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THE BOUNDARY IDENTITY OF EXACT OPPOSITES: A SIMPLE SOLUTION TO THE AGE-OLD PHILOSOPHICAL PROBLEM OF CHANGE

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report presents a discussion of the age-old philosophical problem of change. The principle of the boundary identity of exact opposites is proposed as a fundamental correction to the logic law of the excluded middle. This fundamental principle is shown to resolve the philosophical problem of change, the wave/corpuscle dichotomy, and several other logical difficulties in foundations of mathematics and foundations of physics.

In the sixth century B.C., the philosopher Heraclitus sharply pointed out that everything was in a state of flux and nothing was at rest. He accepted the belief that reason could find an underlying unity or unchanging basis in the world, but asked how this permanence could be reconciled with the fact of change. Up to the present, a completely satisfactory answer to Heraclitus's question has not been discovered [1]. In the sixth century B.C., the prevailing conclusion was that the world is merely the totality of all changes, and stability results from the union of opposites. Even in Heraclitus's day, however, opinion on the problem of change was sharply divided; e.g., Parmenides regarded change as an illusion. He reasoned that whatever is, is; and whatever is not, is not. Thus whatever changes both is and is not at the same time, which is a contradiction since a thing cannot logically be its opposite [2].

This led to the argument that change meant creation, the appearance of something new. However, for something that did not exist before to come into existence implied the creation of something out of nothing, which again was an intolerable contradiction [3].

Hegel [4] regarded the union of opposites as a conflict which created a new entity. Thus he reasoned that one thing (thesis) met its opposite thing (antithesis) and from the conflict between them there emerged a third thing (synthesis). This gave birth to dialetics, which even today is the central philosophical theme of dialectical materialism. However, Hegel's dialetics are primarily a restatement of the ancient "union of opposites" idea of the sixth century B.C.

Contemporary physics is intimately involved with the unsolved problem of change in the "wave versus particle" problem. The basic concept involved in the idea of a "wave" is that it must be operational to exist, while the basic idea involved in the concept of a particle (corpuscle) is that it does not have to be operational to exist. Yet physical entities, both light and matter, persist in behaving in wavelike and corpuscular fashions. A lengthy controversy on the wave versus particle problem was finally resolved only by agreeing that it was proper to accept either the wave or the particle concept in a particular situation, depending upon which theoretical approach was found to yield the correct results. Thus the problem of whether opposites could in fact be identical was evaded in contemporary physics by the agreed upon "principle of complementarity;" i.e., that the opposites are complementary rather than contradictory. The principle of complementarity is merely a statement that the determination (perception) of whether an entity is a wave or a particle may result in either one, depending upon experimental conditions, but it will not result in both findings simultaneously. As such, the principle in reality is merely the disguised statement that perception is a monocular process. In fact, the Heisenberg uncertainty principle, sometimes referred to as the indeterminancy principle, is also a statement that perception is totally monocular. If one absolutely determines one of a pair of canonical variables, then the other is absolutely undetermined; this translates to the statement that if one is totally perceived, the other is totally unperceived. Interestingly enough, one can even paraphrase the uncertainty principle as "It is absolutely certain that nothing is absolutely certain," in which form its direct analogy to the "conflict of opposites" involved in the age-old problem of change is revealed.

But an even worse surprise lay waiting for the physicist with the development of quantum physics. Experimental physics is most solidly founded upon the experimental method, which depends upon a world behaving in a causal manner. But while the macroscopic world is purely causal, the microscopic world most decidedly is not; rather, it is purely statistical. Since a statistical world has destroyed its basic cause-and-effect relationship, the quantum problem of how a causal macroscopic world can possibly be derived from a noncausal microscopic base emerged as an irresolvable conflict.

The problem of change, or of the "union of opposites," is also met in mathematics. For example, if one defines a point as being lengthless and a line as having or being length, then a line cannot be comprised of points unless opposites are identical. Further, one can prove that two parallel lines meet if indefinitely extended, and one can also prove they do not; the key is in the manner of beginning the proof. But how both of these proofs can be true is difficult to realize unless the two different opposites can be identical.

