientist is perfectly confident that the sun will rise tomorrow (barring some celestial holocaust), but the philosopher is not so sure.

There are a number of matters which are questioned only by philosophers. For example, a philosopher may come to the conclusion that only his own mind exists, but this same philosopher will not put his arm in a lion's cage at the zoo, for he knows that the non-existent lion might bite it off. Such a philosophic position well deserves the laughter it evokes. However, such positions do serve the purpose of keeping one's mind open to a broad range of possibilities.

The subject of this thesis is such a philosopher's speculation. It would be reassuring to know that there is not the slightest trace of doubt that so-and-so will produce such-and-such. But most persons never have such philosophic doubts; breakdowns of prediction are explained as being due to ignorance of the causal conditions which would invariably produce such-and-such. For example, the airline pilot making a landing upon an invisible runway trusts his instruments; the scientist continues to putter about in his laboratory in spite of the philosopher's misgivings.

This thesis attempts to justify our expectations of the future by postulating a kind of necessity which is perceived as are colors and shapes, rather than invented as is a symphony.

THE FIRST SECTION: ON NECESSITY

Before we can speak accurately about the world, it might not be amiss to find out what the world is.

Common sense makes a distinction (albeit a sloppy one) between things which "really exist" and things which are inventions. We hear that tables and chairs are real while giants and Greek gods are not. But there is a borderline area where this distinction becomes most fuzzy. Ancient wars were fought over ancient gods, but no modern wars are fought over ancient gods; we prefer our own.

There is a common idea that we should assume a belief to be true until evidence forces us to call it false. This idea, however, sanctions one to fill his head with all sorts of nonsense, such as gods, demons, freewill, holy water, the ether, man's basic goodness/badness, leprechauns, centaurs, the inability of fish to feel pain although they feel the hook, the righteousness of our nation, and so on. Then what is real is sometimes a disputed matter.

Many persons will agree that if anything is real then tables and chairs are real. But what would be said about the reality of a poem? How much is "really there" and how much do we read into the poem? How real is the electron (we all believe that it is more than a name for data)? How real is an idea? How real is a painting?

These questions and comments should show that there is by no means a sharp demarcation between the things which are real

and the things which are not. Philosophers have sought for some device which would indicate whether a thing is real, but all such attempts have been failures because the common application of the label "real" is haphazard.

Ludwig Wittgenstein has an interesting idea in the early portions of his Tractatus Logico-Philosophicus: "Die Welt ist alles, was ist der Fall" (the world is everything which is the case). This is a cryptic utterance, but its essential meaning is that the world is the sum total of what is true. However, to thus sharpen the idea of reality, we must sharpen the idea of truth; but to decide what is true apparently is not easier than to decide what is real.

Usually a distinction is made between a theory and an object, so that the object (a table, say) is real but a theory is not. There is some justification for this distinction, since a theory can be ignored and it disappears; but we will stumble over a table if we try to ignore it, and if we throw it upon a junk-heap it is still there.

It is by reason of this distinction that we say there is no theory concerned in the nature of the table. A cat walking around the table does not theorize upon its reality, and neither do we. However, a bird will sometimes attack its reflection in a glass, while usually we do not. Why is this? Perhaps we are theorizing, and so know that the image in the mirror is not real (the physicist calls it a "virtual" image).

It would be useful to show that there are some assumptions we make about the nature of things which are called "real"; even for the most clearly real objects such as tables and chairs there are assumptions.

Theory in Object-Construction

Let one imagine himself to be on a plain, walking toward a distant, indistinct object. As one approaches it, perhaps it is seen to be a building of a certain color and size. Closer approach may reveal that the color of the building is not uniform, but that its walls are made of vari-colored bricks; and progressively closer approaches may reveal pits in the bricks, pits in the pits, molecules, atoms, neutrinos, quanta, and other constituents of the building.

It is said that all of these appearances are of one object, the building. But certainly there is an enormous difference between the appearance of the building from a distance of ten miles and its appearance from a distance of one foot. However, the appearance of the building from a distance of ten miles does not seem very different from its appearance at a distance of ten miles and one foot. Then if by a succession of small steps one slowly approaches the building, its appearance changes by imperceptible degrees. Thus partially because of the gradual change we speak of all the appearances as belonging to one object. But to look at only one brick, and to say "It is part of the building" is to rely upon memory. For when looking at one brick we do not see the entire building; indeed we never see the entire building.

Then what is it to say that the building is one object which is shown to us by all its many appearances? When we say that an appearance now is very much like a previous appearance, is that alone enough to allow us to say that there is one object common to all the appearances? Usually not, for we require that the appearance shall be "in the same place," also that sensations of touch shall be associable with the visual sensations, and so on. Yet when enough of these sensations are collated, we say that there is a building.

It was mentioned that memory has an important role in our collecting the sensations into one object. But how can the conjunction (by memory) of the appearances be more indicative of the presence of something-other-than-the-appearances than the occurrence of only <u>one</u> appearance? Why should repetition of appearances establish anything other than the separate appearances of their combination? Perhaps it is an oversimplification to speak of "separate" appearances, for sometimes "separate" appearances merge imperceptibly, as when one approaches a building. But all that has been said is that appearances sometimes merge imperceptibly; nothing is said about anything beyond the appearances.

For another example, what is the difference between the appearance of a penny at a distance of two hundred centimeters and its appearance at a distance of two hundred and one centimeters? The answer would vary; some persons would see a difference and some would not. But since one sees only one appearance at a time, then how can one compare two appearances? Obviously only by

comparing a present appearance with a memory of a past one.

When one sees an appearance, one sees only the appearance. Then when one sees a building from various distances and directions, one sees only the various appearances. The name "building" should be restricted to those appearances; for to say that there is in addition to the appearances an object which we sense, is to say that there is something insensible which we sense, and this is self-contradictory.

The Shape of a Penny

Should one ask the question, "What is the shape of a penny?" the answer would be to the effect that a penny is a disk of such-and-such proportions. Should one ask further for the real shape of the penny, one will perhaps receive an uncomprehending stare. When the respondent attaches a meaning to the second question, the answer will likely be again that a disk is the real shape. Should one reply, "No, no, you said that before; I want to know the real shape," the respondent is thrown into confusion. And when we state that the penny has no "real shape," the respondent may say, "Ah! The penny in truth is without real shape, because it sometimes looks elliptical, sometimes circular, and sometimes rectangular ... besides, a disk is a three-dimensional object and we can only see two dimensions of the penny."

This game exhibits some interesting features of our conceptions of shape. In the ordinary usage, the shape of the penny is said to be a disk, and it seems to be pointless concept-

destruction to say that the label is in error. Upon occasion, one does ask for the real shape of something when there is confusion, as when one asks for the real shape of a stick thrust at an angle into water. However, when one asks for the real shape of a penny, one is asking for a concept which is not in the thinking of the marketplace. Thus the uncomprehending stare. Then what is the meaning of our question? Since the answer is to be "The penny has no real shape," the question seems to be a rhetorical way of saying that since the penny has many appearances, there is no reason for preferring some appearances over others as being definitive of the shape of the object.

But is the marketplace wrong when it says that the penny <u>is</u> a disk? No, for it would not deny that the penny has many appearances in shape. Indeed, it is because of its special variety of appearances that the penny is called a disk and not an ellipse, circle, or rectangle. Every shape-appearance of the penny is designated by the word "disk." Further, in order to verify that the penny is a disk, one does the following operation which presents every possible kind of shape-appearance a disk may present; one looks at the circular aspect of the penny, and then one turns it so that its rectangular appearance is seen, and then one has seen all of its possible (macroscopic) shape-appearances. It is then called a disk.

"Disk" is then a class-name for certain kinds of appearances and no others. Of course, for estimating quickly the shape of a penny, some appearances are more useful than others; but this is

not to say that the less-useful rectangular appearance is excluded from the designation of the name "disk" while a more-useful elliptical appearance is included.

"Disk" is the name for a group of appearances. Now it might be well to inquire whether the appearances could be grouped in some other way.

Since the name includes all of the appearances, any other grouping of the appearances would eliminate some of them. The inquiry might be begun by assuming that the penny is a circle. One might also assume that the penny is a rectangle or that it is one of many ellipses. These are equally correct since the penny is compounded from them. But when one is looking at the circular aspect of the penny he cannot see the rectangular aspect, and vice versa. And when one is looking at one of the elliptical aspects he cannot see any other aspect. How then can it be said that the penny has all of these aspects, since at any instant one can verify only one aspect at a time? One uses memory, as in the case of perceiving the building.

When one looks at the circular aspect of a penny, how does one distinguish the penny from a circle? The distinction is accomplished by knowing that if the circle is in imagination rotated a few degrees about a diameter, it will appear to be an ellipse; while if the same operation is performed upon the penny, its thickness will cause its appearance to be somewhat different from that of a two-dimensional ellipse. Furthermore, should the rotation be through ninety degrees, the penny will appear to be

a rectangle while the circle will appear to be a line. But how can we know all of this when looking at the circular aspect of the penny? And when we have turned the penny so that an elliptical aspect is seen, how do we know that it can be turned so as to appear to be a circle?

Pre-philosophically, we think that the appearances seen in the past are somehow "really there" and that we may view them again merely by looking at the penny from a suitable direction, in much the same way as one may view an automobile engine by raising the hood of the car. The common feeling is that these appearances exist whether seen or not. This feeling masks an assumption, for we do not perceive an unseen appearance; to say that these unseen appearances exist is to speak of unseen things as if they were seen.

Then the marketplace is engaging in a bit of metaphysical theorizing when it says that the penny is a disk, for to say this is to say that past appearances exist and may become visible by turning the penny.

It would seem as if all physical objects are subject to the same analysis. Tables, chairs, trees, autos ... anything which presents more than one appearance is called 'one object' by the employment of the same kind of metaphysical theorizing as that which is employed so that we may call all of the appearances of a penny appearances of one object.

The Size of a Penny

To ask for the size of a penny will bring the reply that a penny is, say, about an inch in diameter and about an eighth of an inch in thickness. But to ask for the real size of a penny would bring the familiar mystified countenance. For since the penny has many sizes (depending upon its distance from us), how can we say that the penny is, say, an inch in diameter? A ruler will easily solve this, but only if we assume that the ruler changes in apparent size with changes in distance commensurate with such changes in the penny. But there is another method of size-measure, triangulation.

Let an object be imagined which has the oddity that its size changes irregularly and unpredictably, and let this be called a "Protean" object. Let the Protean object be compared with a penny. One brings them both into his hand, measures them with a ruler (the Protean object all the while deceiving us by remaining quiescent), and, say, finds them to be the same size. Then from a distance one can calculate the distance of the penny from him by measuring the angular size of its appearance and vice versa, but the same method is unreliable for the Protean object, for its size is erratic.

Now how does one know that the penny is not a Protean object? We have certain tests for deciding whether an object has a fixed size: one tries to compress it, or one sees whether the changes in its subtended angle due to the changes in its distance are commensurate with the distance-changes in the angular sizes of

other objects. But these angle-measuring tests are unreliable if an object is silhouetted against the sky when there are no objects near it for comparison. In such cases, one can compute distance only by assuming that the object has constant size at constant distance (i.e., that the object is not Protean). The same assumption applies to the measurement of distances at sea or across a desert: without triangulation (i.e., to calculate distances by using the sizes of images), only the above assumption allows distance to be computed; to employ triangulation is to assume the truth and applicability of mathematics as well as the reliability and accuracy of instruments.

There is therefore an assumption in saying that something has a constant size, whether size is measured by comparison with a ruler or by calculation using a transit: the assumption is that the object is not Protean. And in order to show that a penny is not Protean, we must assume either that the objects with which it is compared are not Protean or that the methods of surveying are reliable.

Thus far, it has been seen that there are assumptions in our ordinary ideas of shape and size. Do these reflections cast any light upon the nature of reality?

There is theory involved in our separation of real things from non-real things, for a Protean penny would be said to be an unreal penny. Theoretical prerequisites are essential to the eligibility of a thing for the label "real."

Necessity in Constructs

At this point another kind of case wherein theory and appearances are mixed should be considered.

Consider a mathematical triangle, and let one ask for the relation between the whole and its parts. This matter should reveal certain relations between theory and appearances which will make easier the transition from the theory-appearance interrelations in stationary things to the theory-appearance interrelations in moving (or rather, "changing") things, and so to causality.

A triangle is composed of lines and relations between the lines. Now to change the shape of the triangle is necessarily to change the relations between the lines, and so to change the appearance of the collection of lines, for at least one line must suffer a change in length. For the same reason, to shorten a line is necessarily to reduce the opposite angle <u>if</u> we are still to have a triangle, otherwise the figure would not be closed.

We do not ordinarily say that there are causal relations between the parts of a triangle or between the complete triangle and any of its parts. However, if one were to change the shape of the triangle, it would perhaps not be wrong to speak of a causal relation between the change in shape of the triangle and the change in length of at least one side of the triangle. Furthermore, it seems that there is some sort of necessity in this particular "causal relation," or at least there is a feeling that there is necessity. But one does not observe this necessity when one observes that the triangle is changing shape. Then how

to account for the feeling of necessity? A careful examination of what one does observe may provide an answer.

How do we observe geometrical figures? When we imagine a chiliagon, we do not form in our minds a clear picture of a plane figure with one thousand sides. Then how do we distinguish our mental image of a chiliagon from our mental image of a circle? We do this by several methods, all of which depend upon the close examination of a section of the chiliagon so that it is seen to be composed of lines and angles; no magnification of the circle will show such lines and angles.

What do we see when we examine a drawing of a chiliagon? We see that the figure is composed of many lines, but we do not know it to be chiliagon until we count the lines. In the same way, we must count the sides of an "icosagon" in order to know it to be such. And most persons must count the sides of an octagon in order to distinguish it from a hexagon.

The purpose of this is to admit the possibility that we do not see the triangle as a unit, but that our perception of it might involve counting sides (i.e., using memory) as does our perception of a chiliagon. The task is now more difficult to justify our feeling that there is necessity between a change in a side and a change in the opposite angle, for such necessity depends upon whether there is a triangle maintained during the change. For we need memory to know the persistence of the triangle during the change, and there is also the possibility that memory enters into the perception of an unchanging triangle.

One solution is that one kind of necessity is a property of definitions, so that from its definition ("a thousand-sided regular polygon") a chiliagon analytically must have one thousand sides. But perhaps there are other answers; perhaps other kinds of necessity are to be discovered in nature rather than in definitions. This thesis is that there are such discoverable necessities.

What is the relation between the definitions and the appearances? If someone were to draw suitable lines on a paper, it would be said that these appearances are a triangle. And that is their relation, at least in this case: we order the appearances by means of the definitions.

But can the necessity in the definition be applied to the relations between the appearances? This can be seen to be so if one does the following experiment. Consider a triangular figure, and shorten one of its sides. To do this, of course, is to change the appearance of the triangle, for one of the sides of the triangle is shorter.

Now is shortening the line-segment forming the side a necessary consequent of shortening the side? Yes, for the line is as long as the side. Then does shortening the line necessarily change the appearance of it? Yes, for the same reason that a change in the shape of a penny produces a change in its appearances: the reason for the necessity is that the denotation of the word "penny" analytically includes certain appearances and excludes others, so that to change the shape of the penny is

analytically to change some or all of the appearances of it.

After one side is shortened, the resultant figure will be a triangle only if the opposite angle is reduced so that the figure is again closed. And there is necessity here.

Necessity in this case has come from definition. To see whether necessity can be found between the appearances one must ask about the relation between triangles and their definition. If by "triangle" one means the perfect triangle of mathematics, then there can be no such triangles which do not fit the definition; that is, there are no triangles which are not triangles.

But is not this mathematical triangle simply a creature of the imagination? Perhaps; but possibly one might attempt to apply the mathematical triangle to the world, to see whether it can be applied to the world, and if so to what extent.

