WHAT DOES THE TINY VAJRA REFUTE?

CAUSALITY AND EVENT STRUCTURE IN BUDDHIST LOGIC AND FOLK PSYCHOLOGY

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Abstract

Using as a framework the logical treatment of causality in the Buddhist Madhyaika, a theory of the psychology of event coherence and causal connectedness is developed, and suggestive experimental evidence is offered. The basic claim is that events are perceived as coherent and causally bound to the extent that the *outcome* is seen to be already contained in the *ground* of the event in some form and the *connecting link* between them is seen as the appropriate means for changing the outcome as it already is in the ground of the outcome as perceived. There are four types of such connections: (a) the identity of the object in the ground and outcome is seen as the same (as in the phi phenomenon); (b) a property is seen to be transformed from ground to outcome (as in a Michottean analysis of perceived causal motion); (c) for animate beings, a cognitive representation and a state of the world are seen to match, either the representation as outcome coming to match the world as ground (as in the folk psychology of perception) or the world as outcome coming to match the representation as ground (as in intentional action); (d) the ‘‘essence’’ of a category is seen to manifest itself (as in folk explanations based on personality). The standard critique of such coherent explanations is that they are tautological. We demonstrate that ‘‘nontautological’’ scientific accounts become convincing coherent explanations only to the extent that the outcome is re-introduced (in a disguised form) into the ground. Explanations which are noncausal altogether such as probability or chance are shown to be psychologically unstable. In conclusion it is suggested that the tautological quality of the folk psychology of event coherence may actually mirror the way the world works at a certain level of analysis.

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> In the first skill of Madhyamika, known as the 'Tiny Vajra,' or as 'Refuting the Notion of Arising,' there are four points of view. These four are the possibilities that: a thing arises out of itself or an identical unit; a thing arises out of something totally different; a thing arises out of both an identical unit and something completely different; and a thing arises without any cause whatever (Thrangu, 1983, p. 30).

For over 2,000 years, the issue of causality has been central to Indian philosophy, and the four possibilities enumerated above were one of the frameworks within which issues of causality could be considered systematically. The Buddhist Madhyamika school (particularly as that school was systematized in the Tibetan tradition[1]) employed this framework as one of many arguments for the emptiness of phenomena, i.e., the Madhyamika wished to refute that any actual independent arising of causes or effects could be found upon careful examination, in any of these four ways.

What do these ancient debates have to do with cognitive science? What is it that is being refuted? What does it mean to claim that something arises from itself? Or from something other? Or both or neither? Is this simply part of an outmoded scholastic philosophy which—in a world in which physics has dispensed with the notion of *cause*—need no longer be considered? It is the aim of the present paper to show that, quite the contrary, these arguments lead us to consider a deep and hitherto largely unexplored part of our psychology of causality.

This paper is intended as a cross-fertilization between the Madhyamikan framework and the psychology of causality (and more generally the relatedness of events) as it can be derived from modern cognitive psychology. It is designed to be of interest equally to the cognitive sciences and to those interested in Buddhism. It is relevant to the latter because, if any argument is to have impact, or even interest, it is necessary to have in mind what is being argued against and the importance of that position psychologically as well as theoretically. For example, Hume's skepticism about the idea of cause gains in meaningfulness not only by understanding the historical context of his claim but by observing that one does have such an idea in one's operating psychology, e.g., when seeing billiard balls strike or performing an

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[1] This paper follows the format for presentation of causality in the Madhyamika of the Tibetan Kagyu (Thrangu, 1983) and Gelugpa (Hopkins, 1983) schools. The extent to which such is equivalent to the Indian formulation (Chandrakirti, 1979) is open to discussion.

intentional action. Buddhist homiletics employ this method a great deal. For example, although the Buddhist claim that we have no self may be, historically, the denial of the *atman* of the Upanishadic tradition, within the teaching context of living Buddhist traditions (Gyamtso, 1986; Hopkins 1983), it is believed that to understand the concept of no self, the practitioner must first realize that he does, in fact, believe that he *has* a self. This paper will attempt to perform an analogous analysis on the notion of the arising of events. In our normal way of thinking, how *do* we see the connection between events?

Such an analysis is relevant to cognitive science because, it will be argued, the four possibilities of arising enumerated in the Madhyamikan framework are actually psychologically very real. In fact, they exhaust the ways in which we can see events to be connected to one another. Furthermore, all four as principles of explanation are unstable and our discontents with each are analogous to some, though not all, of the Madhyamikan refutations of the notion of arising. Finally, the Madhyamikan distinction between absolute and relative arising may provide a challenging way to clarify event explanations.

Preliminaries: An Analytic Framework

Any coherent event or event sequence can be conceived in terms of three parts: a *ground* out of which the event can be seen to arise, something that *happens*, and an *outcome*.[2] The happening is a connecting link between the ground and the outcome. For example, in the classic case of billiard balls striking, the motion of the first ball is the ground, the motion of the second ball the outcome, and the happening or connecting link is the first ball striking the second. In terms of human actions, I can want a drink of water (ground), go get water (link), and drink it (outcome). To claim that something arises from itself is to claim that the outcome is already contained in the ground in some form (actual or potential) and that the connecting link serves to transform the outcome as it is contained in the ground into

[2] Ground, connecting link, and outcome are closely analogous to the three-fold logic of ground, path, and fruition as it appears in Buddhist exposition. What is argued in this paper is that this is the natural way in which we see events.

the form in which it appears in the outcome. To say that a thing arises from what is completely different is to say that the outcome is *not* already contained in the ground; in this case, the connecting link (or series of links) is required to show how the outcome is produced out of something which is not already itself. This framework of analysis is appropriate not only to temporal events but also to abstract structures. In a mathematical proof, for example, the axioms and postulates are the ground; the conclusion is the outcome, and the steps of the proof the connecting link(s).

