A CONDITIONAL CRITERION FOR IDENTITY, LEADING TO A FOURTH LAW OF LOGIC

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If logic is regarded as a set of perceptual operations, then logic has a chronotopology (time structure). Identity or nonidentity then results as a decision from an algorithm--a set of perceptual operations--in which case the nature of a particular identity is conditional upon the nature of the set of perceptual operations comprising che algorithm. Ordinary logic does not account for the temporal aspects of perception, merely accounting for the spatial aspects. In other words, Aristotlean logic is a synthesis of primitive observation, which has been fitted to the partial (spatial) reality emerging from spacetime after

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19. light, logic, logic algorithm, logic operation, mathematics, memory, mind, monocularity, multiocularity, negation, nonidentity, observation, paradigm, paradox, perception, photon, photon interaction, physical phenomena, physics, primitive observation, quantum mechanics, reality, space, spacetime, thing-in-itself, thought, time, wave function, Young's experiment, zen.

20. the imposition of the monocular photon interaction. In quantum mechanics, time is a parameter, not an observable. Hence measurement/detection (observables) deal with primitive observation and Aristotlean logic (topology), while total reality deals with nonprimitive observation--hence, nonAristotlean logic (chronotopology)--as shown in Young's two-slit experiment.

By applying temporal accounting to each perceptual operation, the author shows that Aristotle's three laws are self-contradictory and incomplete as written (i.e., they are topological, not chronotopological). A simple derivation of a fourth law is shown and an applications rule given which itself may be regarded as a fifth law of logic. The resulting four-law logic is chronotopological, and the applications rule states that either Aristotle's three laws apply explicitly and the fourth law is implicit, or the fourth law applies explicitly and Aristotle's three laws are implicit.

The four-law chronotopological logic is theoretically capable of resolving every present three-law paradox.

A CONDITIONAL CRITERION FOR IDENTITY, LEADING TO A FOURTH LAW OF LOGIC

Thomas E. Bearden

Aristotle's three laws of logic, on which foundation rests all mathematical, physical, and rational thinking, can ordinarily be stated as

1. $A \equiv A$
2. $A \neq \bar{A}$
3. $A \vee \bar{A}$

Table 1. Aristotle's three laws of logical thought

A variety of arguments can easily be produced to show that these laws are incomplete; i.e., they do not specify all reality, for parts of reality can be shown to contradict one or more of Aristotle's laws.

Indeed, all "observed" or "observable" reality can be shown to violate all three laws.

E.g., the most direct violation is posed by the problem of change, a problem originally propounded by Heraclitus about 500 B.C., and unsolved to this day. Heraclitus pointed out that, for a thing to change, it must turn into something else, and then asked how a thing could be something other than itself?

E.g., we may think of a thing -- say α, some feature "A" of which is said to change. If A changes, it turns into $\bar{A}$, thus violating logic laws one and two. Further, we are considering A as the "changed thing, $\bar{A}$," i.e., something which is somehow both A and $\bar{A}$, so logic law three is violated as well.

Thus, if Aristotle's three laws are taken to be all the fundamental laws of logic, then logically there can be no change whatsoever, because change negates all three laws. I.e., either change does not exist or it is totally illogical.

Since all measurements, detections, thoughts, and perceptions are simply changes, then it follows that these operations logically cannot exist. Or, if we assume the "operations" to exist, their outputs cannot exist. If the operations do not exist, then again their outputs do not exist.

So if the products or outputs cannot exist, then by this reasoning no perceived, detected, measured, conceived thing exists. If we then insist that such things do indeed exist, then all is paradoxical and illogical. This is essentially the nature of the paradox posed by Heraclitus.

Heraclitus's change paradox has not been satisfactorily resolved to this day, and rigorously all the rational science of the Western world, being based on paradoxical change (detection, perception, observation) is itself totally illogical by its own logical standards.

However, the conditions necessary to resolve the problem of change can be stated simply by inspection of the problem as follows: (1) Aristotle's three laws must specify or apply to only that which is not changing, since change violates or negates all three laws; (2) If change is to logically exist, there must exist at least a fourth law of logic, one which applies to change; (3) This fourth law must contain the negations of each of the first three laws, since change negates them;

(4) To be consistent, in any particular logical case, either the three laws explicitly apply or the fourth law explicitly applies (i.e., either change explicitly exists in that particular case or it does not); (5) Since all four laws must apply at all times, then when the three laws apply explicitly, the fourth law must be implicit -- and when the fourth law applies explicitly, the first three laws must be implicit.

