PART IV

CONCLUDING REMARKS

CHAPTERS

Preliminary Remarks

It is the purpose of Part IV to present the contributions and conclusions of this dissertation. In addition recommendations for future research will be forwarded.

CHAPTER 13

CONTRIBUTIONS AND CONCLUSIONS

Sections

13.1 Introduction

This dissertation has accomplished its purpose. It has given causal statistics a philosophical and mathematical underpinning. In addition it has made potential contributions to the fields of philosophy, physics, and mathematics.

13.2 Philosophy of Causality

Chapter 4 concludes that the necessary and/or sufficient definitions of "cause"--given by various philosophers--are not adequate to denote our common use of the word. Two theoretical definitions are forwarded.

> Definition (4-1): X causes(P) Y, if and only if the behavior of X produces a force on Y, where X and Y are specific events or behaviors.

> Definition (4-2): X causes(P) Y, if and only if the behavior of X produces a force on Y, where X and Y are classes of events.

Definition (4-1) is an event definition of cause and Definition (4-2) is a "law" definition of cause.

In Chapter 5 it is shown--in conformity with Humes arguments--that we cannot be certain(100%) that any two objects are related causally. But it is also concluded that this does not destroy the usefulness of the concept of causality.

In Chapter 6 we concluded that Mill's Canons of Induction are a valuable causal inquiring system. But this system is far from perfect and it cannot prove causal connection, as Mill claimed it could.

13.3 Derivation of Causal Statistics

The derivation of Part III results in the universal model of causal statistics, equations (12-4). This model can serve as a template for describing the causal relationships among any number of macrovariables.

Other outcomes of the derivation are an axiom system and an assumption set, upon which causal statistics can be based. It is pointed out that these are not the only axioms and assumptions which could yield causal statistics; others are possible.

The derivation of causal statistics presented in Part III begins with the statement of two axiom systems which are identical in substance but different in form. The first--Axioms (7-1), (7-2), ..., (7-8)--is an intuitive axiom system, and the second--Axioms (7-1a), (7-2a), ..., (7-7a)--is a mathematical axiom system. The mathematical derivation proceeds from the second axiom system, but, to more clearly convey our basic cosmology, we will restate the intuitive axiom system.

Axiom (7-1): The operation of the universe is based on natural laws.

Axiom (7-2): The natural laws of the universe are microcausal laws.

Axiom (7-3): The natural laws of the universe are concerned only with relationships between adjacent and/or copositional fundamental variables.

Axiom (7-4): The natural laws of the universe are non-stochastic.

Axiom (7-5): There is no action (causation) at a distance in time and/or space.

Axiom (7-6): All microcausal impulses move at finite speeds.

Axiom (7-7): The natural laws of the universe are not functions of time and/or space and do not change over time and/or space.

Axiom (7-8): The natural laws of the universe operate identically between all fundamental objects. In other words, the natural properties of all fundamental objects are identical (see Subsection 7.2.3).

Some important, intuitive theorems resulting from these axioms are as follows:

Theorem (7-1): The value of a given fundamental variable is causally determined--in conformity with the natural laws of the universe--by
(a) values of relevant fundamental variables which are adjacent to the given variable in space <u>and</u> time,
(b) the initial state (i.e., its state in the previous (adjacent) instant of time) of the given variable, and,
(c) values of variables which are copositional (i.e., exist in the same object) with the given variable in time <u>and</u> space.

Theorem (7-2): All fundamental objects are of infinitesimal size.

These intuitive theorems have corresponding mathematical theorems.

These axioms and theorems form the foundations for a microcausal theory of the universe. This theory can causally explain all observed phenomena, even the apparently stochastic nature of quantum physics. One implication of the cosmology is the denial of the existence of free-will. Another implication is that nuclear physicists will not discover the fundamental objects of the universe because their sizes approach zero as a limit.

The major assumptions fundamental to causal statistics are as follows:

> Assumption (8-2): The configuration among the fundamental objects, on or adjacent to the connecting causal chains, is unchanged from run to run (i.e., it is the same on each run).
>
> Assumption (8-4): The immediately prior value of each relevant variable, along or adjacent to each causal chain, is the same on each run.
>
> Assumption (8-10): Any part of the behavior--of a variable adjacent to a causal chain--which is not ultimately caused by the value--after observation begins--of an exogenous variable (like $\emptyset_1$), is the same on each run.
>
> Assumption (10-4): The macrovariables, Z_i's, are defined such that the fundamental variables, Υ_{ij}'s, for all j, in the equations relating macrovariables are completely factorable in terms of (i.e., replaceable by) the Z_i's.
>
> Assumption (10-3): During each run the values of the fundamental variables composing Z_1 have a specific (i.e., unchanging, constant) mathematical relationship to each other.

Assumptions (8-2), (8-4), and (8-10) are necessary for our mathematical description of the universe in terms of discrete processes. Assumptions (10-4) and/or (10-3) are required before we can aggregate fundamental variables to form macrovariables.

The assumption set employed in the derivation of causal statistics makes it clear that the assumptions--upon which almost all applied mathematics is based--are extremely restrictive and, undoubtedly, not generally satisfied. It shows that the usually mathematical manipulations of both macrovariables and discrete variables are almost invariably not legitimate. The question which must be addressed in the future is, to what extent are the assumptions dissatisfied and what effect does this have on the accuracy of the results of our mathematical manipulations?

The axiom and assumption sets, taken together, are important for determining the applicability of causal statistics to specific situations and the generalizability of empirical results to new situations.

Note, the axiom and assumption sets employed in this dissertation are not the only ones consistent with observed phenomena. Therefore the conclusions arrived at are not presented as certainties, but simply as possibilities.

A by-product of the derivation in Chapter 10 is a general, mathematical theory of aggregation. Chapter 12 yields two by-products. One is a causal analysis of error. The other is the partitioning of the variables of the universe into classes, appropriate for the discussion of causal theories and causal statistics.