Beyond the window is a large tract of land criss-crossed with sidewalks. Three of the sidewalks form a triangle. But they are not a triangle; they are three sidewalks. However, their relation is the relation between the components of the mathematical triangle congruent to the sidewalks.

But the mathematical triangle does not have footprints, pebbles, contractor's marks, and so on; nor are the sidewalks straight and plain. In other words, we are not interested in every aspect of the individual sidewalks when we pronounce the collection of the three sidewalks a triangle; we are interested in length only. And length is more nearly an essential part of the physical sidewalk than is the kind of cement or the pithy

sayings inscribed while the cement was wet. Again, a bit of theory is essential to the ordering of appearances, for how can length be an appearance as is shape or color? A chessboard can be seen to be colored, but can it be seen (in the same sense) to have length?

The shape of a mathematical triangle cannot be changed without changing the shape of at least one line. Therefore, since length is an essential part of a sidewalk, and since length is a sufficient condition for a line, the sidewalk necessarily contains a line. Therefore, there is a necessary connection between the essential length of a sidewalk and the mathematical triangle formed by the lengths of three such sidewalks each of which intersects the other two. In the case of the mathematical triangle, the thing is the denotation of its definition and vice versa. Therefore, to find necessity in the internal relations of the thing-by-definition (i.e. the mathematical triangle) is to find necessity in the internal relations of the thing-referred-to (i.e. the physical triangle).

If we invoke the argument above as to the necessity between changing the length of one sidewalk (by shortening it) and changing the triangle formed by three such sidewalks (if we are still to have a triangle) then the distinction indicated in the Introduction between theory and the world is still more fuzzy, for we have said that an analytic statement describes the world. Then the analytic statement is not entirely vacuous. (This point will be considered on page 25 ff.)

The necessity so far has come from definitions, and so it is analytic necessity. Someone might object that in saying that the concept of the sidewalks contains a line. But does the referent of the concept contain a line? For the referent of the term "sidewalk" is a blob of cement, with cracks, footprints, pits, irregularities, chipped places, etc. Surely it is very strange to say that the thing we are now walking upon contains a line; and it is even stranger to say that the line is necessarily contained. For what we are walking upon is only a mass of appearances, and how can one appearance be deductively and thus necessarily connected to another? Is it not going beyond the appearances to say that there is such necessity? We never see necessity as we see a blob of cement, so isn't necessity an invention from the appearances? And are not inventions arbitrary, so that other inventions from the blob of cement might not have the necessity? Which in a roundabout way says that necessity comes from arbitrary definition and invention rather than discovery? Therefore, deductive necessity is not a property of the world, but is a feature of certain of our arrangements of appearances, and the appearances could as easily have been arranged in some other way so that necessity was not applicable to the relations between appearances.

These are powerful objections to the attempt to insinuate necessity into the world. The objector is saying, "You are not being fair in twisting the world so that inventions are discovered in it as are appearances. You are arguing by definition."

It might be replied that the world includes all the real things, and that certain assumptions are requisite for classifying some things as real; for example, the size and shape of pennies (but not of nebulae) must be constant before they are eligible for the label "real."

It will be objected that even though such assumptions may show that what is real depends upon what we say, still it has not been shown that there is any non-invented necessity connecting one appearance with another. The attempt will now be made to show that in the case of length-perception, there is such necessity between appearances.

On Length

When Cro-Magnon heaves his spear at a running deer, or when the fibbon brachiates from limb to limb, or when the quick brown fox jumps over the lazy dog, or when the infant reaches for the moon, or when the surveyor peers through his transit, or when the physicist sends light back and forth along a mile-long vacuum tube: these all involve mensuration of distance.

Except for the degree of accuracy, the measurement of distance by the counting of wave-lengths of light is not different from the Greek armies' way of measuring distance by counting stages. Further, the lion before leaping at a gazelle measures distance in much the same way as does Cro-Magnon before throwing his spear. For these reasons, a distance seen by the lion is very much like a distance seen by Cro-Magnon, and by the gibbon, and by

the Hellenic heavy-armed troops, and by Michelson the physicist.

Imagine a geometry student looking at a piece of paper on which two crosses are drawn. What is the distance between the two? If the distance is small, both can be seen at the same time clearly; but if the distance is somewhat larger, the eyeball must move from one to the other (unless the observer moves further away from the paper).

At this point a term should be introduced. "Perceptual unit" will designate such things as small patches of red, small distances (as between the holes in the top of a saltshaker), and small numbers of objects so that their number may be known at a glance without counting. Then a small circle is a perceptual unit but a small chiliagon is not, for we must count its sides in order to know it to be a chiliagon; however, before such counting, both of the figures display the perceptual unit "circularity," and so in that sense both are perceptual units. But two crosses separated by a distance of two miles are not a perceptual unit, for one must remember one of them as he trudges toward the other.

What happens as the two crosses are slowly brought together after their two-mile separation? The pertinent observation is that the above need for memory gradually becomes less as the distance decreases, until finally the two crosses obviate the need for memory as they become a perceptual unit. What is the amount of the separation at which this occurs? The amount varies from person to person with the variance of peripheral vision; neither is it constant for one observer due to the variance of peripheral

vision with fatigue, glaucoma, and so on. Then the size of the perceptual unit is not independent of the observer.

After the distance has decreased to less than the extension of the perceptual unit, then the perception of its continued shrinking is also a perceptual unit. Then it seems that one might speak of various qualities of these perceptual units (taken singly or in combination), each quality itself being a perceptual unit. Two units may intersect, be parallel, rotate, vibrate; three units may be a triangle, and so on. Then some relations can be perceptual units.

The perception of large distances will be accomplished by a process employing something like the following model: Imagine a rolled scroll, with a cross at each end of the text and with a line joining the two crosses. As the scroll is turned as if to read the text, one cross appears, then disappears, and we follow the line to the other cross. Or perhaps we are on the desert, and come to a railway. Our head turns as we look from one horizon to the other in order to see whether the railway is straight. In each of the two cases, the method is roughly the same: we can estimate a large distance by estimating the number of perceptual units between the two ends of the distance.

But since the perceptual units vary in size with the observer and so are of indefinite size, and since they may be seen to overlap, then the perceptual units are units of one thing, which is called "distance." An example will expand the meaning.

The floor where this is written is laid over with tiles. The perceptual unit centered around a point on the floor about six feet away has a lateral dimension including about seven of these tiles. By shifting the eyes slightly to the right, a new tile appears at the right edge of the perceptual unit and the leftmost tile disappears. In this way one can sweep visually the floor; any one tile appears at one edge of the field of vision, moves across the field, then disappears at the other edge. Now the tiles are rather large, but each of them bears a design which, taken with those of the other tiles, forms a pattern of units smaller than that of the complete tiles. Then when "about seven" of the tiles are in a perceptual unit, one is not sure whether one of the small patterns at the edge of the "seven tiles" is or is not included in the large perceptual unit. That is, the boundaries of the perceptual units are indistinct.

The purpose is to find some necessity linking the adjacent perceptual units.

If one looks at two adjacent perceptual units of tile (but of course not at the same instant), then by shifting the eyes one can see another perceptual unit of tile centered on the boundary between the two first-mentioned units. Then since the same point may now be in one perceptual unit and later in another unit, the units are necessarily connected by their containment of a common point.

Two objections can be made here. The first is that knowledge of <u>any</u> connection between the two units depends upon comparing a

present unit with a memory of a past unit, and so since memory is unreliable we cannot argue for necessity (or for any other relation between the units). The second objection is that even if memory were reliable, that necessity is not something observed, but is something inferred: the possession of a point in common does not show anything else, especially not that such commonness is necessary or that the entities having the common point are necessarily connected. These objections are serious.

As a large distance has been broken into perceptual units, let a perceptual unit now be broken into subdivisions, and let the subdivisions overlap. Here one can "see" the necessary connection (the second objection attacks this "seeing") between subunits without resorting to memory. Then by analogy, the same interrelations (possession of common points is the most important interrelation here) would hold between perceptual units as between the subdivisions of perceptual units. And thus the necessity is "seen." A reply to the second objection will now be made.

Using language, to say "A is A" is to express a tautology, which is said to be necessarily true. Therefore, to say "A is A" is not only to say that A is A, but also that <u>necessarily</u> A is A. Then to make a true statement about concentric circles A and B (for example, "Circle A is in circle B") is to say not only that A is in B, but also that <u>necessarily</u> A is in B. If it is not vacuous to say that "A is A" is not only true but also necessarily true, then it is not vacuous to say that not only is circle A in circle B but also that A <u>necessarily</u> is in B. If the addition is

vacuous that whatever is true is necessarily true, then the necessary truth of the tautology becomes meaningless. Let it not be immediately objected that the tautology and the circle have different modes of truth, for in the section dealing with "topographical models" the "two modes" of truth are considered in an attempt to fuse them.

Necessity by Perception

How can any necessity be a thing known by perception? This quasi-rehtorical question is raised by the second objection. A red patch can be perceived, and so can a length, but can necessity be perceived? The following case may show how this is possible, and it should also show that "perception of necessity" is no more a bizarre usage of "to perceive" than is the accepted usage "perception of length."

Consider three small concentric circles labeled A, B, and C in order of increasing radius. If the circles are suitably small we can see by a perceptual-unit-of-relation that A is included in B, that B is included in C, and that A is included in C. We see (in a purely optical sense) further that A must be in B, for that is what the perception indicates. The perception (optical) "excludes" (topographically) the possibility (linguistic only) that A is not in B. (The meanings here will be explored later at various points).

Now to deny (only verbally, of course) the necessity is to allow (also only verbally) the possibility that A is at present

not included in B. Such possibility is incompatible with the perception that A is at present in B, which means that necessity cannot in any way be denied to A's being in B. But this does not establish "perceptive necessity," and if we say that A is necessarily in B we are saying that what is so is necessarily so. This certainly makes the concept of necessity (fuzzy as it may be) rather vacuous - - - yet we do not consider it vacuous to say that "A is A" is not merely true, but necessarily true. But could the vacuity be avoided by saying that some things are necessarily so and others not? Then if so, what would be the criteria by which necessity is imputed to some and denied to others? One such criterion is currently in use, and it is that necessity is a property solely of certain deductive arguments which somehow "feel right." This property of right-feeling deductive arguments I shall call "deductive necessity."

Now there are two methods by which we can know that circle A is necessarily included in circle C. One of them is the same as that outlined above for seeing the necessity that A is in B; one simply looks, and sees that A is in C. The other method is that characterized by "deductive necessity." I shall now try to show that deductive necessity reduces to perceptive necessity; or rather that deductive necessity can be known only by perceptive necessity.

In one way, the reduction is obvious: the Venn diagrams, the Euler circles, and other pictorial devices for testing syllogistic validity convert deductive necessity into perceptive

necessity. (The devices are not merely "illustrative analogies," for all the "analogues" are examples of perceptive necessity.) Such are not the only methods for testing validity, for there is the scheme of distribution analysis. Furthermore, there are some syllogisms which are so obviously valid or invalid that one can know at a glance their logical form and so their validity.

The last two sentences in the above paragraph are the key to the reduction of deductive necessity into perceptive necessity. For with sufficient intelligence, these diagrams and distribution-schema would not be needed; any syllogism could immediately be grasped and pronounced valid or invalid. The diagrams etc. serve merely to analyze large intuitive leaps into smaller ones which can be understood at a glance. And then given proven relations between the small leaps, we can pronounce judgment upon the larger one of which the smaller ones are parts. That this analyzation of the leap <u>is</u> the function of the diagrams can be seen if one tries to explain even a simple syllogism to a dunce or to a child: one eventually reaches a point in the explanation whereat no further reductions are possible if the size of the requisite logical leaps, and then one must say, "But don't you <u>SEE</u>?" It requires a certain amount of intelligence to understand even the classic Socrates-man-mortal syllogism.

In the light of the preceding comments, consider the "Socrates" syllogism, which shall be a case of deductive necessity. Perhaps the clearest method to show the validity of the syllogism would be to employ the Venn diagram; the circles will show perhaps

more easily than language that if Socrates is a man and all men are mortal then Socrates is mortal. The Venn diagram is understood to show necessity by means of perceptive necessity, but how do we understand the necessity that the conclusion follows when the syllogism is expressed by an English sentence? By the same process? Granted that perceptive necessity is known by inspection of the world, so that we can <u>see</u> that one circle is included in another, and granted also that the Venn diagrams show some cases of deductive necessity to be knowable by transposition to the perceptive necessity of the Venn diagram, does it follow that <u>all</u> cases of deductive necessity can be known, or especially can be known <u>only</u>, by transposition to perceptive necessity?

What is the difference between deductive necessity and perceptive necessity? Perhaps an extensive definition will suffice to illustrate the difference. Perceptive necessity is exemplified by the observation that if one circle is included in another, it is necessarily so included. Deductive necessity is exemplified by such things as using formulas to find the speed of falling bodies; mathematical operations produce the necessity. To summarize the difference, perceptive necessity can be known directly from observing the relations between perceptual units, but deductive necessities deal with abstracted entities such as number, mortality, manhood, and being called Socrates; and so they are known by axioms, rules, definitions, etc.

The essential query is: must the deductive necessities be assimilated to some sort of topographical model in order to be understood?

The Role of Topographical Models in the Comprehension of Necessity

One might note the extent to which topographical models enter metaphorically into our discussions of abstract entities: we speak of "fields" or research, "areas" of specialization, "circular" reasoning, a romantic "triangle," "linear" equations, "spheres" of influence, a "square peg in a round hole," "opposite sides" of a question, a "circle" of friends, a "line" of succession, "circumlocution" in debate, and so on. One might also note that the abstractions so connected are taught to us by means of the concrete things from which the abstractions are withdrawn. Thus a child learns to count by using apples or matches, and the most sophisticated philosophers call for cases and examples of the matters they discuss.

But what of the following case of deductive necessity: "all bachelors are unmarried?" Must <u>this</u> be assimilated to a topographical model in order to be understood?

What sort of mental operation is performed when one perceives that "unmarried adult male" includes "unmarried?" Does one not "see" that the first member of the three-term series is the same as the single term "unmarried?" One does not merely <u>repeat</u> the term "unmarried"; one sees that it occurs once in the three-term series and once in the one-term series (i.e. the single term). This is of course a repetition, but it is more than a mere repetition; for one sees that the contexts of the two occurrences are not the same: the analyticity of "bachelors are unmarried" is

understood only by imagining the three-term series "unmarried adult male" to be seen in one place while the one-term series "unmarried" is seen in another place and in a different context, even if the place is nothing more than the positions of the terms in a formula "unmarried adult male - unmarried." The feeling is of turning the head to look in a different place.

This is no proof that deductive necessities must be assimilated to topographical models in order to be understood, but it seems that many persons understand language in this topographical way. And since all the conventional definitions of logical, analytic, deductive, and apodictic necessity are in essence exemplified by the deducibility of "unmarried" from "bachelor," therefore all necessities are at least capable of being understood in a topographical way. Then there must be something about topographical models from which one can obtain the concept of necessity. That "something" is denoted by the term "perceptive necessity." But the writer does not have any sharper or clearer idea of what that something is, but does anyone know what justice is? Fortunately, it does not seem expedient to investigate further the idea of perceptive necessity, nor of necessity in general.

It will be objected that "perceptive necessity" is grossly analytic. For of course circle A is seen to be in circle B, but does that establish that it is necessarily in circle B? Does this mean anything more than the tautology that if something exists then it exists? The answer to the last question is in the affirmative (cf. p.24 on tautologies). However, a few additional comments will not be amiss.

