THE LOGIC OF CHANGE

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Are we happy with the assertion A=A? To many the answer is obvious and it is an emphatic yes. The whole of western Aristotelian logic depends on this fact and even Buddhists, in general, would not find anything wrong with the answer. However, if one were to analyze the equation one comes across difficulties. When one states that A=A, one assumes that there exists an object (whether Mathematical, Physical, Biological, Social or otherwise) and that object is equal to itself, at least in a given interval of time. Now what happens if the object changes over a period of time? On the other hand this question itself is not quite correct as it is assumed that there is an object that changes. What does one mean when one says that an object changes?

Let us start with an object at a given time t. After a small interval of time do we have the same object or not? If we say that the object has changed are we in a position to say that we have the same object? The statement that an object has changed is meaningless in a way. Either the object remains the same or we have a different object now. (It is not my intention at this stage to go into an analysis of whether the observers (we in this case) remain the same as it complicates matters further.

When we say that an object changes with time (it has to be mentioned that the concept of time arises due to the so-called change of objects - for details please refer to *Mage Lokaya*"[1]- and that in Theravada Buddhism time is described as a "pannatti".in Attasalini [2]) it is assumed that there is something "behind" the object that does not change. A baby born into the world would grow up to become a young person and under "normal" circumstances would die after living as an elderly person. However it is generally believed that there is a person, ego, soul or whatever, behind this process and it is this person that has changed. Even in the case of a material object such as a chair it is assumed that there is a substantial chair that undergoes the changes associated with its decay. Thus it is believed there is an A that undergoes changes and that in spite of these changes it could be identified as A.

The systems of logic that the people have created over the years are nothing but abstractions of their experiences. They had experienced

objects remaining the same over a small interval of time (time being another concept created by people) and also material objects such as chairs that could be observed over a longer period of time and finally the conscious beings that they meet, like themselves, who have memories of being themselves. A=A is only an abstraction of the experience that these various types of objects could be identified as "themselves" over a short or long period of time. If A=B and B=C, then A=C is also an abstraction of day to day experience. If the length of one rod is equal to that of a second rod which in turn is equal to the length of a third rod then experience shows us that the length of the first rod is equal to that of the third rod. It is experience again that tells us that if A=B, then it is not correct to state that A `" B, and vice versa. All these and some other statements go into the formation of what is known as the Aristotelian logic.

It is clear that all these experiences are what could be called our Aristotelian –Newtonian –Einsteinian experiences. Newtonian Mechanics and Newtonian Physics are built on this experience of having objects that could change with time without creating "new" objects. An object or a particle at a given place at a given time would move to a different place at a different time, either under the action of a force or not, without itself changing. In Newtonian Mechanics even when the mass of the object changes it is considered as the same object as any student sitting for Higher Mathematics at the G. C. E. (A/L) examination would know.

However, the logic that is abstracted from Aristotelian - Newtonian - Einsteinian Experiences is not capable of dealing with change in general and motion in particular. It is demonstrated by the famous Zeno's paradox that deals with an arrow in motion. The Aristotelian logic is faced with contradictions when it is employed to describe motion and one would end up by showing that motion is impossible! The Calculus of Newton and Leibniz, though their approaches were not the same, tried to get over this difficulty using infinitesimals intuitively without formally defining them. However, infinitesimals were not liked by the western Mathematicians and Philosophers and there were objections to these "ghosts" by people such as Berkeley. Euler, one of the greatest western Mathematicians with an intuition that surpassed most of the others freely used infinitesimals in his formulation of Mathematical Analysis.

However, as the western Mathematicians did not like these infinitesimals that according to Berkeley were neither finite nor not finite, later Mathematicians Dedekind, Cantor and Cauchy "exorcised" infinitesimals from Mathematical Analysis and introduced what is known as the epsilon - delta definition of limit, which is based on Aristotelian logic. The calculus that tried to deviate from Aristotelian logic at the beginning was brought back to an "arithmetical" definition based on that logic in the nineteenth century. It is interesting to note that something similar is happening in Quantum Physics. Bohr (and in particular Heisenberg) who tried to deviate from the Classical Physics world view in the thirties created what is now known as the Copenhagen Interpretation of Quantum Physics. Copenhagen Interpretation was obviously not in agreement with Aristotelian logic and the tendency at present is to formulate a new interpretation based on Aristotelian logic and doing away with Heisenberg's uncertainty Principle. The western Sociologists and others who are talking of a Postmodern Condition[3] are only going behind Quantum Physics of the thirties to nineties without knowing the latest developments in the western interpretations of Quantum Physics.

What is clear from the above is that the westerners are glued to their Aristotelian- Newtonian – Einsteinian experiences and in spite of Leibniz, Euler, Bohr and others would try to reduce all experiences to the former. This does not mean that all our experiences have to be Aristotelian-Newtonian- Einsteinian and that we also should follow the west blindly in these matters. In the University of Kelaniya a small group of young men and not so young men in the Departments of Mathematics and Physics are looking into these problems from a different point of view. The group consciously deviates from the Aristotelian logic in the sense that it is considered to be a special case of a more general system of logic.

When the king Devanampiya Tissa answered Arhant Mahinda and said that he is neither a relative of himself nor non relative he had demonstrated that there was another system of logic that could include Aristotelian logic as a special case. According to Aristotelian logic one has to be either a relative or a non relative of oneself. However, the group at Kelaniya is more interested using another case of the logic that the king was using. This logic which is known as *Catuskoti*[4] or four fold logic has as its third case where an object could be equal to itself and not

equal to itself (at the same time). Symbolically it could be expressed as A=A and A'''A at the same time. Of course this leads to the question as to what is meant by time.

The case A=A and A'''A describes change. At any given time an object is both itself and something else. If it is the same, that is if A=A, then there is no change and as Zeno has demonstrated then there would be no motion. On the other hand if it is something else but not the same, that is if A'''A, then what we have is something else that has nothing to do with the original object. Thus for any kind of change, whether it is motion or just decay it is necessary to have both A=A and A'''A at the same time.

This is only an improvement of a definition of change as given by *Mahavihara Bhikkus* in the Anuradhapura period. As Prof. Y. Karunadasa[5] has shown the *Mahavihara Bhikkus* in the Theravada tradition changed the definition of change. The Kelaniya group sticking to the Theravada tradition as handed down by the *Vidyalankara Bhikkus* has only improved on the definition of change.

This definition has applications in Mathematical Analysis as well as in Quantum Physics[6]. A so called elementary particle in Physics for example would arise and decay in an instant or a moment. The particle decays giving rise to a new particle. As the particle decays it changes. The particle that decays is not the same as the particle that arises. The particle "lives" or exists as the particle that arose as well as the particle that decayed. The particle at this instant cannot be "grasped" by the mind as the former exists in the stage A=A as well as A'''A.

The case A=A and A'''A defies Aristotelian logic but then that logic is not capable of explaining change. The case neither A=A nor A'''A also has applications other than in the answer given by the king Devanampiya Tissa that he was neither his relative nor his non relative. *Anicca* considered as a concept and not as *anicca* in *anicca dukkha anatta*, could be formulated using the fourth case neither A=A nor A'''A in *Catuskoti*. The rationalist Buddhists of the western tradition who scoff at formulations such as neither you nor somebody else should not think that the whole world could be reduced to the two cases found in Aristotelian logic.

References:

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