Analysis of events into grounds, happenings, and outcomes has psychological reality. This can be demonstrated by our reaction when one of these parts is missing. Take, for example, the interesting cultural institution of magic tricks. Magic tricks are created by the studied removal of one necessary part of the event. If one goes through books of magic tricks, they can all be classified into three types: (1) *Ground missing*—A stage magician pulls a rabbit out of a hat. This is only a magic trick if the rabbit is not perceived to be in the hat in the first place. If a gentleman with all the appropriate flourishes pulls a perfectly visible rabbit out of a top hat, that may be good Monty Python but it is not magic. A rabbit being in one place is the normal ground for it being later in another place connected by the normal link of the rabbit ambulating under its own power or being carried. (2) *Outcome missing*—A magician saws a woman in half. This is only a magic trick if she stands up unharmed at the end. If she turns out truly to be sawed in half it is a matter for the police, but not magic. (3) *Connecting link missing*—A magician says what card the man in the back of the hall is looking at. This is only a magic trick if the man in the back of the hall doesn't call out to him which card it is. Transfer of knowledge happens all the time by connecting links such as hearing, reading, and seeing. Most so-called paranormal psychology deals with missing links of this kind. If Smith suddenly believes that his aunt has had a stroke and rushes to visit to find that she has indeed had a stroke, he is unlikely to report this to a journal of paranormal psychology if his sudden belief was occasioned by receiving a phone call or a letter.

Another demonstration of what happens when parts of an event are removed has to do with intentional behavior. If I suddenly discover that I am getting glasses of water, making phone calls, writing papers, and so on, with no intention at all to do each of these things, I will begin to worry about my sanity. Similarly, I will be greatly distressed if I find myself having completed various acts and remember only that I intended to do them but have no memory at all of actually having performed them. And if I find myself consistently not drinking the glass of water, dialing but then hanging up, sitting endlessly in front of blank paper, and driving to places to which I never arrive, I will probably not know what to think.

In summary, normal events, both in the realm of physical causality and human action, are expected to have grounds, outcomes, and appropriate connecting links; this is a homey, everyday fact about the way we cognize the world.

I. Events that Arise from Themselves

The general claim of this paper is that to be perceived as coherent, events must normally be seen to arise from themselves. That is, normally, any event, temporal or deductive, will be seen to be coherent (or causally bound) to the extent that the outcome is seen to be already in the ground. The connecting link must also be the appropriate sort to transform the outcome as it is contained in the ground into the actual outcome; however, the more identical the outcome in the ground is to the actual outcome, the more minimal need be an account of the happening which connects them. Although this is the natural mode of explanation, when we reflect upon such accounts we find them tautological and demand of scientific explanations that events be shown to arise from what is other than themselves. It is from this demand that the other three types of explanation arise.

There appear to be four distinct types of events in which outcomes are contained in grounds. The first uses the identity of the object in the ground and outcome to produce coherence; the second concerns perception of physical causality and involves transfer of properties from ground to outcome; the third concerns sentient perception and agency and involves a match between a ‘‘representation’’ and a state of affairs; and the fourth derives coherence from an appeal to the essences of categories.

A. Identity

The simplest kind of containment of a ground in an outcome is for ground and outcome to be the same object. This is the sort of coherence that obtains when an object is seen to change location, rotate, approach, recede, change color, change form, to age, or to undergo some other transformation. The coherence is that the object is perceived to be the identical object at the end as at the beginning of the transformation--it just looks different because of the change it has undergone. Perceptual shape, size, form, and color constancies are all constancies because of identity maintenance. Objects are perceived to retain the same size, form, and so on even when the retinal image changes drastically. What makes this kind of coherence interesting is the great bias that we seem to have for perceiving situations as of this type whenever possible.

Shepard (1984) shows the extent to which we will go in maintaining object identity for forms. Shepard used a task similar to that of the classic phi phenomenon. In the phi phenomenon, although the physical stimulus consists of two lights at different locations which flash on and off alternately, the perceiver sees a single light which moves. Shepard presented his experimental subjects with alternating line drawings of related forms. Rather than perceiving two separate forms, given the appropriate time interval between the stimuli, subjects perceived a single form undergoing change--moving, rotating in the picture plane, rotating three-dimensionally through the picture plane, coming towards or receding from the subject, and (if necessary) exhibiting nonrigid deformations such as turning inside out--in fact, doing anything but appearing as two separate objects. Furthermore, the object invariably underwent whatever transformation would change it from the first to the second form by the shortest possible route; for example, a perceived rotation in the picture plane would be either to the right or left dependent upon which direction involved least-perceived movement. This seems to be a clear case of a biological, perceptually based effect.

There are other kinds of identity constances which involve conceptions and appear later in development, for example, the Piagetian (Inhelder and Piaget, 1958) constancies of mass, number, and volume. In a typical Piagetian conservation experiment, water is poured from a short, wide glass into a tall, thin one as a child watches. No water is added or subtracted. The child is asked whether the water in the second glass is more, less, or the same as in the first. In our terms, the water in the first glass is the ground, the water in the second glass the outcome, and pouring is the connecting link. The water in the two glasses look different--if just presented with the water in the two glasses even adults cannot tell whether it is the same or a different amount. When the water is poured, however, while young children tend to confuse *taller* with *more*, adults and older children have learned that the act of pouring preserves identity and unhesitatingly answer that the water is the same.

Thus identity seems to be a powerful coherence principle in both perceptual and conceptual situations.