From these examples, it is clear that in all cases the fundamental problem of change leads directly to the necessity of the identity of opposites. But since one of the laws of logic states that a thing cannot be equal to or identical to its opposite, then a "logical contradiction" occurs so long as one insists on the validity of that particular law of logic. But a close examination of that law will reveal that one is stating that one either has one thing separated, or its opposite thing separated, or the two things separated. One is invoking a separating operation a priori, upon which operation the law is subsequently valid. If the separating operation is removed as a factor, and the law challenged to stand on its own merit, it then cannot do so. The two opposites can then coexist without any separation whatsoever, and that by definition is "identity." It appears then that this particular law of logic, universally assumed valid, is subject to serious challenge.

Also, if one closely examines the reasoning of Parmenides, one can advance it one step further. It is perfectly logical to state that whatever is, is; and whatever is not, is not; yet to "exist not" is of itself to exist [5]. Therefore whatever is not, is not but yet is, which shows that the "conflict of opposites" cannot really be disposed of, even by invoking the argument of Parmenides.

At this point one may admit that (1) all that is perceived is change, and (2) the fact of change inevitably leads to the identity of opposites. Since it is one rule of logic that is responsible for the logical conflict, and since it appears that the rule is subject to serious challenge, it would indeed appear that this rule of logic must be wrong is some sense, or it would not lead to an inevitable contradiction in the problem of change. Since this rule of logic is universally opposed by universal change, it is thus time to modify the law of logic.

We therefore propose the new principle that there is a common boundary between opposites, and that on this boundary the opposites are identical; i.e., no difference can be perceived or established between them. For clarity we refer to the principle as "the boundary identity of exact opposites." This is a slight but absolutely fundamental change to classical logic, and it has far-reaching consequences.

One example of the applicability of the boundary identity of exact opposites is provided by the surface of a geometrical solid. Perception of the solid divides the universe into two; the solid (thing) and the rest of space (nonthing). The surface of the solid belongs totally to the solid (thing) and also totally to the surrounding space (nonthing). Thus the surface interface is both thing and nonthing identically. On the boundary, thing and nonthing are identical. It is the identifying of such opposites that zeroes perception and produces the boundary in the first place. All interfaces and boundaries are so generated, including the bounding difference between "inside" and "outside", for example. Perception, the physical process of detection of change, is a separating/differentiating process, and its beginning and end obviously involve the total loss of separation, i.e., involve identity of all perceptual separates (percepts).

Another example of the boundary identity of exact opposites is provided by the mathematical concept of the absolute value "boundary" of signed numbers. On their absolute value boundary, +1 and -1 may be said to be identical. Normally the "absolute value" is considered to be an operator and it is stated that the absolute value of +1 equals the absolute value of -1. While this is true, the statement is not complete; not only is the absolute value of +1 equal to the absolute value of -1, it is identical to it. That is, the "absolute value operator" cannot tell any difference whatsoever between +1 and -1, and to it +1 and -1 are identical. It is like a process that cannot distinguish color; to that process, a red ball and a blue ball of the same size are indistinguishable. Such a process is invoked, e.g., in the study of all fundamental particles.

The boundary identity of opposites is clarified by Figures 1 and 2.