"Logical necessity" usually means that if something is true then its contradictory is self-contradictory; therefore the original is true. What does this mean, and how does one know what it means? For a case in point, consider the contradiction "married bachelor." Excluding humorous allusions such as "Sam really gets around; he's a married bachelor," one sees that the self-contradiction involved is due to the self-contradiction "married unmarried adult male." But how do we know this latter to be self-contradictory? This seems a puerile question, for the answer can be a condescending "We know it to be a self-contradiction from the definition of what it is to be a contradiction." This verbal answer is admirable for its lofty aims but lamentable for its failure, for if it is in Sanskrit I will not understand it, and indeed many persons will not understand it in English (especially those who do not speak English). The point is, how does one understand English? By being given ostensive definitions until one knows the referents of enough words to be able to understand elementary abstractions, and then more abstruse abstractions to the limit of one's intelligence. But all of these abstractions are understandable only from their common rott, experience. Then language is understood only from experience, one class of which is visual experience.

Therefore again it is suggested that a topographical model is indispensable: one considers "married" and then "unmarried," and sees that they are incompatible. But how does one know their incompatibility? If they are incompatible then how can they be

compared so as to discover such incompatibility? One way would be to take the married things and then the unmarried things and to see that in no case does the same thing have both qualities; another way would be to say that by definition no thing can have both qualities. But in both ways the analysis is incomprehensible unless one examines (eventually) a real group of individuals with one quality and then a separate group with the other quality; and since it is easily "seen" that the two groups are in different places, their incompatibility is known topographically. However, the two groups of people might be mixed, with the marrieds wearing, say, blue hats and the unmarrieds wearing red hats. Then since no blue-hat wearer is also a red-hat wearer, the incompatibility is still known topographically.

Thus self-contradiction in this case is known topographically, and since self-contradiction is essential to logical necessity, then logical necessity is known topographically. Therefore reductio ad absurdum proofs (wherein a contradictory is shown to be self-contradictory, thus proving an original) are knowable by their reducibility to the perceptive necessity found in topographical models. And if deductive necessity is knowable (and testable) by its reducibility to perceptive necessity, then what is deductive necessity but a kind of perceptive necessity dealing with entities which are called "abstract" (even though they must be made less abstract in order to be understood)?

Now the discussion is ready to return to a previous idea (p.23): that in perceiving lengths there is a necessary connection

between the perceptual units into which a large length is divisible. The "second objection" to the idea was that necessity is not observed but inferred. It has been met by reducing logical inference to perception and by the note on the necessity of tautological truths. The first objection may now be considered: it was objected that knowledge of necessity between perceptual units depends upon comparing a present unit with a memory of a past one, and that since memory is unreliable we cannot know the necessity.

The objection has its force from the fact that memory is often mistaken in what it presents to us; we very often make such mistakes in trivial matters. But in matters which we wish to remember, we can remember correctly and know that we remember correctly. What the objection means is that the remembering of a past perceptual unit is subject to the same sort of unreliability as is attributed to memory in the following case: "I thought I had left my fountain pen right here, but apparently I am mistaken in thinking so, for it isn't here and no one could have moved it."

The time between perceptual units is too short for fading to cause unreliability as does fading cause unreliability of our very earliest memories. But a test should show that in the perception of length, recent memories <u>are</u> reliable: given an appearance of a thing, one can turn away, remembering, and note the fading of the memory. But at any time during the fading, one can again turn to the appearance of the thing, and compare the appearance of the thing with the memory (assuming the thing is

unchanged -- photographs will establish this), to see whether the memory has become drastically altered. It will be found that in some respects the memory is changed and in others it is not. (There is a problem with the identity of the memory during its fading, but this problem in general is handled later in the section "On Changes.")

If it is found that the memory is accurate, then one is comparing a present perceptual with a memory of a past one; and by applying the given test one can be sure that the memory is sufficiently a reliable copy of a past appearance. A final point in favor is that retinal persistence indicates that the "fading" is not entirely a fading of memory, but in a way is also a fading of an appearance. (The process-product ambiguity of the term "appearance" so far in the discussion has been noticeable but not serious.)

Necessity in the Motion of a Tricycle

It was said in discussing the case of the triangle formed by three sidewalks that if one sidewalk is shortened the opposite angle must be decreased <u>if</u> we are still to have a triangle. Here is a case wherein for a definition to continue to refer to the world something in the world must change. The question is how we relate the meaning of the definition of a triangle to the world. The answer is that topographical models are used in the process of comprehending the (verbal) definition of the word "triangle," and that the necessity in the topographical model is

transposable to the sidewalk-triangle corresponding to the topographical model.

Suppose a child is driving a tricycle along the sidewalk-triangle. Suppose further that the child repeats the circuit of the three sidewalks, leaving after a few circuits have been completed. If the child has not stopped from the time he entered the sidewalks until the time he left them, shall we say, "It was all one motion?" This is acceptable, for the child never stopped his motion, and what does it matter how many times he changed direction? To be "more accurate," it might be said that whenever the child was moving along this sidewalk it was one motion, and whenever he was moving along that sidewalk it was another motion. After this consideration perhaps the child has not one motion, but three (one for each sidewalk). To be still "more accurate" it might be said that each change of direction would be a new motion, so that ten circuits of the sidewalks would be described as thirty motions. But the tricycle changes direction not only when the child steers from one sidewalk to another, but also every time the handlebars move. And if there is play in the steering mechanism there is another source of changes in direction. Obviously there are now many motions for every yard of distance; if a wheel strikes an ant there will be a change of direction. Further, changes in speed may be taken as changes in motion. Then the situation soon becomes extravagantly complicated, for the child does not apply power evenly throughout a revolution of the drivewheel. The gravitational

attraction of a stone alongside the sidewalk will affect the velocity; so does the wind from passing flying insects.

Is the tricycle's motion one motion, or three or some colossal number? All of these are correct: one's interest of the moment governs which aspect of the motion is emphasized.

What happens if one of the sidewalks is shortened? The motion-as-one is not affected, but the motion-as-three is affected in that one of them is along a shorter path. The other aspects of the motion suffer variously; however, the aspect wherein one considers that an onlooking ant exerts a gravitational influence is probably not involved, for the ant's mass multiplied by the tricycle's mass is a rather small number.

The point is that motion in at least one of its myriad senses (i.e. distance covered) will be affected by changes in the sidewalk triangle. Is there any necessity for this? Yes, the necessity between motion and one of its components is a feature of the definition of motion in terms of distance, velocity, time, and so on.

Necessity has been transposed from a mathematical triangle to a sidewalk-triangle, and then to the motion of a tricycle along the sidewalks. And since one motion is like another in that all motions are processes of change in the space-relations between objects, then what can be said of the tricycle's motion can be said of similar motions of <u>any</u> object.

It will be objected that the necessity of the change in the motion should one side of the triangle be shortened is analytic.

But one need not express the necessity of this fact in language in order to be aware of it; we can know by some non-linguistic process (the existence, operation, and results of which are communicated to others by language) that a shorter distance means a shorter duration of motion (at constant velocity, of course). It may well be that all facts are linguistic in that they are expressible, but this does not exclude from the class of facts non-linguistic elements such as color and pain.

But are not analyticity and necessity usually considered to be features of language only? It has been argued that perceptive necessity is not invented by language, but is discovered in nature by perception and described by language. Of course, linguistic entities (such as 'bachelors') are both invented and described by language (we do not perceive bachelorhood), but this is not so in the case of motion: one perceives motion, and also perceives (but not in the same way, although still non-linguistically) that a shortened path means a shorter duration of motion. (Perception of necessities in linguistic entities requires topographical models and so becomes perceptive necessity.)

It could be objected that the shortened duration along a shortened path is empirical knowledge gained after familiarity with such events, and so there is no more perceptive necessity here than in the prediction that the sun will rise tomorrow.

It is true that one cannot know any perceptive necessity of unperceived things, just as one cannot know the color of an unperceived thing. It is also true that one cannot know the

perceptive necessity of shortened-duration-along-shortened-path until one has observed that activity in nature. But these two truths are irrelevant, for perceptive necessity deals with entities either presently being observed or observed in the past.

THE SECOND SECTION: CAUSALITY WITH NECESSITY

Lengths are divisible into perceptual units of indefinite size, which are necessarily connected linearly and serially by the perception of greatly-extended objects. Also, there is necessity in a few kinds of changes, so that if a side of a triangle is shortened, then to remain in a triangle the opposite angle must also change.

It may now be asked whether causal changes have such necessity. What is causality?

Cases of Causality

It is difficult to give an adequate analytical definition of causality, for the concept is diffuse. And so a list of examples of causality follows, with a general discussion of the concept afterwards.

(A) The suspension cable causes the bridge platform to remain in place.

(B) If I throw a baseball to first base, the acceleration of gravity will cause its path to be a parabola.

(C) The Great Wall of China helped cause the downfall of the Roman Empire.

(D) Time causes a woman's skin to become coarse.

(E) The rusting of iron is caused by its oxidation.

(F) High temperature causes iron to glow.

(G) Being a bachelor causes one to be unmarried.

(H) The sun will rise tomorrow because it has risen every day in the past.

(I) Decapitation caused the death of Charles I.

(J) An unfavorable conjunction of Mars and Venus caused your business to collapse.

(K) The Civil War was caused by Yankee meddling in Southern affairs.

(L) Chance causes a coin toss to have an unpredictable outcome.

(M) "A quarter of a million persons died because of that monkey's bite." -Churchill, referring to the death by blood-poisoning of King Alexander of Greece in 1920.

(N) For want of a nail, a horse was lost; for want of a horse, a message was lost; for want of a message, a battle was lost; for want of a victory, a kingdom was lost. All lost for want of a horseshoe nail.

Need There be a Cause for Every Change?

All but two of the given examples of causality deal with some sort of change; the exceptions are cases (A) and (B). It should be noted that case (A) is a causal statement by reason of its exclusion of causes which would otherwise result in change;

to say "the commander singlehandedly held his company together" is to say that the commander disposed of all disturbing influences, and to say that the cable holds the bridge platform is to say that the cable prevents gravity from plummeting the bridge into the abyss.

These cases indicate that the changeless persistence of something is due to the absence of disturbing factors, which is of course rankly analytic. It <u>is</u> analytic to say that a thing will remain changeless unless it changes, but is it legitimate to assume therefore that a steady state will continue as such? If it changes, then obviously a causal factor has operated to produce the change; and if it does not change, then no causal factor has operated to change it. What are the reasons for the preceding sentence? The last clause is clearly analytic, but the first clause comes from our habitual tendency to think that there is some cause for every change.

Can we assume a cause for the absence of change, except in the sense that something might prevent change by overpowering any impinging causal influence? Many things contribute to lack of change (e.g. the great mass of a ship prevents its motion when a child tugs at the hawser holding it to a pier), but can any of these be said to be a <u>cause</u> for lack of change?

"Causes" usually deal with change, and a steady state is the result either of some sort of balance between conflicting causal agents or of the "shielding" of the steady state from causal agents which without the shielding would produce a change.

Newton's first law of motion illustrates the meaning: can we speak of a cause for a body's remaining at rest or in steady-state motion? Such causes will be data for "the inertia theory of change" (analogous to the inertia theory of steady-state motion).

We say that things remain as they are unless something changes them (it is not easy to say whether this sentence is analytic). But why jump to this conclusion? Why say that there are no spontaneous changes?

It was a shock to the "inertia theory of change" when statistical mechanics came into vogue. For in such a system, it can be predicted that a certain percentage of a mass of atoms will decay in one second, but it cannot be predicted when one selected atom will decay. It might be said that the "cannot" is due to empirical ignorance and not to theoretical edict, but the idea of spontaneous change has been mentioned.

Upon what grounds do we exclude spontaneous changes? Most changes can be attributed to "causes," and many changes once puzzling have been shown to have a causal source. For these reasons it is suspected that causes will be discovered for the decay of each individual atom. However, so far no such causes have been found.

To speak of a cause for a steady state is usually to speak of equilibrium between opposing agents. But would we say that there is a cause for the persistence of an utterly isolated and changeless entity (say, God)? Probably not; we are likely in such a case to say merely that the entity is beyong causation, etc.

It might be said that case (G), "being a bachelor causes one to be unmarried," is neither a case of causality nor does it deal with a change.

Is the case a case of causality? If so, it is such in a somewhat extended sense, as the sense in which the premises of a syllogism cause the conclusion. But for those who would say that it is not a case of causality, I would refer them to the above cause of the truth of a syllogistic conclusion. This is a case of what might be called "deductive causality."

The remainder of the cases given are examples of "physical causality." It will be noted that each of them attempts to explain a change by postulating the influence of something else. It will also be noted that the "something else" varies from case to case: in case (B) a physical force is invoked; case (J) is an unsatisfactory explanation of business failure. Cases (M) and (N) seem partially acceptable and partially inadequate, for if Alexander had been an ordinary man the monkey would have caused perhaps only one death; the battle was lost for many reasons, only one of which was the failure of communications.

Deductive causality and perceptive necessity seem to be very much the same sort of thing, since deduction in general is known and tested by topographical models which exhibit the deductive necessity by reducing it to perceptive necessity.

What of physical causality? There might be cases of it which are known by perceptive necessity (e.g. opening a door), but there will be many cases of it wherein there is no such perceptive

necessity (i.e. the sun will rise tomorrow). However, in some of these latter cases theory attempts to link cause with effect. Now, it will be remembered that theory (such as the assumptions in the shape of a penny, and especially those in the perception of motion and length) is sometimes essential to our judging something to be "real." The task is to search for some such essential assumptions in physical causality, with the aim of finding some sort of necessity in physical causality.

Against the Idea that There is Some Simple First Cause Ultimately Responsible for Every Change

An argument for spontaneous changes will now be presented in order to attack the idea that every change has a cause. This idea appears also in the concept of the first cause: the first cause is a cause, itself uncaused, in relation to which every other cause is an effect.

Consider the toss of a die. We say that the result is governed by chance, but we do not say that the outcome is uncaused. By "chance" we mean that one face of the die has been uppermost after a dietoss as often in the past as has any other; and by "cause" we mean that one event leads predictably to another, so that from the dietoss we should be able to predict which face will be uppermost. Now can these two ideas be reconciled?

It is clear from the above what is meant by chance. But it is not at all clear what is meant by cause, for chance is concerned merely with the frequency of occurrence of a phenomenon, while cause seeks for explanations for the occurrence of the phenomenon.

Precisely what do we mean when we say that the outcome of a dietoss is not uncaused? When we say that the falling of a stone is not uncaused, we mean that it has in some way become unsupported and that therefore gravity can pull it down. And when we say that the outcome of a dietoss is not uncaused, we have in mind some sort of similar explanation for the outcome.

In some chance-governed phenomena, no explanations are advanced. For example, in radio-active decay one knows that a certain percentage of the atoms will decay per second, but one does not know when one selected atom will decay. There is also the opposing view that the greater knowledge will give us the power of prediction in this case; the view seems to spring from the idea that all secret causes will eventually be known, including those which produce the decay of atoms. This latter view assumes that every change has a cause, or that no change can be spontaneous. The following argument will attack this view.

In saying that a dietoss has a caused outcome, we think that knowledge of ballistics and initial conditions of the falling die will alone enable us to predict the outcome: given the falling we can predict the outcome; given the throwing we can predict the falling, the bouncing, and the outcome; given the state of the muscles and nerves, we can predict the throwing and so the falling, the bouncing, and the outcome; and so on. Every change now has some cause which is in turn a change and so has a cause. This analysis continues until some beginning is reached for the chain of causes; this beginning is the first cause. An analogy

to this chain would be the game wherein a child sets up a row of dominoes and then tips the first into the second, which strikes the third, which strikes the fourth, and so on until the last domino falls.

