Keynote Address

AMBIGUITY IN MEASUREMENT*

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This paper gives an overview of the role of ambiguity in measurement and explores analytical methods for exploring its impact. It is argued that certain functional forms are more resilient than others to problems of ambiguity, and that these should be preferred when ambiguity is a serious concern.

Introduction

The Sixth Biennial Conference of the International Society for Scientometrics and Informetrics (ISSI) marks the tenth anniversary of the series. Much has happened during this period, including the creation of the organization whose activities this Conference celebrates. These activities now cover a wide domain, both applied and theoretical. But underlying all of these, and unifying its content, is the primacy of measurement. The purpose of this paper is to reflect on an often overlooked quality permeating almost all of social measurement, ambiguity, and to comment on mechanisms that allow us to succeed in spite of its influence.

Ambiguity is inherent in human activity. Its existence is widely recognized, yet surprisingly little systematic attention has been given to exploring its consequences, or learning to proceed rationally in situations where it is present. Most likely this is because it is difficult to study ambiguity in a precise way: unlike other sources of error, the nature of ambiguity changes with context, and is difficult to formalize.

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Ambiguity is a type of error, whether in measurement or in communication. Contrast this with random error. Both are types of errors ubiquitous in measurement. But random error is of a type whose properties can be well characterized and which is shared by many phenomena. This led to the development of probability theory and statistics. But note that understanding the properties of random fluctuations doesn't teach us how to eliminate this source of error – rather it teaches us how to live with it: to understand its effects and to learn to control for it, to be able to make meaningful statements about content even when random error is present.

Nothing like this is true of ambiguity. Rather, as is typical when confronted with a problem one doesn't understand, one tends to deal with ambiguity by ignoring its existence and effects, in effect pretending it doesn't exist. But ignoring a problem is a dangerous mode of controlling for it. It has only convenience to recommend it. But without explicit study of this problem, no alternative exists.

Even to define ambiguity is difficult. To understand the nature of the problem, it is useful to compare the character of theory in the social sciences with that of the physical sciences, the prototype of successful scientific procedure.

The hallmark of the physical sciences is quantification: development of laws and regularities is expressed precisely in the language of mathematics. Thus, for a physicist, a ball doesn't simple fall, as it does for the rest of us; instead, the distance \( s \) it falls in time \( t \) follows the law \( s = gt^2/2 \). The difference is crucial: an erroneous law is much more likely to be exposed if it takes a quantified form than if it is expressed as a vague descriptive statement; thus if verified, we have more reason to be confident in the quantified version – it has passed a tougher test.

There are many attempts in the Social Sciences to make statements similar in form. There are, however, two critical differences:

- In physical theory, the concepts/variables are comparatively well understood. For example, there is no confusion (today) about what is meant by distance or time. In other areas, concepts such as pressure, temperature, energy, etc. are used. Each is the result of long efforts to understand some phenomenon in a precise way (one criterion of good understanding being that the relationship among the variables is describable in terms of the mathematical laws we now take for granted). In the Social Sciences, no such parallel development of basic concepts exist.

- In the physical sciences, the theory works. We can make predictions, sometimes of astonishing levels of precision, that hold within predictable degrees of error. In the Social Sciences, the degree of success is much more limited, with serious verification and probing often not even attempted.