With the five stated conditions, a fourth axiom of logic can be written simply by writing down the negations of Aristotle's three laws, and synthesizing these negations into a single fourth law. Thus

Aristotle's law	Negation	Explicit statement of negation *
$A \equiv A$	$A \not\equiv A$	$A \equiv \bar{A}$
$A \not\equiv \bar{A}$	$A \equiv \bar{A}$	$A \equiv \bar{A}$
$A \vee \bar{A}$	$A \wedge \bar{A}$	$A \equiv \bar{A}$ or $[A, \bar{A}]$

Table 2. Negations to Aristotle's laws.

However, even though we can synthesize the negation into a single law -- the old "identity of opposites" idea -- we still have the problem of understanding such a law. Though at first glance the negations and the synthesized fourth law seem bewildering, we can readily comprehend them if we carefully consider the temporal nature of the process that occurs in logical thinking.

Specifically, a finite interval of time is required to perceive, think, detect, or observe an entity -- regardless of whether we refer to "physical" or "mental" detection, because both physical and mental processes are temporal. Indeed, we flatly state without further discussion that ultimately the identifying or mapping of physical and mental operations onto each other is what time is a priori.

At any rate, we now carefully account for each individual time interval required to think, conceive, detect, perceive, or observe an entity -- whether that entity is physical or mental -- and we also account for the finite time interval required to perform a logical operation. So we rewrite Aristotle's three laws as shown in Table 3, with subscripted numbers indicating the separate time intervals in each law.

Aristotle's law	Negation
1. $A_1 \equiv_3 A_2$	$A_1 \equiv_3 \bar{A}_2$ or $A_1 \not\equiv_3 A_2$
2. $A_1 \not\equiv_3 \bar{A}_2$	$A_1 \equiv_3 \bar{A}_2$
3. $A_1 \vee_3 \bar{A}_2$	$A_1 \wedge_3 \bar{A}_2$ or $[A_1, \bar{A}_2]_3$

Table 3. Temporally accounted laws and negations.

The resolution to the entire mystery so long inherent in these axioms of logic now stands simply revealed: Whether one of Aristotle's laws holds or its negation holds is determined solely by the nature of the logical operation in time interval three.[1]

2. *These negations simply state that A and $\bar{A}$ are totally undifferentiated.

I.e., the operation in interval three may be regarded as an algorithm comprised of subsidiary (assumed) operations in separate time subintervals that, taken together, comprise the overall operation implied by the logic symbol.

Thus in the first law, if temporal tags (time snapshots) are not accounted (i.e., if they do not apply), then Aristotle's laws hold, for the snapshot 1 of A is not differentiated in algorithm 3 from snapshot 2 of A. This then rigorously holds for spatial (L^3) entities, but not for spacetime entities. The snapshots in this case for Aristotle's first law (and the others as well) are spatial snapshots. On the other hand, if snapshots 1 and 2 of A are themselves temporally differentiated in algorithm 3, then the negation of Aristotle's law applies, because the spacetime snapshots A_1 and A_2 are different. This is immediately apparent, e.g., in a Minkowski geometry representation, where the second snapshot of A will have a time coordinate different from the time coordinate of snapshot 1. This is represented as shown in figure 1, where "A" is taken as a simple magnitude, in this case 5.

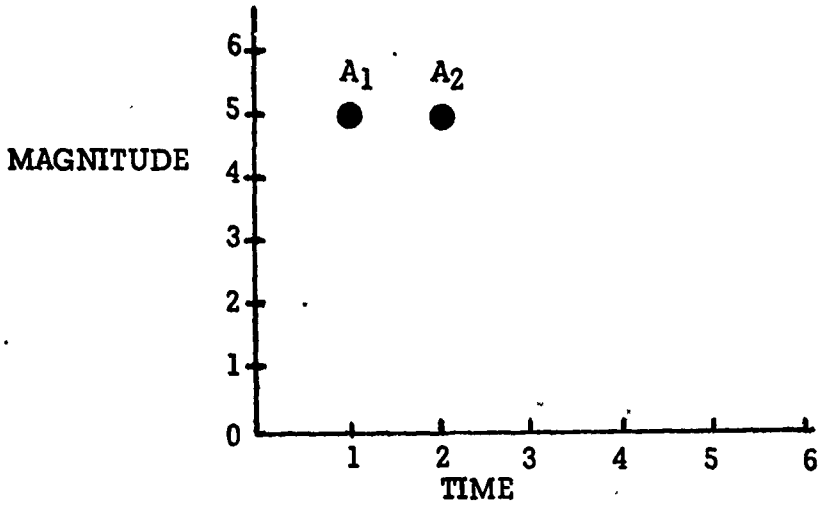

Figure 1. Spacetime snapshots of A.