Suppose that the outcome of the dietoss is a five. Then the bouncing which produced this five is not a duplicate of the bouncing which produces, say, a six, for one of the principles of causality is that duplicate causes cause duplicate effects. And one might say (for the same reason) that the falling which produces the five's bouncing is not a duplicate of the falling which produces, say, a six's bouncing; neither are the two throwings duplicates; nor the two states of the muscles and nerves; and so on. Then no part of the causal chain leading to the five is a duplicate of any part of the chain leading to the six, or else the subsequent parts of the two chains would be duplicates with a duplicate result. It also follows that the beginnings of the two chains cannot be duplicates (or else the entire chains are duplicates with duplicate results). Therefore there can be no <u>simple</u> entity to cause first a five-chain and then a six-chain; nor can there be a simple entity to cause either chain <u>not</u> to occur. This means that there is nothing simple which could direct which chain of the two shall be initiated, nor could a complex entity (i.e. one containing a conjunction of beginnings of the chains) direct the initiation, for in that respect it would be simple when it initiates a chain rather than complex; any complexity would enter when the entity is "considering" which chain to initiate.

This means that such initiation is spontaneous whether or not such initiation is due to "consideration" of which chain shall be initiated. The first cause, if complex, is not a cause but contains causes; as such it is analogous to an egg.

It might be said that spontaneity means self-generation, which is absurd: how can something which does not exist generate anything, especially itself? However, the simple first cause is subject to the same accusation as is the complex first cause: either it is not a first cause, or it has generated itself (absurd), or it has existed from eternity; none of which is a satisfactory answer to the problem of origins faced by both the simple-first-cause school and the complex-first-cause school.

Then it seems that the five-chain and the six-chain are mutually independent. It might be wondered how many of such independent causal chains there are.

Our Interests, and Not Some Power in the Cause, Govern Our Establishment of Any Causal Sequence

A "five" has been mentioned as being the result of one of many causal chains. But "a five" is the name for many things, because the die may assume countless positions around a vertical axis, and any of these would be called a five if the five-face of the die were uppermost. Furthermore, the die may come to rest on the table, on the floor, here, there, anywhere, and as long as the five-face is uppermost the result is "a five." Thus there are very many results, and by the preceding argument each result is the end of an independent causal chain.

From this it is noticed that a detailed picture of causal sequences would be rather complicated. And so a simpler case will be selected for further analysis.

The line of toppling dominoes is such a case. It is simpler than the dietoss in that the die-chain is a linkage of dis-associated events while the domino-chain is a linkage of sequential repetitions of one event, namely the toppling of one domino into another. And so this is an enormous simplification, for we may examine the workings of the chain by inspecting the workings of one link. Now selecting any link except the first or the last, we see that one falling domino upsets another, which falls into a third, which begins to fall before the second domino completes its fall. And then we have a new falling domino, and the whole affair repeats until the last domino topples.

Then what is the effect of pushing one of the dominoes into a second? It is seen that the immediate effect is to topple the second comino. However, before the effect is complete, a third domino is falling, and so on. The effect seems rather diffuse; perhaps it can be clarified.

Let us observe very carefully, using some of the physicists' theory, what happens as the first domino of the set is pushed into the second. As the first is tipped past its balance point toward the second, it falls with increasing speed until it strikes the second. Due to the impact, the second begins to move, and the first continues to move for a short while. The second, having been struck by the first, moves, and falls into the third. The

second then continues to move for a short while.

Such would be the usual description of the events of the domino-chain game. But what is cause and what is effect among these events?

Coarsely speaking, the falling of the first domino is the cause of the falling of the second. But we see immediately that most of the falling of the first domino has nothing to do with the falling of the second, so we modify our description of the cause and say that the cause of the falling of the second is the striking of the second by the first. However, this is incomplete, for the impact must be sufficiently vigorous to topple the second. Further, the second must not be, say, glued in place; it must be free to move. Neither can there be a sudden calamity which destroys both dominoes before the second begins to move, and so on; obviously the causal conditions are somewhat complex. If we attempt to simplify by saying "The second must be free to move and the first must strike the second with sufficient force, then we have made a curious statement. It is analytic, yet it encompasses conditions such as that the second domino shall not be glued in place, that no atom bomb shall vaporize both dominoes, and that the impact shall be greater than a certain number of dynes of force.

Now what of the complexity of the effect?

Again, coarsely speaking, the effect of pushing over the first domino is that the second falls. However, the second domino does not come to rest until it has struck the third, which in turn does

not come to rest until it has struck the fourth, and so on, until the last domino has fallen. Then the effect of pushing over the first domino is that not only the second falls, but also the last. But why restrict the effects to those upon the second domino, or even the last domino? For some hapless ant may be crushed; there is also a wind from the falling domino; there is a sound as one domino strikes another; and the falling produces a more stable position for the first domino.

All of which shows that for the case of the falling domino, the causal relations are complex, although not as complex as for the case of the dietoss. Perhaps a yet simpler case can be found.

Such a case may be the following: the pulling upon a door and its consequent opening. The cause is simply the exertion of muscular force upon the door-handle; the effect is the opening of the door. However, opening is a sub-class of moving, so perhaps a more accurate description of the effect would be to say that the pulling upon the doorhandle moves the doorhandle which in turn moves the door. But there are still the assumptions that the door is free to move and that it is pulled with sufficient force.

The given cases indicate that a cause is complex, containing assumptions as well as active agents. And the previous argument for non-duplicate and independent causal sequences, whose initiations are also independent, shows that spontaneity is more clearly a true description of the origin of changes than would be thought by those who maintain that every change has a cause.

But does this mean that since there are multitudinous independent and non-duplicate sources for changes, that <u>each</u> change is itself independent and so requires no antecedents? Which is to say that <u>no</u> change need have a cause?

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This extreme position is uncomfortable, for we often say that we have found the cause for a phenomenon; our habit is to invent causes where we can find none (this habit is responsible for much of the nonsense one hears).

Since the origins of causal sequences are independent, one does not know where they begin. Does one know when they end?

Consider the execution of Charles I. The ax was the cause, the death was the effect (that is, the effect which interests us; we do not care about the noise made by the ax).

Does not this causal sequence terminate with the decapitation? No, for the decapitation is a cause for the death. But surely the sequence is now completed. But the death is a cause for still other effects, and so on. This would mean that the sequence containing the death of Charles I is still "in action," for it has had at the very least enough long-lasting effects that it is mentioned in this thesis - more importantly, it still colors British political thought (although perhaps not very much); it is a standard case of regicide; who knows what Britain would now be like

except for his execution, etc.

Attenuation of Causal Sequences

But certainly the execution was more significant in 1660 than it is in 1960. Thus it has faded from memory (in a derived sense of memory, of course, since the spectators are all dead), its context no longer is a vital political issue, and so on. But there is another reason for its loss of significance, and I should like to call this reason "attenuation."

Now it is true that the train of political consequents of the execution can be followed for a time before they become diffused with other political problems and so lose significance. But it is also true that there are many effects of the dropping of the ax which are present for spectators but which are ignored by political historians.

What are some of these effects? The beheading, the noise of the impact, the wear upon the block, the death of Charles I, the emotional impact upon the spectators and upon those who later learn of the event, the dropping of the head (and other grisly details), and then there are the political consequences. Each of these effects has consequents, which in turn have consequents. Then the effects of the ax stroke proliferate; which of the manifold branches shall we follow?

Obviously the effects on the ax quickly cease to be important; for the ax is cleaned and sharpened and is soon ready for another occasion. But of course perhaps a museum would want the fateful

ax, in which case a new ax must be obtained for the executioner. This calls for capital expenditure, etc. But whatever the results of the wear on the ax, these results are called "side effects," meaning that such are not the effects which most interest us. The same epithet disposes of such effects as the noise made by the stroke, the wind from the passage of the ax through the air, and so on. Then what is "the" effect (that is, which effect most interests us)? That would depend upon who we are, for the friends of Charles I had more interest in his death than in the subsequent political events, and historians care more for the politics. And the headsman may have been more concerned with the danger to his ax than with the victim or the state of the nation after the execution.

All this is analogous to cases (M) and (N) given earlier, in that a fairly simple event has complicated important effects. The mechanism for explaining the complexity has been explained by N. R. Hanson;[1] the following few pages are loosely patterned after his ideas.

Some Fallacious Arguments for the Simple First Cause

How explain the complexity of the effect of a simple first cause? For when one considers the multitudes of different "fives" which might result from a single dietoss, and since it has been said that an independent and non-duplicate causal chain produces

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[1] N. R. Hanson, "Causal Chains," Mind, July, 1956, 55: 289-311.

each of them, then it would seem as if each discernible bit of the effect of the ax-stroke must also be the result of such a chain. The answer is that the "cause" is not simple.

Due to the time-lapse during the dropping of the ax, it might seem as if the complexity of the cause could be explained by saying that the cause was itself a causal sequence, each member of which produces one of the above list of effects. But this only restates the proliferation of the causal sequence, for it is seen that the presence of the cause for the dropping of the ax is more immediate than the cause for, say, the subsequent political events. That is, one cause is immediately present in space and time; the other is not so present but becomes known at a later time.

How do considerations of the "presence" of a cause aid in explaining the proliferation of causal sequences? Each cause is the junction of several causal sequences, but before exploring this it may be well to answer the following objection to the idea that there may be many independent causal sequences.

It might be said that there need not be two non-duplicate and independent causal sequences to explain two results of a dietoss, for two causal sequences might be duplicates until, say, the time of the falling, and then a wind might come along and disturb one of the sequences sufficiently to produce a face different from the face produced by the other toss.

But this objection will not save the idea of the first cause, for to shift the problem to the wind is to ask why the wind was different in the two cases, and then we must analyze two contrary

wind-sequences. And if the conclusion that there are three first causes (one for the two dietosses, and one each for the cases of wind and no-wind) is to be avoided, then the question must again be shifted to another pair of sequences in order to explain the two different wind-sequences. But now there are four first causes: one for the dietosses, one for the winds, and one each for the two different states of the wind.

It will be noticed that the dietoss sequence after it has been disturbed by the wind is still regarded as a die-sequence and not as a wind-sequence. But if we were more interested in the wind than in the outcome of the dietoss, we would follow the wind after it had met the die, and not the die after it had met the wind. The two sequences might be said to meet, affect one another and then pass on in their separate and non-duplicate ways. Yet of the two ways, we would say that one is the dietoss-sequence altered by the wind, and that the other was the wind-sequence altered by the die. Then the result of these two intersecting sequences is not to be known as the upshot of one powerful sequence modified by a weaker sequence, for we cannot say which of the sequences is more powerful. Were we more interested in the wind-sequence, we would say that it was the more powerful since it was only slightly affected by the tiny influence of the falling die; and were we more interested in the die-sequence, we would remark that the influence of the wind was tiny, although enough to affect the outcome of the dietoss. Then the issue is not which sequence is the more powerful, but which sequence interests us the more.

It should be easily seen that to speak of a single causal sequence is to ignore these extraneous sequences, which intersect with each other and with the "single" sequence, and which influence events in all chains subsequent to but not events prior to the intersection. And soon we have a network of interesting sequences, in which, except for our interests, the path of any putative sequence could not and would not be traced. For example, in tracing backwards in time the sequence leading to a "five" on a dietoss, we soon come to the time when the die is falling, and now which way shall we proceed? Along the wind-sequence, or along the throwing (of the die) sequence? Any selection between the two is arbitrary. But if we say that both must be included in the continuation of the tracing, then soon we are following a bewildering number of sequences, all of which we must follow, for at every intersection all of the intersecting sequences are relevant and contribute to the overall effect.

Another objection may be raised at this point, namely that the outcome of the dietoss is due more to the throwing than to the influence of the wind after it was thrown. The answer to this is as follows: it is true that after throwing, the wind has no effect on fallings in general, but it is also true that the particular bouncing under discussion differs from the other bouncings only in that it has been disturbed by the wind. If someone were to say that the bouncing would not have occurred without the throwing, then his objection can be met by saying that the particular bouncing under discussion would not have occurred without the wind.

For all the above reasons, the idea of a single simple first cause must be abandoned, and in its place is a multitude of such causes. With one such cause, spontaneity and uniqueness is a characteristic of it alone. However, with the multitude of independent non-duplicate causes, spontaneity is rampant in their beginnings. Further, the tracing of causal sequences (or chains; the terms are used interchangeably) is arbitrary and governed by our interests rather than by any intrinsic quality of causes and effects (later, this idea will be more fully developed).

Thus the idea of causal sequence as being discoverable, as is a battleship's anchor chain, must be viewed with suspicion, and possibly the idea must be abandoned.

But what of the simplest and shortest of the sequences, such as those found when an arrow is shot from a bow, or when billiard balls collide? Is the choice of single causes for the effects as arbitrary as for the more remote parts of the longer and more complex sequences, or is our choice of "the" cause for a simple effect (if there are such effects) more nearly controlled by the actual causal situation?

On Simple Causal Sequences

Before considering in detail the elementary causal relation which holds in the simplest cause-effect sequence, I wish to present the following list of problems, the last two of which will be considered.

How does the cause differ from the effect?

How does one causal relation differ from another?

How can something produce a different thing?

How can something produce anything at all?

To what extent is the cause distinct from the effect?

To what extent is the cause united with the effect? And if there is unity, what sort of unity is it?

Every cause-effect sequence contains the following classes of components: the effect, the cause, and the absence of hidden preventers which would if present thwart the operation of the cause. We have seen that "a cause" and "an effect" are each usually general terms which include many possible situations: thus "a five" is the effect of a dietoss, but there are multitudes of die-positions which we call "fives." As Rusell has suggested,[1] if we were to closely specify the effect as being one particular member of the numerous class of fives, then a repetition of that particular five probably would not recur out of the very large number of possible fives. Also, "cause" is a most diffuse term, for the throwing of a die is a cause for a multitude of distinct resulting die-positions; but the causes for one particular five out of the class of fives are so numerous and complex that probably such a complex would not recur and so neither would the highly-specified five under discussion.

Consider the case of the colliding billiard-balls. As the simplest of such cases, consider that one wherein a rolling cue-ball strikes another ball in such a way that the struck ball

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[1] Bertrand Russell, Mysticism and Yogi, p. 188.

moves in the same direction as that in which the cue-ball was moving before impact.

What does one perceive in this case? We see the cue-ball rolling and we see the space between the cue-ball and the target diminish, then we hear a sharp click and see the target move away from its former stationary position. Is there any sort of necessity here?

The usual idea is that there is no necessity, for we can easily imagine that the target ball does not move, or that the cue-ball in some mysterious fashion passes through the target without any change in its motion, or perhaps the target moves off at some fantastic angle.

But we would be astonished by these occurrences, and would look for some "secret cause" (Hume's term) to explain them; we would say that a secret cause explains such deviations from constant conjunction. But while there may not be any necessary connection between cause and effect, we yet feel that there is some sort of connection between them. There seems to be two sources for this feeling other than Hume's constant-association-of-ideas.

Both of these sources rely upon analogy. We can remember an uninterrupted motion of a billiard-ball from one cushion to another, and then we can relate this single motion to the motions of two billiard balls which are chosen such that one strikes the other, their motions being along the same line traced by the motion of the single ball. That is, we consider the motions of the two balls to be one motion which is transferred from one ball to

the other by the collision.

The other source for the belief in some sort of connection beyond that of constant conjunction between cause and effect in the billiard-ball collision comes about from a tactual analogy: we know the feeling of the impact of a billiard ball against our hand, whether the ball strikes the hand or vice versa. Then we can think of the hand as being placed between the two billiard balls, so that the moving ball strikes the hand and the hand then strikes the stationary ball. And since when a ball strikes our hand the hand moves, and since when our hand strikes a ball the ball moves, it is a simple step to imagine the first ball striking the second without any interposing hand. Thus the impact of the first ball upon the second affects the second in the same manner as the impact of our hand would affect the second. And so we form an analogy between the collision of two billiard balls and the collision of our hand with a billiard ball, and this analogy gives us the feeling that there is something beyond constant conjunction in the billiard-ball collision, even though the ball-hand collision is still merely constant conjunction.