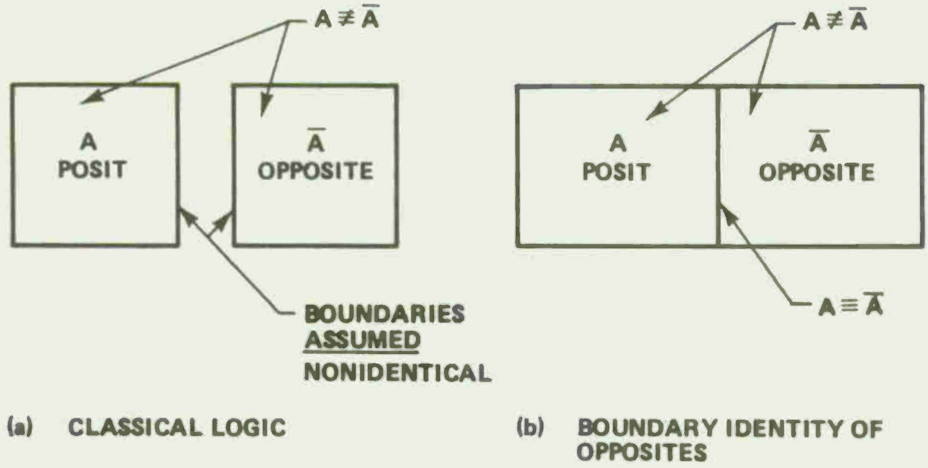

Figure 1. A fundamental change to logic.

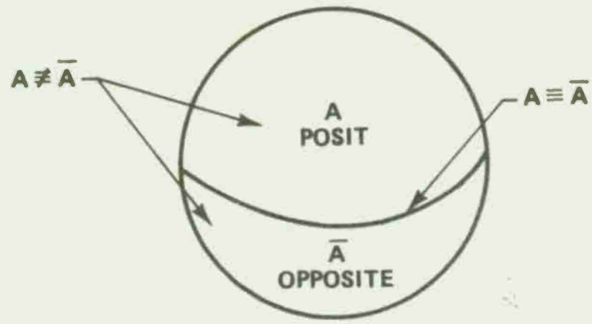

Figure 2. Boundary identity of opposites (spherical surface — best representation).

In fact, philosophers and physicists, and mathematicians as well, have repeatedly faced the problem of change, and repeatedly failed to "bite the bullet" on the problem of the necessity for the identity of exact opposites. To quote Capek [6], "...the traditional distinction between succession and duration must be given up. Since the time of Heraclitus, philosophers who insist on the dynamic nature of reality struggle with the extreme difficulties of expressing in adequate linguistic form this paradoxical 'unity of opposites' which every temporal process realizes." And again: "Perhaps a more attentive analysis of concrete temporal wholes will yield a clue to the solution of the vexed antinomy of 'corpuscles versus waves' which contemporary physics faces and which the term 'complementarity' merely hides without removing. ...individuality and continuity do not appear antithetic and mutually exclusive; they become so only when we try to visualize them" [7]. These are just examples of what is a necessary and fundamental change to one of the basic laws of logic. This change is accomplished by stating a new principle, that of the boundary identity of exact opposites.

This new principle also clears up one of the vexing points in logic: the contradiction posed by statements such as "It is true that this statement is false" [8]. At the operational boundary between truth and falsity, it is perfectly possible for a statement to be both true and false, either true or false, and neither true nor false, all at one and the same time.

Although mathematicians have given up trying to define a point or the meaning of a concept such as "a point on a line," a point can be truly lengthless and a length can be comprised of points because the opposites "length" and "lengthless" are identical at their boundary. The identity of opposites removes this foundation difficulty in mathematics. Thus one can prove that two parallel lines meet if indefinitely extended, or do not meet if indefinitely extended, and both statements can be true. The idea of "indefinite extension" merely moves the problem to the boundary limit of "extension," therefore invoking the identity of exact opposites, "meet" and "do not meet."

At the operational boundary separating the idea of a wave (totally operational entity) and a corpuscle (totally nonoperational entity), that which is operational is identical to that which is nonoperational, so the 'vexed antinomy' referred to by Capek is resolved. And in fact the standard two-slit experiment using electrons shows precisely this effect. Subsequent to determination (observation, perception), the electron either presents a corpuscle or wavelike behavior, but not both. Perception separates the "wave/corpuscle" identity to either one or the other, because perception is a monocular, separating process. Before perception, this separation is not made, hence the electron is not constrained to act as a corpuscle. Photons exhibit the same characteristics, and indeed so do protons, neutrons, etc.

