Science and Research

By Professor Carlo Fonseka[1]

This article is based on a presentation by Carlo Fonseka at the NCAS "Workshop on Research Methodology and Thesis Writing" held at the NCAS Premises on 17th December 2007. Any kind of use of contents should be duly acknowledged.

As an introduction to this workshop on "Research Methodology and Thesis Writing" I have been asked to make a twenty-minute presentation on the subject of Science and Research. This is a tall order but it must be attempted. Let me begin by stating a banality. Like all living things, human beings endeavour to avoid suffering and to pursue happiness, as best they can. We try to do that on the basis of judgments we make about the nature of the world we live in. We make judgments about our physical environment, about our fellow-beings and about our own selves. These judgments are computations of our brains based on information about different aspects of the world obtained through our sense organs such as our eyes and ears.

Appearance & Reality

Our endeavour to avoid suffering and to pursue happiness will be successful to the extent that our judgments about the world correspond to the real nature of the world. These judgments are not always reliable because, apart from being prone to corrigible error, our brains are also susceptible to delusions, illusions and hallucinations. A delusion is a demonstrably false belief which is persisted in despite verifiable evidence to the contrary. Delusions are a well-known symptom of insanity. Illusions are false interpretations of some real objects or phenomena. A classic example is a mirage. Hallucinations are objectless sensations i.e. perceptions of non- existing things e.g. hearing voices when nobody is speaking and seeing visions which others cannot see. Hallucinations are usually evidence of mental disorder. Because humans have an insight into how their

[1] Carlo Fonseka is an Emeritus Professor of Physiology, University of Colombo, and the Acting Chairman of the NCAS Interim Council of Management

brains work, they have collectively discovered a method for minimizing error and thereby making their judgments about the world more reliable. That method is the method of science as a technique. As Karl Marx famously said, "All science would be superfluous if the outward appearance and the essence of things directly coincided". Judgements we make by scientific method constitute what we truly know about the world i.e. knowledge. In this view knowledge consists of judgments based on perceptions and verified by critically and rationally evaluated experience i.e. empirically verified.

Necessary & Sufficient

In such a context, a question immediately poses itself: What are the conditions that must be satisfied before one can validly claim to know something truly ? For example, that you know that somebody else's cigarette can kill you or that you know that there will be an insurrection in this country this year. To answer these questions we have to discuss however briefly the theory of knowledge, that is the branch of philosophy called *epistemology*. The question we have to address is this: What are the conditions that are necessary and sufficient for you to claim validly that you really know something? As philosopher A J Ayer has lucidly expounded in his book called *The Problem of Knowledge (1956),* three conditions must be satisfied.

First: what you claim to know must be true.
Second: you must be sure that it is true.
Third: you must have the right to be sure that it is true.

Research

Let it be said at once that research – more accurately, research using scientific methodology – is concerned with establishing your right to be sure that your claim to knowledge is a valid one. Let me illustrate the matter by taking a simple example. Suppose you say that you know that there is a mango tree in a certain garden in Mihintale. For you to claim that you really know that, first of all, there really must be a

mango tree in that garden. Though necessary, however, the fact that there is indeed a mango tree in that garden, is not sufficient to validate your claim to knowledge of it. If you had just guessed that there was a mango tree in that garden, and your guess had turned out to be true, you cannot claim to have really known it. It was just an instance of a guess which happened to be true. Such an instance does not constitute true knowledge. Therefore, in addition to the fact that there is a mango tree in that garden, another condition must be fulfilled to validate your claim to a definite piece of knowledge. That second condition is that you must be sure on the basis of some evidence that there is such a tree. For example, you should have seen it one or more times or seen a photograph of it. But even such subjective certainty that there is such a tree is not sufficient to validate your claim to true knowledge. Why not? Because like everybody else's brain, your brain too is subject to delusions, illusions and hallucinations. Therefore, a third condition must be satisfied before you can claim true knowledge that there is such a tree. That third condition is that you must have the *right to be sure*. As has been emphasised already, it is research using a particular methodology that will give you the right to be sure. The essence of the matter is that your claim must be based on evidence and that evidence must be verifiable by other competent observers. Why must this be so? Because what is not publicly checkable may become a matter of disagreement and whenever there is an irresolvable disagreement we reach a dead end.

Conclusion

So it comes about that the research on which you base your claim to a particular piece of knowledge must be made available to others for their critical scrutiny. There is a standard way in which claims to knowledge are made public. This takes the format of a scientific paper. A scientific paper has five parts.

1. Introduction - which serves to define the problem being researched, in the form of a testable hypothesis
2. Methodology - which describes the precise method that were used to conduct the research

3. Results - which represents the findings of the research
4. Analysis of results – by logical reasoning and if appropriate by the use of statistical techniques
5. Discussion - to establish your claim to knowledge

Summary

1. Humans endeavour to avoid suffering and to pursue happiness.
2. We are guided by our judgments about the nature of the world made in our brains of the basis of information obtained through our sense organs
3. We succeed in avoiding suffering and attaining happiness to the extent that our judgments about the world correspond to the real nature of the world.
4. Judgments based on our sensory perceptions are not always reliable because our brains are subject to delusions, illusions and hallucinations.
5. Because we have insight into how our brains work, the collective brain of humankind has invented scientific technique as the method of making our judgments more reliable.
6. "All science would be superfluous if the outward appearance and the essence of things directly coincided". (Karl Marx, Das Kapital, Vol III)
7. What are the conditions that are necessary and sufficient to establish a valid claim to knowledge?

   First: what you claim to know must be true.

   Second: you must be sure that it is true.

   Third: you must have the right to be sure that it is true.
8. Research using scientific methodology (empirical testing) is concerned with establishing the right to be sure.
9. Knowledge must be based on evidence which is publicly checkable.
10. Research must be published in a particular format easily remembered by the mnemonic "IMRAD'