B. Mechanical Causality

The coherence of a mechanical causal event is, it will be argued, generated by means of the perception of the transfer of a property from the ground to the outcome. The outcome is already in the ground because the property is in the ground.

A paradigmatic experimental investigation is the case of perceived causality of motion (Michotte, 1963). Michotte wished to demonstrate that we actually *perceive* causality. In one prototypical case called the ‘‘launching effect,’’ subjects see a moving square contact a stationary square; the second square then moves off at the speed of the first. Most subjects report having a ‘‘causal impression,’’ that is, they see the first square strike the second and send it off (cause it to move, ‘‘launch’’ it). After an extensive investigation of conditions under which the causal impression did and did not occur, Michotte concluded that in order for it to occur, subjects had to see the motion of the second object as the same motion as had been in the first object. In fact, he claimed that there had to be a period in which the same motion was perceived to belong simultaneously to both objects.

Another major type of transfer of a property from ground to outcome, and one which is more clearly conceptual than the Michotte experiments, occurs in sympathetic magic (Frazer, 1959). Examples of the principle of sympathetic magic are commonly cited from early medical lore. Ingestion of a yellow substance was believed to cause jaundice, and a fox's lungs (which are strong) could cure emphysema (cited in Nisbett and Ross, 1980). Note that in such cases one does not feel the need for an elaborate explanation of the mechanism by which the outcome is derived from the ground; the fact that they have the same property seems to make it obvious. Mechanisms were only demanded later when the claim was that a disease arose from something quite other than itself such as a bacteria. Pollutions also seem to require a magical transfer of property. Rozin (Rozin, Millman, and Nemeroff, 1986) in an investigation of food preferences has shown that even middle class Americans will reject a food substance which has been touched by a pollutant (from which danger has been removed)—for example, juice touched by a (dried and sterilized) cockroach, or soup by a clean new bedpan. Rozin concludes that the hypothetical polluting quality seems to pass from the pollutant to the object and remain there.

C. Animate Causality: Perception and Action

For sentient creatures, events have an arising-from-itself logic when the world and a mental occurrence, act, or representation are described as matching. In perception the percept matches the world; in intentional action, the world is brought to match a desire or intention (Searle, 1986, calls similar structures a ‘‘word-to-world’’ and a ‘‘world-to-word’’ fit).

Regarding perception, in everyday life, we tend to proceed under the tacit assumption that objects have the properties we see in them. The wall looks blue and square because it *is* blue and square and we see that it is. Thus in the naive view, the object is the ground, our perception of it the outcome, and the act of perceiving (the event of opening one's eyes and looking) is the connecting link. Not much mechanism is required of the connecting link because it need not change the object; in fact, a simple mirror would be sufficient.

In intentional action, the actor wants a state of the world to be in some particular way. In the language of present cognitive science we could say that he has a representation of some desired state of the world, a representation which, of course, need not be verbal or even conscious. He then acts in such a way as to try to bring about that state of affairs. The intention or desire is the ground, the act the connecting link, and the state of the world brought about is the outcome. The whole sequence is seen as coherent to the extent that the resulting state of affairs matches the actor's intentions.

That there is psychological reality to this description of coherence in intentional acts was demonstrated by some research of my own (in collaboration with Barbara Burns). Subjects were shown simple two-sentence stories of the form: ‘‘Dr. Smith was looking for a cure for high blood pressure. He discovered a cure for high blood pressure.’’ ‘‘Fred Jones intended to shoot the president. He shot the president.’’ Each ground was combined with outcomes of varying similarity to the ground. Thus Dr. Smith could find a cure for high blood pressure, for low blood pressure, for baldness, or a new paint thinner. Fred Jones could succeed in shooting the president, the vice-president, a senator, or a bystander. On a variety of measures, stories were judged to be more coherent and more causally bound the more similar the outcome was to the ground. This held true also for similarity in level of abstraction. ‘‘Mary married a proctologist’’ seemed better explained by her desire to marry a doctor, than by a general desire to get married.

It would be difficult to overestimate the power and finality that an intending human has as an explanation of some state of affairs in which we find the world. Heider (1958) has called humans a psychological first cause.[3] In another series of studies we showed that any event, no matter how peculiar or accidental it was initially rated, would be seen as coherent when an actor was supplied with an intention to bring about just that state of affairs. The simplest illustration is the case in which Smith's car runs off the road and hits a tree; this is not an accident if he intended to commit suicide or to collect insurance. Unconscious intentions were as effective in making the event coherent as conscious ones. This may help explain the great popularity of folk psychoanalytic explanations. If no readily apparent cause for an undesirable event can be found (e.g. one trips and injures oneself), the attribute of an unconscious wish (e.g. to injure oneself) makes it into a satisfactorily explained event

[3] It is interesting to note that in his translation from the Tibetan, Herbert Guenther renders *rGyu*, usually translated as *cause* (the ground in our present terminology), as motive—e.g. see Gampopa (1971), Chapter 1.

in which the outcome is a reproduction of the ground.

Nor are unconscious intentions limited to psychoanalytic types of explanation: cognitive psychology is rife with ‘‘unconscious processing.’’ For example, if after working on solving a problem, a subject puts it aside and then suddenly thinks of a solution, this is attributed to ‘‘unconscious problem solving;’’ or if, in the Sternberg paradigm, the subject correctly answers whether a particular digit was in a list he has just heard, it is attributed to ‘‘unconscious high speed search.’’ The image seems to be that of a homunculus whose intentions and actions (solving problems, searching) match the observed outcomes. For nonhuman organisms, instinctual intentions as well as anthropomorphically stated conscious ones, make events coherent—perhaps not unrelated to the popularity of instinct theories in the initial emergence of psychology. And finally, at the societal level there are also classes of explanation which match states of affairs to the intentions of humans—great man theories and conspiracy theories. Insofar as humans are taken as a first cause when a crime, accident, or other event has been traced to an intending human, our search for explanation normally stops.