But is there any necessity in these extra connections? There is none apparent in the "second source," for the source depends upon the relation between the collision of the hand with the ball and the subsequent motion of the struck body (whether hand or ball). But there seems to be something in the first source which may turn out to be necessity. To bring this "something" into focus, let us now turn to another simple case of causality.

Such a case occurs when we pull upon a door. If the door opens, that is the effect; and if the door does not open, we assume that some hidden preventer does not allow it to open (we look to see if the door is locked, jammed, nailed shut, etc.). If we assume that the door does open, then the case is at its simplest. Then let us examine the case carefully.

Taking first a linguistic approach, we may ask whether pulling upon a door causes it to open in the way that being a bachelor causes one to be unmarried, for there is logical necessity in the case of the unmarried bachelor.

The answer is that in one sense, there is such a logically-necessary connection, for one meaning of the word "pull" applies to cases wherein the exertion of a force results in a motion, as when a child pulls a toy wagon. However, this sense of the word (often designated by the term "pull along") is often not distinguished from another sense in which pulling does <u>not</u> result in motion, as when a child pulls at an automobile. In one of these senses, motion is analytically included, but in the other it is not; hence there is necessity in one of the senses but not in the other.

However, an interesting note now arises. As we contemplate pulling upon a door, which sense of "pull" is applicable? And in general, how do we know which sense of the word "pull" is to be applied to cases of pulling? When motion results, as when the child pulls a wagon, the sense of "pull" appropriate is obviously the one including motion. And it is equally clear which sense is

meant when the child tugs at an automobile. But before the child acts, we can only guess which sense is to be applied, even though experience may show that the child has in the past been able to produce motion by pulling upon a wagon but not upon an automobile, and even though we may be able to calculate the child's muscle power and the force required to move various objects. Then past experience tells us which sense of the word is to be used, and so there is no necessity, but only a description of experience. Therefore even though one sense of "pull" does analytically include motion, we do not know whether that sense is applicable to a case of pulling until experience shows whether that case was characterized by motion.

Then the way in which pulling upon a door causes it to open is not the way in which being a bachelor causes one to be unmarried.

It may be thought that a cause is one thing and that an effect is quite another thing, with some sort of connection between the two. But in many cases it will be found that there are common elements (either repetitions or persistences), or that the effect is merely the cause seen from a different viewpoint, or that in some other way the distinction between cause and effect is arbitrary. Then because of the arbitrary distinctions between them and the common elements joining them the cause is separable only linguistically from the effect, and thus we may say that apart from our arbitrary distinctions they are one entity. However, their "unity" (i.e. singleness of being) is not

linguistically derived. This is the view I would like to establish.

Consider a fox examining a squirrel. The fox cannot be reasonably accused of being linguistically aware of the squirrel, but we can see the fox's eyes following the motions of the squirrel, and then we might see the fox chase the swuirrel, following every dodge and twist the squirrel makes. In the same way, we observe the fox and the squirrel. Presumably, then, our observation of the squirrel is much like the fox's observation of the squirrel, and except for differences in sense-organs, coloration given to the squirrel, and other details of the appearance of the squirrel, both the fox and we collate the appearances into the object which the fox chases and which we call "squirrel." The results of this collative process are what I would like to call "non-linguistic unity" and "non-linguistic self-identity." The difference between the two is that "unity" will be used for things usually considered discrete, while "self-identity" will be used for emphasizing the coherence of the many appearances of one object. Both will be sub-classes of "perceptive necessity."

On Changes

For changeless things (e.g. the past), the notion of non-linguistic self-identity does not present any great difficulties, either in comprehension or in acceptance, for it requires no words for, say, an animal to find its burrow after a day's foraging. Neither does it require any such acts for us to drive an

automobile over a familiar road; the curves and hills are there unchanged.

But if some sort of non-linguistic self-identity can be found in changing things, the way will be more nearly cleared to find the same sort of identity between cause and effect, and so perceptive necessity.

Phenomenologically speaking, there are two ways by which anything may change: we may perceive it from a different aspect: or from one aspect we may perceive that its appearance is different from its appearance a moment ago.

We have already considered the class of cases in which an object is viewed from many directions and distances, with resulting many appearances which are integrated into one object. This class will not be considered further, since we do not consider there to be a causal relation between the different aspects of an object which are due to viewing the object from different distances and directions. However, such changes in appearance do indicate motion of an object relative to an observer, and such motion is an effect of some cause (we say). This last observation is made in order to distinguish this class of cases from the other class wherein there is a change in appearance but no change in distance or direction, as when we see a stone break a window.

The problem of change is a knotty one, for if something changes, then it is something else. Then how can there be identity between a thing before change and a thing after change?

I suggest that to say that a thing has changed is to say that a class has a different membership. As an illustration, consider the statement, "The smokestack has changed," meaning that a certain large brick structure is not as it was a moment ago. Upon hearing such a statement, we are likely to ask, "How has it changed; in what respect is it different?" The reply can be various: we may say that the atoms are different, or that the bricks are different, or that the shape is different, or that the whole thing has fallen down and so it is all different, or that it has been painted, and so on.

But what does it mean to say that a brick is different? The same battery of questions may be applied to the brick as was applied to the smokestock: that is, the brick has been painted, or broken with a hammer, or it is composed of radio-active atoms which have decayed, and so on. And what is it to say that a radio-active atom is different? How have its parts (or the whole) changed?

The purpose of the above line of questioning is to reduce changing entities into their simplest component parts; once this is done we may ask what it is like for one of these "atomic" parts to change - this latter question will throw light on the nature of the change of the "molecular" objects such as smokestacks.

What is it to say that one of these "atomic" parts has changed? If X is an atomic part, then X may be replaced by another atomic part (that is, one brick in the smokestack may be

replaced by another). But if X is not replaced, but has simply "changed," then the change is in the sense that the "molecular" part containing X is changed when X is replaced (that is, the entire ensemble of the smokestack is changed when X is replaced); and X is not atomic but molecular. Then an atomic part of the smokestack cannot (by definition) change in the sense that the smokestack changes. But how can an atomic part change? By replacement with another atomic part. For example, if a brick is regarded as an atomic part of the smokestack, it can be replaced by another brick; but it cannot change as the smokestack can change, for then the brick becomes molecular and its parts become atomic. And so change on the atomic level is accomplished only by replacement of one atom with another.

Now when we consider a change of the complete smokestack, another mode of change appears. This mode is usually what we mean when we say that something has changed: some atomic parts are replaced, but others are not; so that the object as a whole presents some differences between its appearances before and after change, but also some similarities. For example, when the smokestack changes, bricks may be replaced and perhaps the ensemble is painted. But there are other qualities which are not altered: the location of the smokestack is unchanged; its size, weight, and shape are not appreciably affected; etc. And it is because of these persistent similarities that we say "the smokestack has changed" rather than "where did that smokestack go?" or "it is no longer a smokestack; it is now an elephant."

And so the smokestack is a class of appearances, and when the smokestack is changed, some but not all of the appearances are removed or replaced by others. This kind of change I shall call "XtoX'", meaning that X has become somewhat different, but not sufficiently to warrant calling the resultant product by a different letter. However, a complete change, such that all of the appearances are removed or replaced, will be called an "XtoY" change. Examples: when we say "the smokestack has become an elephant" or perhaps "the caterpillar has become a butterfly," this is an XtoY change.

Now I would like to see whether causal changes of the XtoY variety (if there are any such) have necessity, and afterwards whether there is necessity in the XtoX' changes.

A case of causal changes of the XtoY variety (i.e. where the effect is that something undergoes an XtoY change) would be the effect of a solar supernova upon the planet Mercury. What change could be more complete? All of the molecules of matter in Mercury would be separated from each other and then dissociated into atoms, many of which would then be ionized or annihilated into energy.

It might be objected that this is still not a complete change, for the atoms of Mercury still exist; and even those which are annihilated into energy by the sun't metabolism still exist (although converted into the form of radiant energy) and are moving by electromagnetic propagation and particular ejection through space. However, although strictly speaking this objection

is sound, it unfortunately destroys a useful concept for by the objection we lose the concept of the finality and completeness of torpedoed ships, novaed stars, dead animals, delivered children, and so on.

But although the concept of utter change is useful in expressing termination, it is misleading in speaking of causal changes, for it is an oversimplification: we neglect the debris left by the novaed stars; we ignore the corpse; we do not consider the sunken hulk on the ocean floor. On this basis, then, the objection is sound; due to the residues of the changes mentioned there are no utterly complete changes (not even between that which goes into the chrysalis and that which comes out) such as would be labeled XtoY, for the components of the residue were components of the ship before torpedoing or the sun before novaing or the body while living. And the components of the adult butterfly were components of the caterpillar. The steel is a common component of both the ship and the hulk; the atoms are components of both the sun and the nebula after supernova; the body is common both to the live animal and to the corpse. And in the chrysalis the atoms of the caterpillar are rearranged to produce a butterfly.

Thus there can be XtoX' changes, X'toX'', X''toX''', and so on (thus an egg becomes successively a caterpillar, a pupa, a butterfly, a dead butterfly...); but however far this process is carried we do not produce XtoY changes: the change is always $X^n$to X^{n-1}. Complete annihilation would be an utter change of the

XtoY variety (where Y is nothingness), but there is no reason for believing in complete annihilation: if we separate every brick of the smokestack from every other brick and then convert the entire mass into energy, the energy will spread out along a spherical wavefront and become progressively more attenuated, but there is no reason to believe that it ever completely disappears as would a sound wave (which becomes heat).

Then avoiding the misleading usage of the term "complete change," it is seen that all changes are of the XtoX' variety, wherein a class has some different members.

Then if X is a class with members a, b, c, d, e,...; and if X' is a class with members a,--, c, #, %,...; the change XtoX' is allowable because of the members "a" and "c" which are common to both. Without these two factors, the change would have been the impossible XtoY, which classes have no common members (this includes the non-existent "annihilation" case where Y is a null class).

X and X' are linked by the common members "a" and "c", which persist while "b" is removed to another place and while "d" is replaced by "#." These factors "a" and "c" furnish the perceptive necessity between X and X' because of the "non-linguistic self-identity" of the a's in X and X' and of the c's in X and X'. That is, if "a" is a perceived factor in X and also in X', then the presence of "a" in both X and X' justifies us in calling the latter "X'" rather than "Y." Now of course the mere presence of "a" in something is not enough to justify calling that thing "X'"

unless "a" is restricted to a feature of "X", say, one smokestack. For example, if "a" is the overall shape of a smokestack X, then the same kind of shape "a" of other smokestacks is not sufficient to justify calling them X'; that is, the smokestack X does not change into the other smokestacks. But the presence of the shape "a" in smokestack X and in the smokestack-after-painting X', where the shape is in "the same place," is sufficient to justify our calling the painted smokestack "X'" rather than "Y." And so the shape "a" links X and X'. Further, this linkage is one describable as being accomplished by non-linguistic self-identity. The presence of one such common member is sufficient to establish the identity. Now it may be that instead of keeping the smokestack under constant observation while it is being painted, we see it on two occasions, before and after painting. But in either case, we know that the shape "a" is in "the same place," and so it does not matter whether we see the shape persistently or repetitiously.

Now the crucial question may be asked: can X be a cause for X'?

On Causal Changes

A physical object, such as a smokestack, can undergo an XtoX' change, but a physical object alone cannot be a cause; for when one billiard ball strikes another, it is not the billiard ball alone which is the cause of the motion of the second: it is rather the billiard-ball-plus-its-motion which is the cause.

Similarly, it is not the Great Wall of China alone which diverted the barbarian tribes toward Rome, for the Great Wall (as an object made of stone, dirt, etc.) would not have had such an effect unless it had existed at the proper time and place. Thus again the cause is complex, and therefore X can be a cause only if X is complex. Then in the case of the billiard balls, X must be "billiard-ball-plus-motion" if it is to be a cause; and in the case of the Great Wall X can be a cause only if X includes not only the physical Great Wall (which could be removed and taken to the United States as castles have been taken) but also qualifications of time and place.

Then subject to the above considerations X can be a cause. But can the effect of such a cause be described as X'? If we have the picture of causality as being some sort of relation between entirely different things, then obviously the effect is not X' but Y (so that the effect may be "entirely different"). And if our picture is that causality is some sort of relation between things which <u>except for the causal relation</u> are entirely different and distinct (this springs from the idea that any two related things have at least the relation in common), then there is still no justification for calling the effect X', for the relation of cause to effect is not in any way the same as the relation of effect to cause because of the time-order; and if cases of simultaneous cause and effect are mentioned, then there is still a difference between cause and effect: namely, that the cause is "active" and the effect "passive."

Then a causal relation, to be of the XtoX' type, cannot be between entirely different things (X and Y) which are called "cause" and "effect." It may be that there are causal relations of the XtoY type, but I feel that necessity of any sort will be very difficult to establish between cause and effect in such cases. However, there might be necessity (due to non-linguistic self-identity or non-linguistic unity) between cause and effect in the XtoX' relation.

At this point I wish to introduce an analogy to the ideas of this section. Consider the noise (or music, if you prefer) emitted from a bagpipe. The sound is a din of steady pitches, produced by "drones" plus a melody played upon a clarinet-like tube called the "chanter." Now the changes in sound from the chanter would represent removal and replacement of the members of classes: thus the total sound which includes one note of the chanter is one class X, the total sound which includes the next note of the chanter is the next class X', then we have X'', and so on. The notes from the drones represent the members common to all the classes. Further, the ensemble covers a time-span as do most but perhaps not all causal relations. Perhaps a case of causality can be found which is assimilable to the bagpipe-noise model, so that the total sound which includes one note from the chanter is the cause and the total sound including the next note is the effect.

And since the drone's noise is deafening and overpowers the chanter, we may easily think of the bagpipe-noise as a screech with variations. So there would be non-linguistic self-identity

in the tumult, due to its immense unity of impact upon the ear. However, if it were a case of causality we were considering, we would shift the emphasis and describe the noise as melody with background harmony. In the earlier (predominant among non-lovers of bagpipe music) interpretation, we emphasize the constants of the entity under discussion (which is the entire mass of noise); but in the later (predominant among lovers of bagpipe music) interpretation, we emphasize the variables of the entity.

Which of these interpretations is more "natural?" That is, which is the better description of reality? An objection here would say: Can we not separate the sound of the chanter from that of the drones and say that all of the perceptive necessity in the total sound comes from the constancy of the sound of the drones? So that the notes of the chanter are separable from those of the drones, and then there is no non-linguistic unity connecting the notes of the chanter? For the "illusion" of unity comes from the impressive total effect of the bagpipe-music, and properly speaking we cannot ignore the distinctions between the chanter's notes and those of the drones.

This objection has its sting from an assumption that the variables of the bagpipe-music are more important than the constants for determining the nature of the music. The assumption is exposed and rejected by remarking that our interests rather than some power in the cause determine what we shall call the effect of a causal matrix. It is true that a dynamite charge may topple a smokestack, but although it is an impressive sight to see

a large brick smokestock being dynamited, that sight is only one of many effects: should there be miscalculation and the smoke-stack fall into a house, our interests are more with the house than with the smokestack. Similarly, the launching of a large rocket is impressive, but the scientists watch their instruments rather than the rocket. However, there is an impressive unity connecting everything concerned with the rocket-launch and there is an impressive unity in the dynamiting of a large smokestack. For the bagpipe model, this unity includes all of the sounds, as well as the sight of the colorful and puffing musical Scotsman.

The perception of this unity is absolutely indispensable to the argument of this thesis. Unfortunately, such perception has some of the disreputable qualities of the insights of the mystic, in that both the perception and the insights are most difficult to communicate. When the mystic exclaims that the World is One, that is on a large scale what I mean by saying that the bagpipe-music is One or that the toppling smokestack or the rocketlaunch is One.

