A Framework for the Development of a Theory of Financial Accounting

by

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DEPARTMENT OF COMMERCE
(formerly Department of Accountancy)

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A FRAMEWORK FOR THE DEVELOPMENT OF A THEORY OF FINANCIAL ACCOUNTING

I. INTRODUCTION

The present state of accounting theory: An observation

The literature of accounting discloses an impressive variety of interpretations as to how and what accounting reports should disclose; the ingenuity and vitality of opposing proponents of differing ideas, wherewith they debate their respective "theories", detracts little from the stimulation provided by the writings. In 1962, Goldberg suggested:

> there are signs of an awakening of interest by academic accountants (and some others) in the potential intellectual dignity of accounting as an area of study. But while there has been a great deal of talk about the need for and advantage of a comprehensive theory of accounting and the means of arriving at it, not much has been done by way of positive and convincing contributions to it.[1]

The last ten years have seen the "positive and convincing contributions" for which the above appealed.[2] Also in 1962, Hylton maintained that "our difficulty with present accounting theory lies not in the existing differences of opinion but in the lack of any sense of direction . . .".[3] While it is felt that the years 1955 to 1963 marked the era of deliberation of methodology in accounting theory and thus the relevance of the above statements at that time, the years succeeding have been marked by the development of alternative models implementing that methodology. Thus the "present difficulty" (in 1970) is that which Hylton brushed aside in 1962—the conflict between alternative accounting models. A new era of accounting research has arrived—the era of synthesis.

It appears to the writer that accounting theory has passed through four eras in its progressive development. Examination of these will suggest a fifth and final era and provide a necessary background for the contentions which follow:

1. Accounting *Antiquity* (from the times of Raugeo and Pacioli to the early twentieth century) was largely a-theoretic, the concern being with practices.

2. The *Age of Rationalization* (early twentieth century to the 1950s), of which Sprague (1907), Hatfield (1909), and Paton (1922) must be considered the forerunners, was characterized by a pragmatic methodology based on the notion of

discovering theory underlying practice—hence the endeavour to derive "generally-accepted accounting principles". It is studded with many prominent works which, although they must be considered classics in the literature, do not contribute to present-day thought.[4]

3. The *Age of Methodology* (1955–63) was devoted to the discovery of the logical errors of the rationalists and the recognition of accounting as a science; hence the demand for the derivation of a theory utilizing deductive or axiomatic methodology. Emphasis was placed on the derivation of accounting principles by a process of deduction from postulates which themselves are derived by induction from the environment.[5]

4. The last few years (1963–70) have witnessed the construction of alternative, often conflicting, accounting theories on the foundation provided by the methodologists.[6] This period may be called the *Age of Analysis and Construction.*

5. The fruit of such a period has led the writer to forecast a new age—the *Age of Synthesis*—into which accounting theorists must now enter.[7]

It is the relationship between the Age of Analysis and Construction and the Age of Synthesis which sets the stage for the present study. The profusion of alternative financial accounting models developed on the groundwork of the methodologists has provided the literature with a broad array of structural presentations of how and for what to account. However, while each model purports to have application to the decision problems with which accounting deals, the presumed aim of accounting theorists—that of obtaining *a* theory of accounting—has not been attained. In fact, although consistent (with a few irregularities in some cases) within their own assumptions, the models are greatly diverse and, in their essentials, irreconcilable. These observations find support in the following:

> The considerable volume of work on the subject of accounting theory during the last quarter of a century has born impressive fruit. By the early thirties, we had put historical cost as a basis of valuation on a sound logical foundation; since that time we have built and furnished the superstructure. However, we have also developed impressive arguments in support of numerous alternative bases of valuation, so the accountant today finds himself faced with a poverty of riches. He has many theories to choose among, but he finds the criteria or tools for choice inadequate.[8]

Hence we are faced with a number of mutually exclusive and opposing solutions to the central financial accounting problem of reporting enterprise (economic) performance. A sense of despair thus arises and it is felt that accounting theorists may enter, together with the practitioners into what may be called "The Dark Ages, of Accounting", typified by local squabbles, loss of sense of direction, suppression by authority (governmental domination of accounting principles?) and activity centred upon mere subsistence (more elegant activities vested in the "new disciplines"?)[9]

A proposal

An alternative and a solution exist: the theorist must move on from the Age of Analysis and Construction, where dispute and debate had their place, to the Age of Synthesis "where analytical and fact-finding developments are unified into broader, multi-dimensional theories"[10] by a process of reconciliation and integration.

The transition is basically a reorientation in approach—a change in the way of thinking. As Johnson, Kast, and Rosenzweig point out,[11] evidence is available that every field of human knowledge undergoes phases of analysis and development and phases of synthesis and integration alternately.[12] It would appear that accounting science also must enter into this latter phase if it is to attain adulthood as a field of enquiry.

The task at hand, then, for accounting theorists is the blending of the many one-dimensional accounting models developed during the Age of Analysis and Construction (together with others which may yet be developed) into a multi-dimensional, diversified theory of accounting which demands expression: such is the research proposal outlined here.