D. The Essence of a Category Manifests Itself in its Appropriate Way

Categories are used a great deal in explanations as the grounds out of which events arise. For example, there are personality traits—‘‘John behaved honestly because he is an honest person;’’ species-specific behaviors—‘‘The stickleback does a waggle dance because the dance is species-specific (i.e. stickleback) behavior;’’ genetic determinations—‘‘The rice seed grows into a rice, and not a barley plant because it’s a rice seed;’’ man-made objects—‘‘One puts flowers in the vase because it is a vase and that is what it’s for;’’ and chemical qualities—‘‘Opium puts one to sleep because of its dormitive power.’’ Such accounts may best be understood as the essence of the category (the ‘‘formal cause’’ in the Aristotelian sense) manifesting itself in its natural manner.[4] The case in which outcomes are contained in

[4] Individuals may also be conceived as having essences. Rozin *et al* (1986) argue that one of the principles of sympathetic magic is the presence of the essences of individual objects in their parts or images.

grounds in the form of a category whose natural manifestation is the outcome is perhaps the most obvious example in which an outcome can be seen as arising from itself.

E. Characteristics Shared by All Outcome-Contained-in-Ground Cases

Some characteristics are shared by all the four cases in which outcomes are seen to be contained in grounds. In the first place, the ground and outcome must match in whatever characteristics are relevant for the type of event in question. Interestingly they must match in quantity or importance as well as in content. For example, in the case of transfer of motion, for causality to be perceived, the amount of motion in the second object should be equivalent to that in the first. If the second object, upon contact shoots away from the first as a speed much great than the first, it it perceived to have an additional ground of motion in itself—in Michotte's terms, to be *triggered* rather than *launched*. In the Shepard (1984) experiments showing constancy of object identity, if the second form is the same as the first only larger, subjects will see a rigid motion in space rather than a change in size; that is, the object will appear to approach and loom, rather than to remain stationary and expand.

In this same light, if what a person accomplishes does not match what he intends, the outcome will be seen as partly accidental or be attributed to some additional causal source. Furthermore, importance of motives should match importance of outcomes. Barbara Burns and I have shown that fictive persons were judged to be lying or insane to the extent to which their motives for performing actions were judged to be less important (or more trivial) than the actions (e.g. subjects doubt Mary's veracity or sanity if she marries Fred because of his cute bald spot although she can unimputedly go on a date with him for that reason). Social psychological research on attribution of responsibility has demonstrated that when a person has performed an action which has an outcome, character traits will be attributed to him which match the outcome not only in type but in seriousness; for example, a driver who leaves his car improperly parked on a hill will be seen as a more irresponsible person if the car rolls down and causes a serious rather than a slight accident (Walster, 1966). Finally, for historical events, ‘‘for want of a nail the battle was lost’’ reasoning is dubbed as a historian's fallacy to be assiduously avoided (Fischer, 1970).

A second characteristic of causal reasoning when grounds are contained in outcomes is that a single match is generally all that is needed to generate an acceptable explanation. If an outcome is seen as matching a person's intention or character trait, we usually stop with that and do not ask for the origins of the intention or trait. For example, in the Michotte experiment, we do not feel that we need to know what set the first square in motion. Of course, sometimes the ground which is offered as explanation seems itself particularly problematic; for example, if a proffered intention seems particularly bizarre or an imputed trait contradicts what we otherwise know of that person. In such a case the putative ground may become the outcome in need of explanation, and we will search for the ground out of which it itself arose. If we find an acceptable ground, that will probably be seen as the causal origins of the event and our problematic middle ground simply drops out of the equation—for example, if Smith commits a crime because Murgatroyd forced him to do so at gunpoint, Smith drops out of our consideration and the crime is seen to arise from Murgatroyd. This lack of taxonomic depth in causal reasoning is pointed up by Piaget's (1952) analysis in which causal reasoning (unlike logical operations) is intransitive.

F. Critique of Arising-From-Self Explanations

Since explanations of events in terms of outcomes contained in grounds are so pervasive, we might ask what is wrong with such explanations? Indeed, one of the six classical *darshanas* (systems) of Hindu philosophy, the Samkhya, claimed explicitly that everything did arise from itself (Larson, 1975; Radhakrishnan & Moore, 1957; Raju, 1971). ''The effect is what was ... in the cause.'' (Larson, 1975, p. 31).

The objection to such reasoning propounded, in analogous form, by both the Madhyamika and scientific methodology is that it is circular. The Madhyamika arguments (Candrakirti, 1979; Hopkins, 1983; Murti, 1960; Thrangu, 1983) emphasize the incoherent nature of a thing arising from itself. First, if something has already occurred, then there is no need for it to reoccur. Once a child is born, he does not have to be born again. Second, if something is imputed to recreate itself once, why not an infinite number of times? But in that case, what would be the difference between a thing remaining as it is and recreating itself over and over? Third, if things just recreate themselves, how can anything new come into being; e.g. how can we get from the rice seed to the (rather different) rice stalk? If the Samkhyan or the folk psychologist counters that it is a matter of things which are only *potential* in the cause becoming *manifest* in the result, the Madhyamika replies that either the thing is already existent in its potential or it is not. If it is, then all the above arguments apply. If it is not, then this is not a case of a thing arising from itself as cause but rather an example of a thing arising from something other than itself.