Unity Between Cause and Effect

But is not such unity destroyed by the lack of unity in the first-cause mass of independent causes? That is, cannot every facet of the noise of the bagpipe be independent from the others as each cause in the bundle of First Causes is independent from the other first causes?

The difficulty is resolved by the following considerations. Although the idea of causal unity (that is, a single first cause)

is an illusion if applied to the mass of first causes, we do not have the same reason for saying that the idea of perceptive unity between cause and effect cannot be applied to cases of causality assimilable to the bagpipe-noise model, for there is a different sort of unity in the two instances: it is much less of a generalization to say that the bagpipe-music is a unity than to say that the entire universe is a unity; further, we do not perceive the first causes but we do perceive cause and effect in cases assimilable to the bagpipe-music model. For this reason there cannot be any perceptive necessity that the Universe is One, for we do not perceive the first causes; but perhaps there may be such necessity in cases of causality fitting the bagpipe-model.

It may be objected that the perception of unity, being flexible and subjective and undemonstrable, is a very poor ground upon which to erect a structure of necessity in causal relations. However, to deny unity is to that extent to admit spontaneity, for the fewer things united, the greater the number of acts of spontaneity required to produce a given mass of entities. That is, if things a, b, c, d, e, f,...are united causally or perceptively, then one spontaneous generation will produce all of them; but if those same things have no such unity, then a separate spontaneous generation is needed for each of them. The less spontaneity, the less the shock to our scientific prejudice that every change has a cause.

Now despite the impossibility of a single simple first cause, we cannot say with the mystic that "The Universe is One; that is,

there is neither perceptive nor causal unity connecting everything in the universe with everything else (but the mystic might have some other kind of unity in mind; that will not concern us).

But does that require us to deny unity even to such modest agglutinations as the unity of the bagpipe music? If the answer is in the affirmative, a reasonable extension of the process of denying unity would lead us then to say that every change is spontaneous and that every grouping of appearances or changes or whatnot is arbitrary. Then there would be no unity among the many appearances of a penny.

My argument is that although we customarily distinguish the pulling upon a door from its opening, an equally plausible view of the world would ignore such a distinction. Without the distinction, there is non-linguistic self-identity between cause and effect, and thus perceptive necessity that if the cause occurs the effect will occur.

But there is a problem in assimilating the opening-door case to the bagpipe-music model, for the model requires not only elements analogous to the sound from the chanter, but also elements analogous to the sound of the drones. Any of the many changes which occur when a door is opened may be analogous to the changing sound from the chanter, but what elements will be analogous to the constant sound of the drones?

The pulling is such a constant, for it is present in both the cause and the effect. Certainly it will be accepted that the pulling is present in the cause (along with stipulations that the

door to be free to move, etc.), but that the pulling is present in the effect is by no means so clear.

The objection to the presence of the pulling in the effect has its force from a distinction which I believe is gratuitous. This is the distinction between the effects of earlier and later portions of the pulling; it will be said that the effect of the earlier pulling does not include the later pulling.

The truth of the objection is obvious. However, I question its application. For the continuous application of force, while not an effect of an earlier part of itself, is still present in matrices of the effects of earlier parts. But the above will be rejoined with the following: what happens when the force is removed? The effect continues (the door continues to open), but the force is no longer present, and therefore its continued presence seems accidental to the continuation of the effect, and therefore the presence in the effect of a continuation of the force which was in the cause could as well be absent.

This rejoinder is serious. I cannot meet it and so must search for another case to fit the bagpipe-music model.

Such a case is the row of toppling dominoes, and the drone here is an entity I shall call "transfer of motion." Since the motion of a first domino into a second is the cause of the motion of the second, then the motion of the second is both effect (of the motion of the first) and a cause (of the motion of a third domino), with the motion of the second being a perceptive, non-linguistic unity of a very clear sort. Then to call the earlier

parts of the motion "an effect" and the later parts "a cause" is to be grossly arbitrary, for the entire motion is equally both cause and effect.

The above method of identifying cause and effect appears to be sophistical, for what is made into a unity is not a cause and its effect, but the effect of one cause and the cause of another effect. This is easily seen if we recall the temporal order in a causal sequence, wherein a cause produces an effect which is the cause of another effect, and so on. Then one event can easily be both the effect of an earlier cause and the cause of a later event, and no one would deny this. But once the reader's suspicion of rank sophistry is somewhat abated, then the case of the falling dominoes exhibits perceptive necessity between cause and effect.

CONCLUSION

If the falling dominoes are regarded as one entity, then to deny the logical connection between its parts is to subvert that fuzzy concept denoted variously by the words "oneness," "unity," "identity," "singularity," etc. But there is an oppressive cohesiveness joining the events of the chain of toppling dominoes. We are not in error in speaking of the unity of certain objects of perception, such as lengths, shapes, and sizes. We speak of the unity of a circle, the unity of a band of labor unions, the ensemble effect of an orchestra, "togetherness" in family relations, and so on. Then why recoil from attributing unity to the

falling dominoes? It is true that parts can be found in the chain, but parts can be found in the other given examples of unity; so the individual dominoes and their fallings should not prevent the feeling of unity produced by the smooth connectedness of the falling chain.

If this unity is admitted, all parts of the chain of falling dominoes are necessarily connected by their being facets of the same unity. (cf. tautology-argument, p.21 at*.) Since we can find causes and effects in the chain, these causes and effects are necessarily connected.

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A BIBLIOGRAPHICAL SUPPLEMENT RELATING THE PRESENT THESIS TO THOSE OF CERTAIN LEADING PHILOSOPHERS

Most persons have the idea that a dropped stone falls because it has always done so in the past - when asked why this occurs, their answer is likely to be "gravity." This word introduces a new idea, namely that a stone falls not merely because it has always done so, but because something makes it do so. To link dropping and falling by gravity is satisfactory to common sense, and the further questions of the connections between dropping, gravity, and falling are ignored.

However, philosophers do not ignore these questions, as the following pages will attest. Much of the discussion concerns the Hume-Leibniz-Kant melee, but others will also be found; all in the following order: Aristotle, Locke, Berkeley, Hume, Leibniz, Kant, and Schopenhauer.

Aristotle

> The current view places what is of necessity in the process of production, just as if one were to suppose that the wall of a house necessarily comes to be because what is heavy is naturally carried downwards and what is light is carried to the top, wherefore the stones ... take the lowest place, ... and wood at the top of all .... Whereas, though the wall does not come to be without these it is not due to these, except as its material cause .... Similarly in all other things which involve production for an end; the product cannot come to be without things which have a necessary nature, but it is not due to these (except as material); it comes to be for an end. For instance, why is a saw such as it is? To affect so-and-so and for the sake of so-and-so. This end, however, cannot be realized unless the saw is made of iron. It is, therefore, necessary for it to be made of iron, if we are to have a saw and perform the operation of sawing. What is necessary, then, is necessary on a hypothesis, it is not a result necessarily determined by antecedents. Necessity is in the matter, while "that for the sake of which" is in the definition.

> Necessity in mathematics is in a way similar to necessity in things which come to be through the operation of nature. But since a straight line is what it is, it is necessary that the angles of a triangle should equal two right angles. ...though if the angles are not equal to two right angles, then the straight line is not what is is either. But in things which come to be for an end the reverse is true. If the end is to exist or does exist, that also which precedes it will exist or does exist; otherwise just as there, if the conclusion is not true, the premise will not be true, so here the end or "that for the sake of which" will not exist ....
>
> The necessary in nature, then, is plainly what we call by the name of matter, and the changes in it. Both causes must be stated by the physicist, but especially the end, for that is the cause of the matter, and not vice versa .... Perhaps the necessary is present also in the definition. For if one defines the operation of sawing as being a certain kind of dividing, then this cannot come about unless the saw has teeth of a certain kind; and these cannot be unless it is made of iron. For in the definition too there are some parts that are, as it were, its matter.[1]

Plainly, however, that cause is first which we call the final one. For this is the reason, and the reason forms the starting point, alike in works of art and works of nature.[2]

> For there is absolute necessity, manifesting itself in eternal phenomena, and there is conditional necessity, manifested in everything that is generated by nature, ... For if a house or other such final object is to be realized, it is necessary that such and such material shall exist, ... (and production, and motion), ... until the end and final result is reached, for the sake of which each prior thing is produced and exists.[3]

Aristotle may be said to hold that the effect determines the cause; a present end operated teleologically in the past to

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[1] Aristotle, Physics, pp. 179-187.

[2] Aristotle, Parts of Animals, p. 43.

[3] Loc. cit.

produce the present, yet the end is also regarded as an effect. "End" is thus equivocally to mean "result" and "purpose."

In leading us into the past in pursuit of aboriginal purpose, Aristotle eventually presents us with a half-hundred "unmoved movers," which are the initiators of motion. These movers are each sovereign; there is no systemic unity bonding them together in a manner analogous to human political establishments; in contrast to Leibniz who organizes causal quanta under a God.

There is nothing in Book Lambda of the Metaphysics to suggest that the unmoved movers compel motion, in the strong sense in which the Leibnizian God inexorably regulates. Causal necessity for Aristotle is limited to what is necessitated that a purpose be fulfilled. For while a saw cannot be unless it is made of iron, it does not come to be because it is made of iron; rather, it comes to be because we wish to saw.

A question arises here. Apparently Aristotle would see nothing wrong with saying, "The patient dies of yellow fever; therefore he was bitten by an Anopheles mosquito;" for he holds the similar view that if something is a saw, it is made of iron. Now, we would hold that death of yellow fever necessitates an Anopheles bite. And just as for us yellow fever includes with near-analyticity an Anopheles bite, so for Aristotle being a saw includes with near-analyticity being made of iron. But of course, nowadays saws are made of steel, and it is no longer necessary that they be made of iron. Then why did Aristotle consider iron a necessary ingredient of saws? Was it iron which was part of

his conception, or was it "substance suitable for saws?" With iron being the only such substance he knew? In either of these cases, his material necessity is eliminated, except in the vacuous sense by which saws must be made of some material since they are material objects. Any necessity would then reside in the definition.

Further, to say "sawing cannot come about unless the saw has teeth of a certain kind" means merely that the teeth must be suitable for sawing - we cannot say even that it means that the teeth must be like successful known teeth, for new styles of saw teeth may be developed. "Teeth of a certain kind" does not denote any class of material saw teeth; it means that a saw tooth is called such only because we can saw with it (except for derivative senses, as in a type of electronic waveform known as "sawtooth").

Necessary connection in Aristotle, for the case discussed, reduces to analytic necessity. He does not mention any powers which enforce that effects shall follow causes.

John Locke
George Berkeley

Lock and Berkeley both ascribe causation to powers, and both anticipate Hume by denying any perception by us of such powers. Locke calls them unknown; Berkeley tells us that orderly, or causal, succession is due to the power of the will of God. In either case, the remarks apply which will be found in the discussion of Leibnizian power. Yet it will be interesting to

examine their own expressions of the powers.

Locke writes:

> In the notice that our senses take of the constant vicissitude of things, we cannot but observe that several particulars, both qualities and substances, begin to exist, and that they receive this their existence from the due application and operation of some other being. From this observation we get our idea of cause and effect.[1]

"... whatever change is observed, the mind must collect a power somewhere able to make that change, ..."[2]

Berkeley, in his major work, states:

> All ... the things which we perceive are visibly inactive - there is nothing of power or agency included in them. So that one idea or object of thought cannot produce or make any alteration in another.[3]

> We perceive a continual succession of ideas .... There is therefore some cause of these ideas ... which produces and changes them ... it remains therefore that the cause of ideas is an incorporeal active substance or Spirit.[4]

> When in broad daylight I open my eyes, it is not in my power to choose whether I shall see or no, ... the ideas imprinted (on my senses) are not creatures of my will. There is therefore some <u>other</u> Will or Spirit that produces them.[5]

It is historically interesting to note how the inchoate skepticism of Locke and Berkeley attains more complete development in the philosophy of David Hume. Hume rejects causal powers;

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[1] John Locke, <u>Essay Concerning Human Understanding</u>, II, 26, 1.

[2] <u>Ibid</u>., II, 21, 4.

[3] George Berkeley, <u>Principle of Human Knowledge</u>, p. 207.

[4] <u>Ibid</u>., p. 208.

[5] <u>Ibid</u>., p. 209.

and at the risk of over-interpretation, it seems that Locke and Berkeley, had they been successors of Hume, would likely have agreed.

David Hume

David Hume is the most celebrated of the English empiricists. The clarity and power of his writing, coupled with a skeptical position, have great persuasive force.

On the question whether there is necessity between cause and effect, Hume is starkly agnostic, saying that we know only that cause and effect are constantly conjoined:

> Should anyone pretend to define a cause by saying that it is something productive of another, 'tis evident he would say nothing. For what does he mean by production? Can he give any definition of it, that will not be the same with that of causation? If he can; I desire that it may be produced. If he cannot; here he runs in a circle, and gives a synonymous term instead of a definition.[1]

> Motion in one body is regarded upon impulse as the cause of motion in another. When we consider these objects with the utmost attention, we find only that the one body approaches the other, ... 'Tis in vain to rack ourselves with farther thought and reflection upon this subject. We can go no farther in considering this particular instance.[2]

> It appears that, in single operations of bodies we never can, by our utmost scrutiny, discover anything but one event following another. So that, upon the whole, there appears not, throughout all nature, any one instance of connection, which is conceivable by us. All events seem entirely loose and separate. One event follows another, but we never can observe

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[1] David Hume, Treatise on Human Nature, p. 379.

[2] Ibid., p. 378.

> any type between them. They seem conjoined, but never connected.[1]
>
> The idea of time is not derived from a particular impression mixed up with others, and plainly distinguishable from them; but arises altogether from the manner, in which impressions appear to the mind, without making one of their number. Five notes played on a flute give us the impression and idea of time, though time be not a sixth impression, which presents itself to the hearing or any other of the senses.[2]
>
> All kinds of reasoning consist in nothing but a comparison, and a discovery of those relations, either constant or inconstant, which two or more objects bear to each other. This comparison we may make, either when both the objects are present to the senses, or when only one. When both the objects are present to the senses along with the relation, we call this perception rather than reasoning.[3]

Hume attempts to place all ideas into the class of those arising from the senses. However, it is difficult to place time and causality in the class of sensibles, as may be seen in Hume's own words above for the case of time: Hume presents as an explanation of time an invocation of the "manner" in which impressions appear to the mind. "Manner" is by no means clearly an empirical idea. Yet when Hume speaks of two or more objects present to the senses along with the relation, he perhaps allows that "manner," or relation, is perceivable. Then why cannot necessary connection be such a manner or relation?

The thesis argues for such a perceivable connection. In order to explore the possibility of its existence, it would not be irrelevant to present here the thought of a modern writer.

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[1] David Hume, Essays Moral, Political, and Literary, p. 61.

[2] David Hume, Treatise on Human Nature I, iii, 2.

[3] Ibid., I, ii, 3.

> When the word 'connection' is uttered, ... most of us ... think of a ... chain link, and Hume doubtless did likewise. Now, no such object ... is perceptible tying together the pouring of acid and the rise in temperature of the water ... therefore we say, there is no connection observable between them. But a moment's reflection forces us to admit that even a rope or a chain link, where they do occur, are not, as perceptions, themselves connections at all, but things, objects, ... in precisely the same sense as the objects between which - in a purely spacial sense of 'between' - they are situated. ... obviously, a connection ... (is a) relation between entities which are present to the senses ... as 'observable' as any other relation.
>
> Necessity in the world of conceptions ... is known to exist in precisely the same way as in the objective world, that is to say by empirical observation .... Let us assume to consider an example: ... how do we know that (both that all men are mortal and that some are not) is self-contradictory? ... it constitutes a case of the definition of self-contradiction. But whether it constitutes a case of it is, again, a matter of empirical observation.[1]

The argument here is that since a rope is not a connection, but is an object like those between which it may be found, then no connection is observable when we observe a rope; and since this is the case, it is unfair to demand that a rope or a chain should link acid-pouring with water-warming and then to declaim that no connection is observable because there is no rope: even if there were a rope, no connection would be observable. Then why say that there is a connection along a rope, but not between the water and the acid? Therefore (ad ignorantium) since we say that there is a connection along the rope we may as well say that there is one in the water-acid. Therefore there is one.