It can now be pointed out that, from the standpoint of perception, a boundary requires an operation, a change (actually an identity operation, a zeroing operation) and this is an operation upon perception itself, i.e., it is a perceived change. This now allows a fundamental solution to the age-old philosophical problem of change: Change itself always involves two opposites at once being identical, i.e., having no perceivable difference, thus constituting the "beginning" or the "ending" of perceptual separation (perceptual operation). Thus change is discrete. Perception operation (production, output by the perceiving operation) is bounded by identification of opposites (loss of differentiation, loss of separation). Change may now be precisely defined as the identity of two exact opposites, for such defines the operational change from the continuity of posit to the discontinuity of opposite, and vice versa.

As an example, examine the concept of a "mass change", i.e., of a "change to, of, or by a mass." Mass changes only by involving nonmass; e.g., time, length, or some other nonmass entity. All change involves such exact and simultaneous identity of contrasting opposites, and the "operation" of so identifying exact opposites is what creates the "boundary" between the opposites; i.e., it creates change itself. Hegel came very close with his discovery of dialectics, but failed to realize that he had uncovered the fundamental operation of perceived change and therefore perceived reality, not fundamental, ultimate, unperceived reality. Since only changes are perceived, then physical perception is a differentiating operation. Ergo physical phenomena (that which is perceived or "outputted by perception") are first derivatives of a more fundamental, or "ultimate," reality. Ultimate reality is unperceived (zero, void) since by definition the differentiating process of perception has not operated to output it. The physicist would do well to investigate and model the basic relationship between "virtual" and "observed", and the mathematician and logician would do well to investigate the deepest meaning of the zero concept.

Since the use of the "absolute value" concept is already understood in mathematics, it is quite useful to extend the concept more generally. Hence the absolute value of opposites can be assumed to define an operational boundary between the opposites such that the opposites coexist on the boundary and are identical on it.

For example, "two" is a remarkable concept: a two is a one-thing (unrepeated operation) which can also be causally ordered (time ordered or perceptually separated) into one-and-one (identically repeated operation). The identity of the one (unrepeated) and the one-and-one (repeated) opposites on the boundary between repeated and unrepeated operations establishes the concept two in perception. And thus it is with all numbers. The concept one (the basic perception, operation, or change), e.g., involves the identity of absolute continuity (within) and absolute discontinuity (without) on the operational boundary between continuity and discontinuity. It is the operation of "making opposites identical" (extinguishing perceptual output) that creates (causes perception of) a change (one, perception). It also is responsible for the creation of "inside" and "outside" in the first place, and making them available to perceptual operation for separation and monocular comparison.

Thus the principle of the boundary identity of exact opposites is proposed as a fundamental correction to the logic law $A \not\equiv \overline{A}$. With this principle, the age-old philosophical problem of change is solved [9].

NOTES AND REFERENCES

1. Hawton, Hector, Philosophy for Pleasure, Fawcett World Library, fifth printing, June 1970, pp. 21-24.

2. Parmenides, 504 B.C.

3. Hawton, op. cit., p. 24. But note that whether or not the making of something out of nothing is contradictory is "purely assumption."

4. Hegel, George Wilhelm Friedrich, German philosopher, 1770-1831.

5. For example, the state of being nonexistent is in fact being "not-being," which requires the "nonexistent" to be and not be at the same time, and leads to a logical contradiction according to classical logic. Another example of such a "flat contradiction" that is nonetheless "true" is the Heisenberg uncertainty principle. This principle states that it is one hundred percent certain that everything is uncertain, thus "contradicting" itself.

6. Capek, Milic, The Philosophical Impact of Contemporary Physics, D. Van Nostrand, 1961, p. 372.

7. Capek, op. cit., p. 374.

8. Or another example, "It is one hundred percent certain that everything is uncertain!" (Heisenberg uncertainty principle.)

9. The boundary identity of exact opposites is proposed therefore as a correction to Aristotle's law of the excluded middle.