The objection in scientific methodology is similar. An explanation in terms of the outcome being already in the ground (e.g. opium puts you to sleep because of its dormitive power) is simply a restatement of itself in words; it is a circular account which adds nothing to that which one already knows and which one wants to explain, predict, or control. Such accounts only look like explanations in archaic or folk psychology because they occur in a disguised form in which their circularity is hidden. Thus, human intentions, attributes such as motion or pollution which pass from one object to another, categories as explanatory referents—these and many other folk notions are to be banished from scientific accounts.

II. Arising from Something Other

A real account of causes, a noncircular explanation, a scientific account, must show how something arises from what is not already itself. There is no such thing as a blue square wall in the external environment which can be simply reflected on a mirrorlike eye; all the eye receives is reflected light rays which stimulate retinal cells. How is one to get perception of blue and square out of that? If we don't explain the rat's foraging and eating behavior by his desire for food, how will we explain it? Diseases do not come from mortal failing nor from contact with substances that mimic the symptoms; they come from bacteria. Rice stalks come from DNA and RNA. And so on.

In coherences based on a thing arising from itself, the emphasis is on the similarity of ground and outcome; the connecting link is proforma and may be virtually omitted in thought. When an event is explained as coming from something completely different, the burden of explanation is placed on the connecting link. Often this becomes a long chain of connecting links. After light strikes the retina there is a chain of physiological and hypothetical stages before we get the percept. But however long the chain, explanations which derive outcomes from what is entirely other than themselves face an interesting difficulty. As long as an event comes from ground which is strictly and thoroughly other than the outcome, the relationship between ground and outcome remains incoherent. That is, the explanation doesn't look anything like an explanation.

Of the various arguments which Madhyamika makes concerning the incoherence of events arising from what is completely other, one argument seems particularly relevant to the present case. If a putative cause is completely different from its result, if the only relationship they have to each other is one of difference, why should just that result arise from that cause rather than a myriad of other results which are also completely different from the cause?

This criticism points to the heart of our demands for coherence, perhaps even to what we mean by coherence—in logic and conversational postulates as well as in cognitive science. In logic, it seems to be accepted on pre-axiomatic grounds that no system is acceptable in which anything can be derived from just anything. Take, for example, the logical connective *tonk* invented by A. N. Prior (1960). *Tonk* is defined such that from any statement *p*, one may infer *p tonk q* (as in the usual definition of disjunction), and from any statement *p tonk q*, one may infer *q* (as in the usual definition of conjunction). Because of the transitivity of deduction, from any *p*, one may infer any *q*. *Tonk* would appear to be the perfect formulation of the view that things arise from that which is other. But, in fact, *tonk*, is offered as a refutation of the analytical theory of logical validity, the theory that says that the validity of a deductive inference resides in the meaning of the logical words alone. It can serve as such a refutation because it is universally acknowledged that a logical connective with tonk-like properties is totally unacceptable; in fact, logical systems fall if they can be shown to allow such inferences—e.g. Russell's (1902) and Lewis' (1912) definitions of implication. The rejection of tonk-like systems seems to be a major constraint on our forms of thought.

In nonformalized ordinary conversation, similar principles of connectedness would seem to apply. For example, if Smith gives as a reason for his being late that he received a telephone call, although this is strictly speaking a non sequitur, his excuse will probably be generously interpreted (even if not believed) by his listener by means of a scenario in which the phone call took up just that amount of time by which he was late (such that lateness arose from lateness). We are finding subjects to be facile in developing *ad hoc* scenarios to connect any two random appearing events (events which at first glance appear to have only a relationship of otherness between them such as ‘‘Smith was late’’ and ‘‘The French invaded Uganda’’). These scenarios have the property that the to be explained event is prefigured in them.

The contention of this paper is that all explanations deriving events from something completely other than themselves become explanations because somewhere along the way they introduce the outcome itself and thus turn the account into one in which the outcome is already contained in the ground. Cognitive science accounts often have just this form. Take, for example, a computational account of form perception (Hinton, 1979; Marr, 1982). Retinal stimulation goes through a series of stages at each of which the representation looks more and more like the percept. In fact, ‘‘looks like’’ is taken somewhat literally by the computationalists; we may be shown actual pictures of how the stimulus supposedly looks at each stage so that one can see its similarity to the percept (For a critique of the logic, see Shepard, 1978). With color one cannot perform this particular exercise because there are obviously no first order isomorphisms between neural representations, which are not colored, and the percept which is. But here the cognitive scientist can introduce *second order* isomorphisms. This term was first introduced by Shepard and Chipman (1970) to refer to the lawful relationship between imagery and percepts. In the present context it fits very aptly the logic by which the cognitive theorist can introduce outcomes into grounds. In regard to color, the structure of neural representations at the cortical level can be said to *map* the structure of the color solid. The more similar the better.

In behaviorism, mental representations, images, intentions, desires, and all other anthropomorphic constructions and intervening variables were explicitly banished. Responses were to be derived solely from stimuli. But exactly the same concessions arise in these theories as in the account of form and color perception. Hull's (1943) initial theoretical machinery operated to get the rat into the maze, but before the rat got to the reinforcement at the end, Hull was forced to introduce a mediating variable called ‘‘fractional antedating goal responses.’’ these are just what they sound like, miniature versions of the outcome. Skinner's (1935) dictum of the organism as a black box allowed for no intervening variables at all. Coherence in his explanations come from second order isomorphisms; certain characteristics of stimuli are correlated with equivalent aspects of response. Amount of bar pressing to get food is a simple function of number of hours of food deprivation. The temporal characteristics of responses on a fixed interval schedule mirror the intervals of the schedule. Where such elegant relationships cannot be found, a Skinnerian analysis breaks down.