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[1] Curt J. Ducasse, Causation and the Types of Necessity, p. 128.

Then a connection is as observable as any other relation. But Ducasse does not tell us the degree of this observability, nor whether it varies.

The argument of Ducasse concerning conceptual necessity is also somewhat unsound. Do we look at two conceptions to see whether they are in themselves contradictory, or to see whether they reasonably are copies of either model contradictories and/or some concept of contradiction? What Ducasse means is that we perceive the similarities between concept, model example, and cases; and that these similarities are connections. But a similarity is not a forcible connection maintained by some power, and since it obtains between discretes, it is not a logical connection by the principle of unity.

Why did Hume not explore this possibility mentioned by Ducasse, especially since Hume speaks of manner as sensibly-founded? Possibly Hume wished to avoid talk of powers, since powers (productive agencies) are unobservable and superfluous; manner is more credible. Further, necessary connection, rather than power, was the notion Hume disputed with the greater zeal. For power produces motion by either other powers or by necessary connection (as noted in the discussion of Leibniz); Hume attacks necessary connection on the grounds that it is unobservable. He is correct, unless we state necessary connection to be merely constant conjunction, in which case the conjunction could be constant merely by accident. But the concept of necessary connection is considerably more lively than that of constant conjunction;

the former entails ineluctability.

The skeptical position of Hume is difficult to contest, due to its minimum of affirmations. For that reason, it can be said against Hume only that his philosophy is an epitome of empiricism clearly showing its features. One of these features is penury of existences and consequent gauntness of reality. Such starvation is disharmonious with the human propensity to believe in a rich and complex universe.

This propensity produces beliefs of all sorts, one of which is a belief in necessary connection. Hume regards necessary connection as a gross leap beyond the given mere constant conjunction. But had he held, along somewhat the ideas of the thesis, that "topographical models" exhibit "perceptual necessity," his skepticism would not have been impaired. However, topographical models are not adequate to explain necessary connection between, say, dropping and falling; although "perceptual unity" does seem adequate. Hume does not advance such a suggestion.

Necessary connection is a complex and obscure concept; if the concept is fogged, the thing conceptualized cannot be known more clearly. Perhaps Hume was avoiding this mist - but this possibility must be rejected when we consider that Hume speaks of time, which is even more mysterious than necessary connection.

Hume's position is only moderately close to that of the thesis, although with the indicated extensions, Hume could have included "perceptual unity" and "perceptive necessity" in his skepticism without damage to its strength.

Leibniz

A truth is necessary when the opposite implies contradiction, and when it is not necessary it is contingent .... And God has chosen among an infinite number of possibles what he judged most fit. But since he has chosen, it must be affirmed that everything is comprised in his choice and that nothing could be changed, since he has once for all foreseen and regulated all, he who could not regulate things piece-meal and by fits and starts .... This is the necessity, which can now be ascribed to things in the future, which is called hypothetical or consequential necessity (that is to say, founded upon the consequence of the hypothesis of the choice made), which does not destroy the contingency of things, and does not produce that absolute necessity which contingency does not alter.

Nevertheless, although all the facts of the universe are now certain in relation to God, ... it does not follow that their connection is always truly necessary; that is to say, that their truth, which pronounces that one fact follows another, is necessary.[1]

The demonstration of this predicate (that Caesar resolved to cross the Rubicon) is not as absolute as those of number or of geometry, but presupposes the series of things which God has chosen freely, and which is founded on the first free decree of God, namely, to do always what is most perfect, ... Now everything which is founded on decrees of this kind is contingent, although it is certain .... All contingent propositions have reasons for being as they are rather than otherwise, or ... they have a *priori* proofs of their truth, which renders them certain, and show that the connection of subject and predicate in these propositions has its foundation in the nature of the one and the other; but they do not have demonstrations of necessity, since these reasons are only founded on the principle of contingency, or of the existence of things, i.e. on what is or appears to be the best among several possible things ....

As there are an infinity of possible worlds, there are also an infinity of laws, some proper to one, others to another, and each possible individual of any world contains in its own notion the laws of its world.

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[1] G. W. Leibniz, *Selections*, p. 480.

> I think you will concede that not everything possible exists .... But when this is admitted, it follows that it is not from absolute necessity, but from some other reason (as good, order, perfection) that some possibles obtain rather than others.[1]

"... it is one of the greatest principles of good sense that nothing ever occurs without cause or determining reason."[2]

> And in truth we discover that everything takes place in the world according to the laws of eternal truths, not only geometrical but also metaphysical, that is, not only according to material necessities, but also according to formal reasons ... but also by descending to the special we see by a wonderful plan in all nature the metaphysical laws of cause, of power, of action, have place, and these prevail over the purely geometrical laws themselves of matter, ...[3]

> There are doubtless a thousand irregularities, a thousand disorders, in particulars. But it is impossible that there should be any in the whole, ... Now it is impossible that the entire universe should not be well regulated, the prevailing perfection being the reason for the existence of this system of things in preference to any other possible system. Thus disorders can appear only in the parts. In like manner there are geometric lines in which there are irregular parts, but when we consider the entire line, we find it perfectly ordered according to its equation or general nature.[4]

> ... in spite of certain laws of change, a succeeding state is in a certain manner only a copy of the preceding, and to whatever anterior state you may go back you will never find there a complete reason why there is any world at all, and why this world rather than another. And even if you imagine the world eternal, nevertheless since you posit nothing but a succession of states, and as you find a sufficient reason for them in none of them whatsoever, and as any number of them whatever does not aid you in giving a reason for them,

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[1] G. W. Leibniz, Selections, p. 94-5.

[2] Ibid., p. 482.

[3] Ibid., p. 345-6.

[4] Ibid., p. 189.

> it is evident that the reason must be sought elsewhere. ... We must therefore pass from physical, or hypothetical necessity, which determines the later states by the former, to something which is of absolute or metaphysical necessity, the reason for which cannot be given.[1]
>
> For since the reason of the series is not found in itself, as we have shown above, but must be sought in metaphysical necessities or eternal truths, and since that which exists can only come from that which exists, as we have remarked above, eternal truths must have their existence in a certain subject, absolutely and metaphysically necessary, that is in God, through whom those things, which otherwise would be imaginary, are realized.[2]
>
> And now we have physical necessity from metaphysical, for although the world be not metaphysically necessary, in the sense that its contrary implies a contradiction or a logical absurdity, it is nevertheless physically necessary, or determined in such a way that its contrary implies imperfection or moral absurdity.[3]

As is clear from the above selections, Leibniz holds that every state of the universe is related by law to the immediately preceding state, in such a way that by knowing the law and a state, the succeeding state may be predicted. This is not an uncommon philosophical position. But the question is not that there is rule of law, but whether in addition to the Humian contiguity there is not only law, but also some ineluctable power which enforces the law. Hume tells us that we observe contiguity and nothing else; we do not know laws or powers to enforce the laws. But Leibniz, with Berkeley, holds that the relation

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[1] G. W. Leibniz, Selections, p. 345-6.

[2] Ibid., p. 349.

[3] Ibid., p. 348.

between law and compliance with the law is established by the power of divine decree.

But if power is added to the relation, then how is this to be known; what is the power like? And why do we invoke powers; is power a convenient explanation for regularity, as gravity is for falling?

We know gravity only by its effects. But what are the effects of the powers? The two examples are not precisely analogous, although both are cases springing from the same root as produces the following model: "Hmmm - fox tracks. I'll go fox-hunting." And the hunter seeks a little animal. But can we expect to find gravity or the divine causal power in this kind of manner? For the causal power, our clues are expressed by the words "contiguity," "constant conjunction," "perfection," "harmony," "order," "regularity"; with the polars "chaos," "disorder," and "cacophony."

Is there not a difference between the meanings of "order" and "contiguity?" "Contiguity" is clearly closely related to the perception of visual objects, while "order" applies also to objects of touch and hearing. "Order" is also more generally applied to non-sensory objects; we do not say that someone has a contiguous mind. There is no adverb form of "contiguous." The point is fairly obvious, namely that there is a gradation of the amount of abstraction to be found in our expressions of order - from a well-kept lawn to a self-consistent geometry. The bugbear here is that since the concrete portions of our concepts have

referents, we think that the abstract portions are similarly represented in some kind of abstract reality.

Such thinking leads to a host of disreputable intellectual activity. Thus the ideas of powers, laws, and universals are often treated as versions of things which exist as sharply as do stones. We are cautioned against such thinking in a proverb attributed to J. J. Thompson, "Quantum theory should be a policy instead of a creed."

Leibniz may be suspected of such thinking, due to his urgency to explain away the thousand irregularities. But aside from all such objections, he ignores a regress which appears when one speaks of powers enforcing causal laws: what is the relation between the law and the power? Is it merely constant conjunction, or is there some further power to enforce that the first power can indeed enforce the law? And powers without end? Of course the power in the cause could be defined to be adequate, but this would be reification.

The thesis attempts to avoid regress by speaking of unity. For example: I lift a stone. The muscular stress is felt as the stone ascends; if I reduce the tension, the stone descends or falls. The reduction of effort is part of the cause; the descent is the effect. Presumably, the descent comes as one force overcomes another; the unity springs from the presence of the felt muscular tension during both lifting and lowering, or expressed abstractly, both forces are present in lifting and falling.

If powers are invoked so as to avoid the regress, they must be assimulated to unity as indicated above.

Leibniz does not suffer greatly from these objections, for to accuse of regress is not to destroy; everyone who believes in the past believes in a regress. But to disbelieve the past is so bizarre that it may be called an impossible belief, while disbelief in causal powers is not so unlikely. Regress is no solution to problems of origin. But the need for the past covers any objections made on grounds of regress; however there is no such need for causal powers and therefore no corresponding acceptance of regress.

Leibniz very nearly speaks of unity of the type propounded by the thesis, as seen in his handling of the "thousand disorders." The well-regulated whole apparently is so well regulated that there is no need for controlling agencies, as no law against cannibalism is necessary in New York City. And since there are no conflicting elements to require suppression, the word "regulation" is somewhat a misnomer: there is nothing to be regulated, due to the pervasive unity. By a small extension of his notion of consistency of this world, and with reflection that the other possible universes do not exist and hence do not offer conflict, Leibniz could have produced a world-view differing from the thesis only in the hierarchy of laws, and God, and the value he assigns to this world. But of course, if all is one, then nothing can be said about the one, for there is nothing with which it may be compared. Had Leibniz agreed, then I can see no point

where the two views would have been different.

Kant

Kant's Critique of Pure Reason attempts broadly to harmonize rationalism with empiricism, the attempt consisting of a presentation of a priori prerequisites for experience. Specifically in application to causal necessity, Kant holds that some sequences of perceptions are objectively founded, irreversible by us, and therefore necessarily interconnected.

The elaborate argument of the Critique opens with a discussion of space and time:

"These (extension and figure) belong to pure intuition, which, without any actual object of the senses or of sensation, exists in the mind as an a priori form of sensibility."[1]

> ... but there is nevertheless a determinate form (namely, time) in which alone the intuition of inner states is possible, and everything which belongs to inner determination is therefore represented in relation of time.[2]

"Space is not an empirical concept which has been derived from outer experiences."[3]

"Space is a necessary a priori representation, which underlies all outer intuitions."[4]

> Space is nothing but the form of all appearances of outer sense. It is the subjective condition of

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[1] Immanuel Kant, Critique of Pure Reason, B 35.

[2] Ibid., B 38.

[3] Loc. cit.

[4] Ibid., B 39.

> sensibility, under which alone outer intuition is possible for us. Since, then, the receptivity of the subject, its capacity to be affected by objects, must necessarily precede all intuitions of these objects, it can be readily understood how the form of all appearances can be given prior to all actual perceptions, and so exist in the mind a priori, and how, as a pure intuition, in which all objects must be determined, it can contain, prior to all experience, principles which determine the relations of these objects.[1]

Kant states substantially the same opinion regarding time, and prepares for the extension of this complex of a priori principles to include the content of concepts, or a priori sensibility, with the purpose of introducing the categories of experience.

The skeptical position, and Kant's strategic plan against it:

> If we thought to escape these toilsome enquiries by saying that experience continually presents examples of such regularity among appearances and so affords abundant opportunity of extracting the concept of cause, and at the same time of verifying the objective validity of such a concept, we should be overlooking the fact that the concept of cause can never arise in this manner. It must either be grounded completely a priori in the understanding, or must be entirely given up as a mere phamtom of the brain. For this concept makes strict demand that something, A, should be such that something else, B, follows from it necessarily and in accordance with an absolutely universal rule. Appearances do indeed present cases from which a rule can be obtained according to which something usually happens, but they never prove the sequence to be necessary. To the synthesis of cause and effect there belongs a dignity which cannot be empirically expressed, namely, that the effect not only succeeds upon the cause, but that it is posited through it and arises out of it. This strict universality of the rule is never a characteristic of empirical rules; they can acquire through induction only comparative universality, that is extensive applicability.[2]

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[1] Ibid., B 42.

[2] Ibid., B 123.

> The question now arises whether a priori concepts do not also serve as antecedent conditions under which alone anything can be, if not intuited, yet thought as object in general. In that case all empirical knowledge of objects would necessarily conform to such concepts, because only as thus presupposing them is anything possible as object of experience. Now all experience does indeed contain,... a concept of an object as being thereby given, that is to say, as appearing. Concepts of objects in general thus underlie all empirical knowledge as its a priori conditions.... The objective validity of the categories as a priori concepts rests, therefore, on the fact that, so far as the form of thought is concerned, through them alone does experience become possible. They relate of necessity and a priori to objects of experience, for the reason that only by means of them can any object whatsoever of experience be thought.[1]

Kant next argues for a classification of experience as objective or subjective, so as to avoid an objection which otherwise would become troublesome in his discussion of successions in the "Second Analogy."

> It must be possible for the "I think" to accompany all my representations; for otherwise something would be represented in me which could not be thought at all, and that is equivalent to saying that the representation would be impossible, or at least would be nothing to me. That representation which can be given prior to all thought is entitled intuition. All the manifold of intuition has, therefore, a necessary relation to the "I think" in the same subject in which this manifold is found. But this representation is an act of spontaneity, that is, it cannot be regarded as belonging to sensibility. I call it pure apperception, to distinguish it from empirical apperception, or, again, original apperception, because it is that self-consciousness which, while generating the representation "I think" (a representation which must be capable of accompanying all other representations, and which in all consciousness is one and the same), cannot itself be accompanied by any further representation. The unity of this apperception, I likewise entitle the transcendental unity of self-consciousness, in order

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[1] Ibid., B 126.

> to indicate the possibility of a priori knowledge arising from it.[1]

> I do not here assert that these representations (in the judgment, 'bodies are heavy') necessarily belong to one another in the empirical intuition, but that they belong to one another in virtue of the necessary unity of apperception in the synthesis of intuitions, ...[2]

After further repetitions of the assertion that a priori entities enable us to have experience, Kant then offers three "Analogies of Experience," the second of which is pertinent. Its thesis may be casually stated as being that some successions of perceptions are not capricious wanderings of our senses, but are perceptions of a succession. These perceptions of successions are known by the irreversibility of their time-order.