As can be seen from figure 1, 5_1 is not identical to 5_2 unless we imply the operator $\partial/\partial T$ in the time interval three algorithm.

The negation of the second law may also be simply understood if we use temporal accounting. E.g., suppose we take $A_1 = +1$, $\bar{A}_2 = -1$, and then pose the absolute value operator $||$ for potential use in algorithm 3. If $||$ is not used, then

$$(+1)_1 \not\equiv_3 (-1)_2$$

and Aristotle's second law holds. If $||$ is used, then

$$\left|(+1)_1\right|_3 \equiv_3 \left|(-1)_2\right|_3$$

and in that case

$$A_1 \equiv_3 \bar{A}_2$$

Note we are taking the view that there is nothing "absolute" or "inherent"

about identity or non-identity; instead, each is a conditional result that can only be established by some logical, comparative set of operations. If the suboperations comprising the decision algorithm for the identity/non-identity determination are changed, the finding of the algorithm (the decision) may often change. Specifically, one can have the cases

$$\hat{=}_1 \neq_3 \hat{=}_2$$

$$\neq_1 \neq_3 \neq_2$$

Thus we advance a conditional identity criterion to be incorporated into formal logic: "Identity" or "non-identity" is defined by a decision made as a result of applying an operational algorithm; changing the internal operator components assumed inherent in the algorithm can change the decision. We are stating a fundamental principle that "identity" and "non-identity" are conditional and only conditional; they are never absolute.

With these points made, we now turn to the third law. From Table 2, on examination it can be seen that the third law actually is a statement for monocular perception, detection, observation, thought, or conception. Indeed, this law says that only a single thing at a time can be perceived, detected, observed, thought, or conceived.

As we pointed out in a previous paper[2], there is a very good reason for this "law." Primitive man lived almost exclusively in a reality detected by light, by the photon interaction. Even in the absence of visible light, all bodies have temperature, and man is immersed in a "sea" of continual electromagnetic photon interactions. The photon interaction is monocular -- only one at a time interacts with a particle of mass. Further, photon interaction constitutes the operator $\partial/\partial T$ invoked upon L^3T spacetime. Photon emission carries away time (the photon is made of $(\Delta E\, \Delta T)$, leaving behind an L^3 spatial reality, as we have previously pointed out.[3]

So all our primitive concepts, ideas, and notions about reality have come from over four million years of hominid and human experience in the photon-detected partial reality ("physical", "objective," or "spatial" reality) that remains when the time "dimension" (fundamental variable) is destroyed from L^3T spacetime, leaving only L^3 space behind. Specifically, our observed macroscopic reality consists of large temporal (mental) aggregates of such spatial results, where we cannot distinguish the tiny temporal separations of the pieces. Thus all our observed/perceived entities are spatial, and further, each perception/observation snapshot results in a frozen, unchanging spatial entity (resulting -- in physical detection -- from the so-called "collapse of the wave function." The loss of a wave function is simply the loss of time.) We vaguely sense "time" and "change" as the relation between these snapshots -- i.e., by causality, or the ordering of the spatial changes -- much as we see "movement" in movie frames rapidly projected onto a screen one-at-a-time.

Thus our primitive observations, from which have painfully been formed our relational concepts and ideas, are monocular, unchanging, and spatial. Aristotle's three laws of logic -- which indeed may be taken to be only a simple synthesis of our primitive observation and corresponding relational concepts -- then exhibit the same characteristics; they are monocular, unchanging, 3-dimensional, spatial, non-temporal relational statements. Any statement that is temporal, changing, or 4-dimensional

will thus appear as a logical paradox to this logical shorthand.