In summary, explanations which derive outcomes from grounds in which the outcome cannot already be seen to exist gain their credibility through their ability to turn this explanation into one of the type where the outcome can be seen to exist already in the ground. But that is just the sort of account which can be accused of circularity.

III. Arising from Both Self and Something Other

Perhaps what is wrong with our folk sense of explanation is its simplistic emphasis on single causes. Both our desire for single cause explanations and their absurdity is illustrated, one might claim, by a photograph on the front page of the New York Times several days after the 1976 power failure which affected large portions of the Atlantic states. The photograph shows a Conn Ed official pointing to a fuse, and the caption reads, ‘‘THE CAUSE!’’[5] Psychological research seems to confirm our preference for single causes. For example, children apparently do not think that they can be doing something both because they like to do it *and* because they are rewarded; subjects who were given a prize for playing with magic markers ceased playing with the markers when the promise of a reward was withdrawn,

[5] It can, of course, be argued that what makes this explanation seem absurd is only our naive requirement that ground and outcome match in importance—a fuse seems too small to cause so much trouble.

whereas children who had never been given any external reason for playing with the markers continued happily scribbling (see Lepper & Greene, 1978). Is it that we need to overcome such primitive thinking and look at events as arising from many different grounds?

Certain types of research explicitly take a multi-causal stance—for example, many social indicators can be found which predict juvenile delinquency. However, little appears to be built on such research. As an illustration of the psychological problem we may have in dealing with indicator research consider the following: suppose that there is a large study of reading ability in third grade children involving thousands of children and multiple measures of all aspects of their life. And suppose that results exhibit the following pattern: one factor, number of books in the child's home, account for 17% of the variance and a variety of other factors account for small but significant portions of the variance such that 88% of the variance is, in the end accounted for. We know that third grade reading ability can be predicted by a combination of number of books in the home, father's income, number of siblings, mother's age at marriage, length of time in present school, number of same sex friends, number of absences in the present year, general intelligence, verbal fluency, height, childhood diseases, dental history ... and so on. One feels guiltily discontented with such explanations and usually strives to reduce the data into the fewest possible general factors (e.g. perhaps a general social class factor). How much better one feels to be told nothing but that 17% of the variance is accounted for by number of books in the child's home. From such a variable one can readily see the outcome as already contained in the ground. Like the Skinnerian case there is a simple isomorphism of function between number of books and reading skill and also a scenario for functional connections—for example, that the child is read to so reads. What is so unsatisfying about multiple indicator explanations is that they interfere with the usual ground-outcome relationship that each one of them might have were it the sole finding.

The Madhyamika critique of arising from both self and other is that it logically combines the inadequacies of both of these and provides no new virtues. That could also be said of our multiple factors example. Like an account which derives events from what is other, it fails to function as an explanation unless it can be reduced to a picture in which the events are derived from themselves. And when this happens, one may apply the accusation of circularity. A multiplicity of factors simply obscure, rather than solve, the logical problems of causal accounts.

IV. Arising from No Cause at All

This view was espoused by the Carvaka (Hedonist) school of ancient India (Radhakrishnan & Moore, 1957; Raju, 1971; Thrangu, 1983). According to the Carvakas, phenomenon, like mushrooms, appear out of nowhere, exhibit their own natures (a thorn is sharp, a peacock colorful) and then, like dust when the wind hits it and blows it anywhere, events and actions disperse with no result. Thus, there are no such things as virtuous and unvirtuous actions. This latter claim made the Carvakas abhorrent to all other schools (although like the Greek Epicureans and modern Berkeley Hills liberals they appear to have lived rather moderate lives). The Madhyamika argument which is most relevant to our present concerns is that this simply is not the way the world works. Objects and events, even mushrooms, don't appear out of thin air, nor does anything chaotically come from anything. Rice plants grow from rice seeds and barley from barley. This regularity requires explanation. (We might add to the critique that the Carvakas didn't really stick to a strict no cause view since things are explained as manifesting their own nature—one of the ways in which outcomes can arise from themselves.)

The modern version of events arising from no cause at all is the concept of chance and probability. Indeed, the probabilistic view can be maintained with downright fervour—as in the case of the physicist who accused all work on perception of causality of being superstition. To what extent, however, is a noncausal view psychologically real? In our present folk psychology, and one suspects in the folk psychology of other cultures, when the events of individual lives are at issue, there is always an ambivalence between causality and chance. Where the official view is that certain classes of events are to be understood probabilistically, as in our present scientific attitude, then viewing such events causally is called superstition. If a causal doctrine such as fate, providence, or karma is dominant, then viewing individual life events as chance may be seen as superstition. In either case, at the level of individual psychology, there is a tension between the causal and the chance interpretation of individual events and perhaps a tendency to switch back and forth between the two (as in viewing a necker cube).

There is certainly a level of explanation in which folk psychology and philosophy of science are unabashedly matched in seeing the world in causally relevant terms. Bullock, Gelman and Baillargeon (1982) showed that by three years of age children asserted that any event presented did not come out of nowhere but was made to happen by something else (Piaget, 1954, traces the development of such ideas to a much earlier age). Carey (1982) argues that causal ideas within any particular domain, such as that of animate beings, develop and have meaning only within inclusive scientific theories—a point made in the general case by Kuhn (1962). As adults we do not think for a minute that our belief that rice plants will grow from rice seeds is only an expectation generated from the constant conjunction of these events in the past; we understand this regularity within our theory of genetics which itself is part of our general theory of biological systems. Likewise the alternation of day and night is not an isolated consistency but is part of our astronomical cosmology. And when we turn on a light switch we know, like Bullock *et al*'s (1982) three-year-olds, that wires connect it to the light, and that something that experts know about, at the very least, makes the light come on. Philosophers, too, have argued plentifully that constant conjunction under any name, even when accompanied by experimental manipulations, although it may well lead to causal *hypotheses*, will not be taken as causality itself unless it is embedded in an appropriate theory (see Stroud, 1977, for illustrations).