> The apprehension of the manifold of appearance is always successive. The representations of the parts follow upon one another. Whether they also follow one another in the object is a point which calls for further reflection, and which is not decided by the above statement. Everything, ... may be entitled object. ... since we have to deal solely with our representations, we could never determine from the succession of the representations how their manifold may be connected in the object. ... For instance, the apprehension of the manifold in the appearance of a house which stands before me is successive. The question then arises, whether the manifold of the house is also in itself successive. This, however, is what no one will grant. ... What, then, are we to understand by the question: how the manifold may be connected in the appearance itself, which yet is nothing in itself?[3]

> Every apprehension of an event is therefore a perception that follows upon another perception. But since, as I have above illustrated by reference to the

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[1] Ibid., B 132.

[2] Ibid., B 142.

[3] Ibid., B 235.

> appearance of a house, this likewise happens in all synthesis of apprehension, the apprehension of an event is not yet thereby distinguished from other apprehensions. But, as I also note, in an appearance which contains a happening (the preceding state of the perception we may entitle A, and the succeeding B) B can be apprehended only as following upon A; the perception A cannot follow upon B but only precede it. For instance, I see a ship move downstream. My perception of its lower position follows upon the perception of its position higher up in the stream, and it is impossible that in the apprehension of this appearance the ship should first be perceived lower down in the stream and afterwards higher up. The order in which the perceptions succeed one another in apprehension is in this instance determined, and to this order apprehension is bound down. In the previous example of a house my perceptions could begin with the apprehension of the roof and end with the basement, or could begin from below and end above; and I could similarly apprehend the manifold of the empirical intuition either from right to left or from left to right. ... But in the perception of an event there is always a rule that makes the order in which the perceptions ... follow upon one another a necessary order.[1]

Kant here has committed a petitio principii, offering us no reasons why a house is not perceived as is a boat-motion, except for the variable order of house-perceptions.

> In this case, therefore, we must derive the subjective succession of apprehension from the objective succession of appearances. Otherwise the order of apprehension is utterly undetermined, and does not distinguish one appearance from another. Since the subjective succession by itself is altogether arbitrary, it does not prove anything as to the manner in which the manifold is connected in the object. The objective succession will therefore consist in that order of the manifold of appearance according to which, in conformity with a rule, the apprehension of that which happens follows upon the apprehension of that which precedes. Thus only can I be justified in asserting, not merely of my apprehension, but of appearance itself, that a succession is to be met within it. This is only another way of saying that I cannot arrange the apprehension otherwise than in this very succession.

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[1] Ibid., B 238.

> In conformity with such a rule there must lie in that which precedes an event the condition of a rule according to which this event invariably and necessarily follows. I cannot reverse this order, proceeding back from the event to determine through apprehension that which precedes. ... The advance, on the other hand, from a given time to the determinate time that follows is a necessary advance. Therefore since there is certainly something which follows, ... , I must refer it necessarily to something else which precedes it and upon which it follows in conformity with a rule, that is, of necessity.[1]

> If, then, we experience that something happens, we in so doing always presuppose that something precedes it, on which it follows according to a rule. Otherwise I should not say of the object that it follows.[2]

Kant here falls into the Pickwickian fallacy: common usage does not imply that when something follows it follows according to a rule.

> Understanding is required for all experience and for its possibility. Its primary contribution does not consist in making the representation of objects distinct, but in making the representation of an object possible at all. This it does by carrying the time-order over into the appearances and their existence. For to each of them, as consequent, it assigns, through relation to the preceding appearances, a position determined a priori in time. Otherwise, they would not accord with time itself, which a priori determines the position of all its parts. Now since absolute time is not an object of perception, this determination of position cannot be derived from the relation of appearances to it. On the contrary, the appearances must determine for one another their position in time, and make their time-order a necessary order.[3]

Time a priori positions its parts, and therefore successive appearances are positioned in time. And since time is not an

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[1] Ibid., B 239.

[2] Ibid., B 240.

[3] Ibid., B 245.

object of perception, neither are time-orders of appearance.

There are many picayune objections which may be applied to Kant's argumentation. However, the value of his general thought is more properly our concern; is Kant's notion of mental keyholes adequate for imputing causal necessity into the world?

Rationalism and empiricism each before Kant had attempted to impute such necessity. Rationalism characterized the attempt of Leibniz, while the classic empirical and skeptical position was advanced by Hume.

Empiricism is alluring because of its avoidance of metaphysical squabbles; empiricism is at the root of common sense, in conflict with ways of thinking which produce superstitions and wishful thinking. Supposedly, empiricism is the way to truth, by freeing us from subjectivity.

But empiricism is not sufficiently compelling to assuage our feeling that there is something unseen lurking behind the jumble of sense-impressions; this feeling is expressed variously by concepts such as mind, God, form, substance, cause, self, beauty, and a myriad of others: all of them are difficult to explain with empiricism. Further, a belief in sollipsism is the product of the empiricist habit; in this there is a chaos of scattered mental contents. The empiricist cannot explain space or time, nor even exactly what things he affirms to exist.

Can the rationalist fare better? Not really, for he only removes the troublesome problems of the empiricist to a foggy realm, so that he may say, for example, that there <u>is</u> a self,

even though we know very little about it. Rationalists also have disputes among themselves concerning what is real and what is not (cf. Kant, "Antinomies of Pure Reason," in his Critique).

The resolution of this tangle of problems would seem to be a synthesis of the merits of the two approaches. Kent attempted this; and how should we judge his product, by self-consistency, or usefulness, or efficiency of structure?

Hume seems to have driven away too much of the world; Leibniz to have invented too much, in his zeal to explain away the less pleasant features of our existence. Neither Hume nor Leibniz is consanguinous with the Kantian moderation, and neither do they seem to possess the sweeping range and comprehension of Kant: each denies propositions Kant allows.

But Kant's moderation, while avoiding the troublesome extremes of Hume and Leibniz, is not Kant's only appeal. What increases the value of his rationalistic thought is that his entities are natural functions of our biological-electrical structure rather than being static laws, or immaterial stuffs, or any other mysteries. There is nothing about the categories more unworldly than there is about any of our other capacities.

However, after such an exemplary approach, Kant in the "Second Analogy" of the Critique disappoints us with several petitios occurring at critical points. However, there is no obvious way to improve his argument. It may very well be that space and time are a priori mental denizens - but causal necessity seems to be more closely related to ideas evolved from constant

conjunction by mental habits, as Hume holds. For how do we know a series of perceptions to be irreversible? Only by induction. And as Schopenhauer points out, a melody is irreversible, but there is no causal connection between the notes. Night follows days, and no causal connection is established there. This is the crucial point, for with no irreversibility there is no necessity. Kant gives us no test for irreversibility.

Is this a serious flaw? Perhaps it appears so, until we reflect that since only the past is known irreversible, no test may be applied to the future. Kant exploits this, saying in B 165 that

> Special laws, as concerning those appearances which are empirically determined, cannot in their specific character be derived from the categories, although they are one and all subject to them. To obtain any knowledge whatsoever of these special laws, we must resort to experience; but it is the a priori laws that alone can instruct us in regard to experience in general, and as to what it is that can be known as an object of experience.

This maneuver affirms the truth of the general principle of causality, yet allows our mistakes in saying which situations are and which are not causal. (Leibniz similarly cavalierly dismisses his thousand disorders.)

Kant presents nothing resembling the thesis "perceptual unity"; his "synthetic unity of apperception" is the result of a mental function, while "perceptual unity" is a feature of the world independent of our mental functions. Here, in his zeal to avoid objectionable metaphysical imputations into experience, Kant has perhaps overlooked the possibility that not only are we

disposed to perceive the world in certain ways, but that the world is structured in itself according to those ways, therefore we add or delete nothing by perceiving the world according to the confines of the categories. Were this his position, his indication of unity implicit in the world would produce much the same idea as that which the thesis names "perceptual unity."

Certainly for perceiving obvious unities, such as that of a smokestack, Kant would agree with the thesis. But for more abstract unities, such as that joining the functions of smokestacks with those of factories, Kant would become reluctant to admit that the unities were in the world, and eager to place them in the understanding. Here I would diverge, and maintain that the most extreme unity-abstraction, namely the unity of everything, is a feature of the world, although since the commonplace unities (as of a tabletop) usually engage completely our activities, we rarely consider the more abstruse ones. Consider the unity of a musical work; if the unity were in our minds then how may works of the same form, and by the same composer, be said to have different intensities of unity? Unity is more easily explained by finding some of it in the world than all of it in our imagination.

Yet Kant invents the categories. The thesis invents nothing since unity already exists; unity is placed in objects rather than in the mind. In this sense, Kant's universe is more subjective than the thesis; the universe of the thesis presents a featureless subject, which imposes nothing on objects in its perception of them.

Schopenhauer

"But it is absurd to call an object the cause of another object."[1]

"... they (the primary forces of nature) alone (are those) by which changes or effects become possible; for they alone give causality to causes, ..."[2]

> The present ... hurled the preceding ... into the bottomless pit of the past, not through causality, but immediately, through its mere existence, which existence was nevertheless inevitable. It is impossible to make this comprehensible or even clear by means of mere conception; we recognize it, on the contrary, quite directly and instinctively, just as we recognize the difference between right and left ... that our left glove will not fit our right hand, etc., etc.[3]

> All our representations stand toward one another in a regulated connection; which may be determined a priori, ... It is this connection which is expressed by the principle of sufficient reason in its generality.[4]

> Now, as the law of causality is known to us a priori, and is therefore a transcendental law, ... the relation between cause and effect is a necessary one, so that the causal law authorizes us to form hypothetical judgments.[5]

> It is only when the Understanding begins to act - ... - only when it begins to apply its sole form, the causal law, that a powerful transformation takes place, by which subjective sensation becomes objective perception.[6]

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[1] Arthur Schopenhauer, The Fourfold Root of the Principle of Sufficient Reason, p. 40.

[2] Ibid., p. 51.

[3] Ibid., p. 29.

[4] Ibid., p. 30.

[5] Ibid., p. 46.

[6] Ibid., p. 60.

> Not long ago I had some long curtains put up at my bedroom window, which reached down to the floor, and which were drawn aside from the center by means of a string. The first morning after they were opened, I was surprised to see my dog, a very intelligent poodle, standing quite perplexed, and looking upwards and sidewards for the cause of the phenomenon: that is, he was seeking for the change which he knew a priori must have taken place.
>
> A very young puppy will not ... jump off a table, because he foresees what will be the consequence.[1]
>
> But the process (of understanding) consists throughout in referring from given effects to their causes, ... The very fact that we presuppose causality in this process, proves precisely that this law must have been supplied by the Understanding itself, for it could never have found its way into the intellect from outside. It is indeed the first condition of all empirical perception...[2]

"Necessity has no other true and distinct meaning than that of the infallibility of the consequence when the reason is posited."[3]

Schopenhauer strongly resembles Kant. His example of the puzzled dog illustrates with extraordinary clarity the a priori nature of the belief in causal connection. The similar nature of necessary connection, and the remarkable likeness of his view to that of the thesis' "perceptual unity" will be exemplified by the following passages.

After stating Euclid's proof of Theorem Six, Book I of the Elements, Schopenhauer proceeds:

> But who bases his conviction of that geometrical truth upon this proof? Do we not rather base our

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[1] Ibid., p. 89.

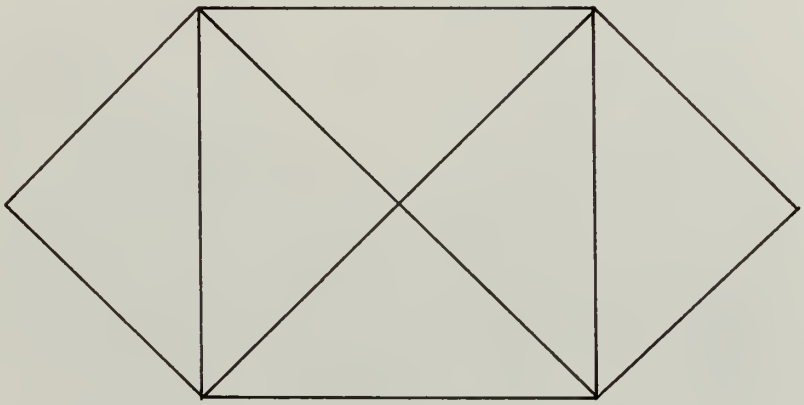
[2] Ibid., p. 92.

[3] Ibid., p. 181.

> conviction upon the reason of being, which we know intuitively, and according to which two lines drawn from both extremes of another line, and inclining equally toward one another, can only meet at a point which is equally distant from both extremities; since the two arising angles are properly but one, to which the oppositeness of position gives the appearance of being two, wherefore there is no reason why the lines should meet at any point nearer to the one end than to the other.[1]

> Without this intellectual operation (understanding via causality) for which the forms must lie ready within us, the perception of an objective external world could never arise from a mere sensation within our skin.[2]

Schopenhauer next presents a diagram which he holds to be an immediately obvious proof of the Pythagorean theorem. The diagram is a substitute for the verbal proof usually offered, and for this special case is better to comprehend and possible more rigorous:



This type of proof is an exact example of "perceptive necessity," as the term is coined, defined, and used in the thesis.

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[1] Ibid., p. 161.

[2] A. Schopenhauer, The World as Will and Idea, p. 37.

Schopenhauer precisely coincides in this original concept, although there are differences in the two expositions. In addition, there is a difference in the attached significance.

According to the thesis, the necessity in "perceptive necessity" arises from "perceptual unity"; in the diagram the unity is apparent as our attention flickers from form to form, atomic and molecular. Schopenhauer states merely that it arises "quite directly and instinctively." Further, as we have already noted, Schopenhauer defines necessity as having "no other true and distinct meaning than that of the infallibility of the consequence when the reason is posited." But there is no reason and no consequence anywhere in the diagram, yet Schopenhauer claims the power of proof for it. It may be inferred that he has not given the matter more thought than to call it intuitive, direct, instinctive. And for the physical world apart from mathematical proofs, his examples of the behavior of dogs his view that causality in the world is also intuitive, direct, and instinctive.

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NECESSITY IN CAUSAL RELATIONS

by

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AN ABSTRACT OF A MASTER'S THESIS

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The purpose of this thesis is to find a justification for the belief in causality. However, this does not mean that every change has a cause, and argument is offered to show that it is not possible for every change to have a cause.

One would like science to be as certain as is mathematics and analytic truth. This thesis maintains that such "deductive necessity" is comprehensible only by transmutation into "perceptive necessity" which is a feature of "topographical models" such as Venn diagrams. In comprehending such an analytic statement as "bachelors are unmarried," the necessity is known through abstractions from topographical models.

Perceptive necessity does not require the use of language for its comprehension; it is a feature of the world as are colors, shapes, and sizes. No language is needed to see the perceptive necessity that if circle A is in circle B, and B in C, then A is in C. Perceptive necessity is linguistically expressed by "a thing is necessarily what it is," but language is not required for the perception of this fact.

To say, using language, that A is A is to express a tautology, which is necessarily true. Then to say "A is A" IS NOT ONLY TO SAY THAT A is A, but also that necessarily A is A. Then let it not be objected that to the statement "circle A is in circle B" it is vacuous to add that such is necessarily the case merely since such is the case, for this addition is allowed to the tautology.

Unity of appearances is not entirely a linguistic affair, for (to take an extreme case) else the mystic could tell us what he means by such utterances as "the universe is One." Whether something is regarded as a unity or as an amorphous heap of parts depends upon one's interests of the moment.

All changes are from one thing into something which is similar in at least one respect; such are called "XtoX'" changes. A complete and utter change would be symbolized as XtoY, but there are none such. One uses the idea of XtoY changes to express finality; but the presence of the corpse makes death not an XtoY change, but an Xto X' change. Then there is unity between the thing which changes and that into which it changes. This unity is a matter of perception, as with the mystic. It is also a matter of perception that united things are the same. Language makes the addition that united things are necessarily the same, but this necessity also is perceived as are the united things.

Causal changes can be of the XtoX' variety (the pulling and consequent motion of opening a door can be regarded as a unity). Therefore in such cases there is necessity between cause and effect.