But from Young's two-slit experiment, we already know that reality and the relationships between its parts are quite different if the photon interaction is not invoked -- i.e., if $\partial/\partial T$ is not invoked. Classical reality (as prescribed by Aristotle's laws) is directly violated by an electron in the two-slit experiment, e.g., if and only if photon interaction with the electron is not invoked. Again, this has been simply explained by the present author[4], and Charles Muses as early as 1957 pointed out the absence of any mystery in Young's experiment if the chronotopological aspects were considered.[5]

However, what is normally referred to as the "conscious, thinking mind" is simply a functioning temporal (rigorously, chronotopological) mechanism that is painfully built up in the individual's awareness (his mind in the greater sense of both thought and awareness, whether monocular or multiocular) by training, conditioning, and experience. Its functioning is largely conditioned by one's 90% or so attention to visual stimuli (to the partial reality remaining after photon interaction has been invoked, and to the memory-collated ordering of vast numbers of such photon interactions) and by one's cultural conditioning -- which itself has been almost exclusively conditioned and shaped by the monocular photon interaction at base root.

Thus, since the beginning of man, his conscious, rational mind has been trained and constructed to function almost exclusively in basic correspondence with the photon interaction, and his experiential reality consists of the partial reality stripped from fundamental reality by photon interaction.

All "perceived differences," e.g., are created by this deep mindset. As has been previously pointed out,[6] the solitary human problem responsible for all man's inhumanity to his fellow man is directly dependent upon man's almost exclusive detection, observation, perception, and conception of "difference" between humans, these "differences" being due exclusively and totally to the fitting of men's conscious minds to the photon interaction's monocular separation of spatial reality from nonspatial reality; i.e., to

$$\partial/\partial T\ (L^3T) \Rightarrow L^3$$

Such well-nigh total devotion to, and enslavement by, the photon interaction also is responsible for the scientist's well-nigh total devotion to, and enslavement by, the present imperfect and incomplete three laws of logic, as presented by Aristotle. The depth of that devotion and enslavement is evidenced by the fact that the resolution of such paradoxes as Heraclitus's problem of change have eluded the best minds of humanity for several thousands of years. Indeed, these paradoxes cannot be resolved by the conscious, rational mind in its present state, for it has been most firmly constructed and fitted to function in accordance with the photon interaction.[7] One cannot hope to resolve any logical paradox by using only those same logical methods that found the situation to be paradoxical in the first place!

That we need not be constrained by such universal delusion is already shown by binocular vision. Specifically, in viewing a three-dimensional object, each eye never detects a "third dimension," but detects only an L^2 2-dimensional picture. By taking two slightly different 2-dimensional snapshots and superposing them, the third dimension is gained. One then essentially sees the resultant superposed pictures as "almost the same but not quite." I.e., the Aristotlean identity algorithm, if satisfied, yields "no difference, hence one object," and if not satisfied, yields

"difference, hence multiple (extended) object(s)." So if the two snapshots are almost Aristotlean-identical but not quite, we get an extended two-dimensional (three-dimensional) object. Otherwise we see two separate, two-dimensional snapshots blurred together (the reader is urged to try this and see).

The point is, "dimensionality" and the identity algorithm are directly related, and geometrically one follows from the other.

In very similar manner, we can only gain cognizance or awareness of "time" (as a fourth dimension) by the superposing of two slightly differing (Aristotlean-wise) 3-dimensional snapshots. As is well known, e.g., time is not an "observable" in quantum mechanics; it is a "parameter." Rigorously, the only place such snapshots -- each of which is "past" (spatially separated by the annihilation of time in the collapse of the wave function) -- can multiply exist is in the "mind" in its most general sense. In a rigorous sense, mind and time can be taken as identical, and the "flow of time" can be taken as the "flow of mind connections or superpositions " of its spatial components. I.e., measured/detected/observed "physical phenomena" are a priori 3-dimensional and spatial, while a mind is four-dimensional and hyperspatial.[8] Spacetime exists mentally but not observably. Time is logically implicit, not explicit.

Now we return to the temporal aspects of logic. Each perceptual part of each Aristotlean law is fitted to the photon interaction, hence monocular. The logic operation, inherent in the logic symbol in each statement, involves temporal superposition or comparison of spatial perceptual objects. Hence the logic operation is hyperdimensionally a function of mind, and injects mind/time into the statement. Yet these laws, being fitted to or synthesizing photon interaction, attempt to prescribe the absence of time, even though writing down the logic operation rigorously invokes time. They are thus totally contradictory, since as written they implicitly violate themselves.