On the other hand, individual events at a certain level of moral or personal significance are to be seen in terms of scientific folk psychology as the products of chance—having an accident or winning a lottery being examples of bad and good luck. Consider the following example: ten friends having dinner at a seafood restaurant eat raw oysters but Smith alone becomes ill with hepatitis. Although we could theoretically trace back the whole natural history from the birth of that bacteria and that oyster, through the restaurant kitchen, onto the plate, onto the table and into Smith's mouth, there is nothing in this history which answers the question, why should it have been Smith and not anyone else who received the infested shellfish? We cannot turn to explanations in terms of Smith's moral failings or the witchcraft of an enemy; it is simply bad luck. At this level, the event has no cause. In fact, we tend to be quite imperious about the reality of chance, particularly when describing other cultures. Spiro (1970) says of his Burmese villagers, ‘‘...when a person's misfortune is explained, as it frequently is, by *kan makaung;bu:*—his karma is bad—what is meant is that he has had some bad luck’’ (Spiro, 1970, p. 115).

For all this, the analysis of individual events in terms of chance does not appear to be psychologically, entirely satisfactory and tends to be unstable. There are several types of evidence which indicate our dislike of probabilistic accounts:

(1) It is events just as the above example, events of personal illness or misfortune, for which individuals most strive to find coherent grounds. Berglas (1985) reports that the major obsession of victims of violent crimes is the question ‘‘Why did this happen to me?’’ And Taylor (1982) found women's reaction to breast cancer to be first and foremost a search for ‘‘meaning’’ in the event.

(2) It is precisely for individual events that subjects typically do not use probabilistic reasoning, such as base rates, but turn instead to heuristics which match outcomes to grounds, such as representativeness (Tversky & Kahneman, 1982b). Thus, the probability of a given person being a librarian is computed, not on the basis of the (low) rate of occurrence of librarians in the population sampled, but by how closely the individual in question matches the stereotype of a librarian, a category essence relationship (Kahneman & Tversky, 1972). This may not be simply a technical error in computing probability, as it is often treated, but a downright refusal on the part of subjects to take the situation as probabilistic. Subjects are quite capable of using base rates when those are presented as causally relevant (Tversky & Kahneman, 1982a). Further ambivalence about probability is demonstrated by our many superstitions concerning games of chance; to take a representative example, Langer (1975) found that even subjects from a population of middle class Americans who affirmed that lottery outcomes were purely a matter of chance were far less willing to part with a lottery ticket which they had

chosen themselves than one which had been assigned to them.

(3) Once a person has acted, an event has happened or an individual has assumed or been assigned a particular role, the overwhelming tendency is to attribute the occurrence to attributes or intentions of the persons involved rather than to probability or to circumstances (Fiske & Taylor, 1985). This has been called the ‘‘fundamental attribution error’’ (Nisbett & Ross, 1980).

All of these phenomena are examples of our ambivalence toward use of probability as a working principle in everyday causal explanations. We seem to be averse to acausal explanations. Thus, even in our own culture which has a highly developed theory of probability, the concept of chance in folk psychology appears to be fragile and is easily replaced by the view that events arise from themselves.

Conclusions

That a thing arises from itself, from something other, from both and from neither exhausts the possibility of how any one event can be related to another. All of these have been shown to have psychological import for the way in which both ordinary people and cognitive scientists conceive of the relatedness of events. And all have been shown to be unsatisfactory. Normally, events are considered coherent or causally bound if they can be seen as arising from themselves, that is, if their outcomes can be seen as already present in their grounds. But upon examination, this logic is found to be circular and uninformative. Unfortunately, the other three ways of seeing causality become satisfying explanations only when they are reduced to the first.

What are we to make of this state of affairs? It may be here that the Madhyamika and cognitive science part company. The Madhyamika wishes to demonstrate that causes and effects (like the perceiver and thing perceived, part and whole, and so on) cannot be conceived as separate, absolute entities, each existing independently in its own right. This is part of a nondual vision of the world which is radically different from the conception of either cognitive science or any normal folk psychology. Is there anything that cognitive science can obtain from this vision which will help with its own problems of causality?

It may not make sense to talk of causes and effects existing independently of each other, but what of dependent causes and effects? The Madhyamikan would be the last to deny that these have a pattern. Why do explanations only seem coherent when outcomes are seen to be already present in grounds? The usual answer might be that we, as lay scientists, are prone to grievous errors (Nisbett & Ross, 1980). The other possibility that we are suggesting here is that we see things this way because this is the way the world, as we know it, actually works. Things may not, in fact, arise in any new or independent way but simply circulate.[6] Infants may start to learn this kind of principle very early. If one smiles at someone, they smile back; if one yells at someone, they yell back. It is the same action, just reversed as to the persons. If one is wet, hungry, grumpy or satisfied at one moment, one is likely to be so again, for example in the next moment. It is the same event just displaced over time. When change does occur, it does not come out of nowhere but in a dialectical relationship with what is already there. The thing about sympathetic magic that is incorrect may not be the principle; it is that the wrong similarities and relationships are often focused upon.