Figure 2 summarizes the operations now to be permitted in the time-three algorithm, in developing a new four-law logic:

1. $\overline{\lceil S_1, S_2 \rceil}_3 = (\text{zero})_3 \Rightarrow (\text{identity})_3$
2. $\overline{\lceil S_1, S_2 \rceil}_3 = (\text{nonzero})_3 \Rightarrow (\text{non-identity})_3$
3. $\lceil S \rceil_3 = \overline{\lceil \overset{S}{\lceil S \rceil_1}, \lceil S \rceil_2 \rceil}_3 \Rightarrow$ monocular separation, differentiation internally
4. $\overset{S}{\lceil \rceil}_3 = \overset{S}{\lceil \rceil}_3 \Rightarrow$ nonseparation, no differentiation internally

Figure 2. Conditional identity rules.

Rules one and two simply state that, when snapshots 1 and 2 are superimposed (subtracted) in time interval 3, the resultant snapshot 3 may be zero or nonzero. If zero, snapshots 1 and 2 are said to be identical, and if snapshot 1 is to be labeled A, then snapshot 2 is to be labeled A. If snapshot 3 is nonzero, snapshots 1 and 2 are said to be nonidentical; if snapshot 1 is labeled A, then snapshot 2 is labeled $\overline{A}$.

Rule 3 says that snapshot 3 is a "memory" snapshot, and it may be particulately examined to monocularly separate snapshots 1 and 2.

Rule 4 states that snapshot 3 is not a "memory snapshot" and may not be further separated.

Note that in logic we repeatedly apply these rules in combination, serially or compositely. Note further that Rule 1 must serially apply both rules 3 and 4, as must rule 2 also.

If we take $4|_3$ to mean "rule 4 applied conditional to rule 3 also being applied," and $4|_{\overline{3}}$ to mean "rule 4 applied conditional to rule 3 not also being applied," we may write:

$4|_{\overline{3}} \wedge 1$ = identity (S_1, S_2)

$4|_{\overline{3}} \wedge 2$ = non-identity (S_1, S_2)

$4|_{\overline{3}}$ = oneness without separate-ones;
oneness, extraordinary and unperceivable;
thing-in-itself

$4|_3$ = "ordinary" one, perceivable separation
"thing-as-separated-from-others"

Figure 3. Conditional identity, non-identity, and oneness.

As can be seen, this type of reasoning also sheds a great deal of light on the long-standing problem of the "thing-in-itself," but that is beyond the scope of this paper.

Now we write the fourth law of logic as follows:

$$4.\ (A_1, \overline{A}_2)_3 \Rightarrow A_1 \overset{=}{}_3\ \overline{A}_2$$

where all we have said is that, by rule 4, in snapshot 3 no memory process is allowed, and no separation/differentiation whatsoever of A_1 and $\overline{A}_2$ is permitted. Under these operational conditions for identity, what had previously been called A_1 in snapshot 1 and what had been called $\overline{A}_2$ in snapshot 2 are indistinguishable, hence identical.

Thus the age-old philosophical dilemma posed by the illogical identity of opposites has a simple resolution if one considers temporal aspects, and introduces temporal conditions for identity or non-identity decisions.

We now write the new four law conditional identity logic as:

1. $A_1 \overset{=}{}_3 A_2$

2. $A \overset{\neq}{}_3 \overline{A}_2$

3. $A_1 \vee_3 \overline{A}_2$

4. $A_1 \overset{=}{}_3 \overline{A}_2$

Figure 4. Four law conditional identity logic.

Further, we point out that all four laws now apply. Laws 1,2, and 3 are the laws of explicit monocular perception, with implicit binocular perception. Law four is the law of explicit binocular perception, with implicit monocular perception.

Both monocular and binocular perceptions must be and are used in each law. So in any situation, either the triad applies explicitly and the fourth law applies implicitly, or the fourth law applies explicitly and the triad applies implicitly.

Indeed, one can even take the view that we have prescribed a five-law logic, the fifth law being taken as

$$5.\quad 1,2,3 \wedge (4) \vee 4 \wedge (1,2,3) \qquad \text{where } (\,) \Rightarrow \text{implicit}$$

Figure 5. A possible fifth law of logic.

In a previous paper,[9] the author has already presented methods to apply this new logic to resolve present paradoxes. At least hypothetically, every present paradox should be simply a statement of the explicit fourth law, and it should be resolvable by explicit application of that law.

NOTES AND REFERENCES

1. Specifically, by whether or not exclusivity applies. I.e., we may read Law 1 as "In snapshot (time interval) 3, what was A in snapshot 1 is exclusively identical to (unseparated from) what was A in snapshot 2." Law 2 may be read as "In snapshot 3, what was A in snapshot 1 is exclusively not identical to (is exclusively separated from) what was not-A in snapshot 2." Law 3 reads, "In snapshot 3, what was A in snapshot 1 and what was not-A in snapshot two are exclusively separated." Thus it can be seen that the three laws simply are statements involving whether or not two former perceptions are to be separated in a third perception. These three statements presently prescribe the total separation of the two previous perceptions and prohibit any admixture of the two -- the so-called "excluded middle." Thus the three laws prescribe monocular, one-at-a-time perception.

What we call a "wave" exists in time and is considered to contain an admixture of timeless, static spatial states (such as "wavelengths."). The prohibiting of admixtures thus represents the "collapse of the wave function" and the corresponding loss of time. This defines "observation" and explains why all "measurement" and "detection" and "observation" -- requiring a collapse of said wave function -- are spatial and not spatiotemporal. That is why time is a parameter in quantum mechanics, not an observable.

As we will see, the fitting of our logic to the monocular photon interaction is what has produced this "reality paradigm" that is spatial rather than spatiotemporal, in agreement with what we and all our primitive ancestors have seen with our eyes. For primitive observation via the photon interaction has defined or constrained all our basic concepts, just as it still defines "classical reality."

Relativity, being constrained by such logic, obviously can find nothing "physical" (observed, spatial, timeless thing frozen by the collapse of the wave function as engendered by or fitted to the photon interaction) that is traveling faster than light -- i.e., that violates the conditions implied by the "observing/detecting agent."

That reality need not at all be so constrained is clearly shown by Young's two-slit experiment, the heart of all quantum mechanics. In this experiment, "classical" reality is violated iff the photon interaction is not invoked. Classical reality is obeyed iff the photon interaction is invoked.

With appropriate change to logic to fit "reality that has not been interacted with by photons" and therefore is spatiotemporal, a new physics becomes possible.

2. Thomas E. Bearden, "Solution of the Fundamental Problem of Quantum Mechanics," January 3, 1977, Defense Documentation Center.

3. Bearden, "Photon Quenching of the Paranormal (Time) Channel: A Brief Note," 20 April 1977, Defense Documentation Center.

4. Bearden, "Virtual State Engineering and Its Implications," 1979, Defense Documentation Center.

5. With the possible exception of Kozyrev -- whose more technical works on time remain undisclosed to open science -- no other person known to this author seems to have grasped the implications of a dynamic structure of time as penetratingly as has Charles Musès. The importance of the time interaction in explaining the two-slit experiment (i.e., in explaining wave-particle duality) was noted as early as 1957 by Musès. See, e.g., Musès' introduction to Jerome Rothstein's Communication, Organization, and Science , The Falcon's Wing Press, Indian Hills, Colorado, 1958, p. lxii, where Musès pointed out that the celebrated wave-particle paradox remains a paradox only so long as the chronotopological (his word) phases of the phenomena are left unrealized in the analysis. The entire foreword by Musès is a remarkable document which analyzes the structure of time itself. With his hypernumbers Musès can describe the nested structure of time, which is what is actually being carried by the photon. Further, he can theoretically predict mechanisms by means of which these structures can be orthorotated. It would appear that practical devices should be constructable on the principles elucidated by Musès, and it is little short of astonishing that fundamental work of such importance and application has been thus far little used by theorists, though it is already recognized in the standard literature; e.g., the profound summary paper "Hypernumbers II" in the January 1978 issue of the journal Applied Mathematics and Computation , published by Elsevier.

6. Bearden, "The One Human Problem, Its Solution, and Its Relation to UFO Phenomena," Defense Documentation Center, January 3, 1977.

7. Which is why a Zen master often gives the student a koan to confound and overwhelm this automatic, robotic mindset and functioning that has been constructed as the student's "conscious mind."

8. Specifically, consciousness/life involves a seven dimensional body/being in an infinite-dimensional universe. See Thomas E. Bearden, "A Mind/Brain/Matter Model Consistent with Quantum Physics and UFO Phenomena," prepared for the 1979 MUFON Annual Symposium, available in the Proceedings , MUFON, 103 Oldtown Road, Seguin, Texas 78155.

9. Bearden, "The Fourth Law of Logic," Specula , Journal of the American Association of Meta-Science, P.O. Box 1182, Huntsville, Alabama 35807, Vol. 2, No. 1, January-March 1979, pp. 30-40; also in publication in Defense Documentation Center.