In summary, normal events, both in physical causality and in human action, are expected to have grounds, outcomes, and appropriate connecting links. We normally strive to find connections and coherences between events by finding how outcomes are contained in grounds. This need not be taken as the error of superstitious lay scientists; it may be a description of how the conditional world operates—a principle which should be taken seriously.

References

Berglas, S. (1985). Why did this happen to me? *Psychology Today*, **19**, 44-49.

Bullock, M., Gelman, R., Baillargeon, R. (1982). The development of causal reasoning. In W. J. Freidman (Ed.), *The development of the psychology of time*. New York: Academic Press.

[6] This may be part of what is meant by karma.

Carey, S. (1982). Semantic development: The state of the art. In E. Wanner & L. R. Gleitman (Eds.), *Language acquisition: The state of the art*. New York: Cambridge University Press.

Candrakirti (1979). *Lucid expositions of the middle way*. M. Sprung (Tr.), Boulder, Colorado: Prajna Press.

Fischer, D. H. (1970). *Historians' fallacies: Toward a logic of historical thought*. New York: Harper and Row.

Fiske, L. & Taylor, S. (1985). *Social Cognition*. New York: Random House.

Frazer, J. G. (1959). *The new golden bough: A study in magic and religion* (abridged). New York: MacMillan (Edited by T. H. Goster, 1922. Original work published 1890).

Gampopa (1971). *Jewel ornament of liberation*. H. Guenther (Tr.), Berkeley, California: Shambhala Books.

Gyamtso, T. (1986). *Progressive stages of meditation on emptiness.* Oxford: Longchen Foundation.

Heider, F. (1958). *The psychology of interpersonal relations*. New York: Wiley.

Hinton, G. (1979). Some demonstrations of the effects of structural descriptions in mental imagery. *Cognitive Science*, **3**, 231-259.

Hopkins, J. (1983). *Meditations on emptiness*. London: Wisdom Publications.

Hull, C. L. (1943). *Principles of behavior*. New York: Appleton-Century.

Inhelder, B., & Piaget, J. (1958). *The growth of logical thinking from childhood to adolescence*. New York: Basic Books.

Kahneman, D. & Tversky, A. (1972). Subjective probability: A judgement of representativeness. *Cognitive Psychology*, **3**, 430-454.

Kuhn, T. S. (1962). *The structure of scientific revolutions*. Chicago: University of Chicago Press.

Langer, E. J. (1975). The illusion of control. *Journal of Personality and Social Psychology*, **32**, 311-328.

Larson, G. J. (1975). The notion of *satkarya* in Samkhya: Toward a philosophical reconstruction. *Philosophy East West*, 31-41.

Lepper, M. R. & Greene, E. (1978). *The hidden costs of reward*. Hillsdale, New Jersey: Lawrence Erlbaum.

Lewis, C. (1912) Implication and the algebra of logic. *Mind*, **21**, 522-531.

Marr, E. (1982). *Vision*. San Francisco: Freeman.

Michotte, A. (1963). *The perception of causality*. London: Methuen.

Murti, T. R. V. (1960). *The central philosophy of Buddhism*. London: George Allen and Unwin Ltd.

Nisbett, R. & Ross, L. (1960). *Human inference: Strategies and shortcomings*. Englewood Cliffs, New Jersey: Prentice-Hall.

Piaget, J. (1952). *The origins of intelligence in children*. New York: International Universities Press.

Piaget, J. (1954). *The construction of reality in the child*. New York: Basic Books.

Prior, A. N. (1960). The runabout inference ticket. *Analysis*, **21**, 38-39.

Radhakrishnan, S. & Moore, C. A. (1957). *A sourcebook in Indian philosophy*. Princeton, New Jersey: Princeton University Press.

Raju, P. T. (1971). *The philosophical traditions of India*. London: George Allen and Unwin Ltd.

Rozin, P., Millman, L. & Nemeroff, C. (1986). Operations of the laws of sympathetic magic in disgust and other domains. *Journal of Personality and Social Psychology*, **50**, 1-10.

Russell, B. (1903). *The principles of mathematics*. Cambridge: Cambridge University Press.

Searle (1983). *Intentionality: An essay on the philosophy of mind.* Cambridge: Cambridge University Press.

Shepard, R. N. (1978). The mental image. *American Psychologist*, **33**, 125-137.

Shepard, R. N. (1984). Ecological constraints on internal representation: Resonant kinematics of perceiving, imagining, thinking and dreaming. *Psychological Review*, **91**, 417-447.

Shepard, R. N. & Chipman, S. (1970). Second-order isomorphisms of internal representation: Shapes of states. *Cognitive Psychology*, **1**, 1-17.

Skinner, B. F. (1938). *The behavior of organisms*. New York: Appleton-Century.

Spiro, M. E. (1970). *Buddhism and society: A great tradition and its Burmese vicissitudes*. Berkeley, California: University of California Press.

Stroud, B. (1977). *Hume*. London: Routledge & Kegan Paul.

Taylor, S. (1982). Social cognition and health. *Personality and Social Psychology Bulletin*, **8**, 459-462.

Thrangu, K. (1983). *The open door to emptiness*. Manila, The Philippines: Tara Publishing.

Tversky, A. & Kahneman, D. (1982a). Evidential impact of base rates. In D. Kahneman, P. Slovic & A. Tversky (Eds.), *Judgement under uncertainty: Heuristics and biases*. New York: Cambridge University Press.

Tversky, A. & Kahneman, D. (1982b). Judgements of and by representativeness. In D. Kahneman, P. Slovic & A. Tversky (Eds.), *Judgement under uncertainty: Heuristics and biases*. New York: Cambridge University Press.

Walster, E. (1966). Assignment of responsibility for an accident. *Journal of Personality and Social Psychology*, **3**, 73-79.