The study

The present study, however, does not aspire to such a high goal. Rather, the above proposal is set forth, not as the proposal for this specific work but rather to give it a sense of direction, a motivation.

Hence, what follows may be seen as a stepping-stone to the more ambitious research outlined above. It follows that whatever is presented here must be seen as incomplete and its conclusions very short of the solution to the dilemma described above; hopefully it will produce a pattern by which future research can be directed, and thus the ultimate goal of a systematic, unified theory capable of universal application will lie a step closer.

Four activities are evident within the process of synthesis: examination, criticism, reconciliation, and selection. Thesis and antithesis must first be examined to discover the existence of and reason for underlying differences and then all aspects of both must be subjected to critical evaluation, before reconciliation can be effected. Further, where reconciliation is impossible, selection, on the basis of certain critical decision criteria, must be made. The result is synthesis.

The present study fails to fulfil the broad research objective proposed because it is limited to the initial process, examination. Hence, no attempt is made to criticize alternative accounting models in order to develop criteria for selection. Such criticism is readily available in the literature of the Age of Analysis and Construction. Further, no attempt is made to reconcile those models. To put the matter a little differently, the present study makes no attempt to make any further contributions to accounting theory. The purpose is methodological—not substantive. While development of theory and the synthesis of theory is most important, it must be preceded by an examination of the nature of theory construction. The study thus attempts to lay the methodological foundation for synthesis of accounting theory by discovering the nature of things—the ontological questions—in accounting and the thought processes underlying the derivation of alternative accounting models. It is intended that such an examination will reveal the essence of the differences between accounting theories and provide a framework for accounting theory development which will be a basis for reconciliation in the Age of Synthesis.

One further point regarding a limitation of the study requires mention. Without entering into the definitional disputes as to what constitutes "accounting", the study is further restricted to a consideration of the area of financial accounting, and in particular to asset valuation and income determination models.[13]

The methodological framework

The basic premise upon which the study (and the methodological framework which it presents) rests, is that accounting is a process of providing *information.* Given this, a number of conclusions as to the accounting process are established.

In section 2, the nature of an information system is discovered, and in particular, the accounting, information-generating system is depicted and categorized into three problem areas—*construction, operationalization,* and *communication.* It is argued that accountants, as transmitters of information, bear a responsibility, not only for technical operations and communication of information, but also for the conceptualization of that which is to be transmitted, and it is the first of these three problem areas

which receives attention in this study. A vital role of the accountant is to discover what information inputs are relevant in a specific decision context. After some consideration of the thought patterns in theory construction, a methodological framework is presented for the derivation of accounting constructs—the information elements which are relevant to particular decisions.

The thought processes in theory construction are further developed in section 3. The process of construction is depicted as the mental development of initial perceptions of environmental observables. "Percepts", "concepts", and "constructs" are defined as progressive refinements of sensory experience. Constructs emerge as formal propositions in theory about the real world. Also, stress is placed upon the influence of perceptions of individuals as affected by past behavioural experiences in construct formulation. The section, which draws heavily on certain aspects of the literature of psychology and philosophy, derives some important conclusions for accounting synthesis.

Section 4 applies these epistemological conclusions to the area of financial accounting constructs. Two streams of accounting conceptualization are identified: "asset" constructs and "capital" constructs. The merging of these two streams derives analytically a further construct of wealth (and complementarily, income) which are the outputs of financial accounting models. The section describes the derivation of the two streams of constructs and demonstrates how each affect the wealth construct.

Constructs not only have a relationship with their environmental referents, but also among themselves. Section 5 attempts to map these relationships for accounting classificational purposes into a data pattern. A mathematical data matrix is evident and this provides a basis for the classification of accounting transactions. This section provides the link between accounting constructs and operations. Before constructs can be operationalized, it is necessary to determine the relationships between them and to structure them into classes. Such a structuring builds the accounting data framework.

While sections 2 to 5 are concerned with derivation of a framework of accounting constructs, section 6 is concerned with the second problem area designated above as that of operationalization of the structural framework. A number of processes whereby the data framework developed finds practical application are depicted so that theory and experience are married together. The third problem area—that of communication of the operationalized structure—is excluded from the scope of this work; however a short Epilogue is added to indicate the principles of communication theory which are important in providing the theoretical basis for this activity. Hence the whole accounting system is depicted.

Summary and conclusion are contained in section 7. The framework developed in this study is presented to the accounting researcher for use in the Age of Synthesis.

2. ONTOLOGICAL QUESTIONS IN ACCOUNTING

An appraisal of a particular field of knowledge and an examination of differences evident within that field of knowledge can only be carried out after the essence of things regarding the discipline is discovered. The common tool in logical analysis for this discovery is the method of abstraction. Such is the method adopted in this section to determine the nature of things in accounting.

The conceptual cornerstone: The objective of accounting

An accounting practitioner (and a methodologist!) in rejecting the circularity of the pragmatic approach to the development of accounting theory, has maintained that "the proper place to begin a study to establish a foundation for accounting is

with the reasons for having accounting"[14], and "the *cornerstone* of accounting must be a clear, comprehensive and accurate statement of the *purposes* and *objectives* of accounting"[15]. The "cornerstone" upon which this study (and indeed, the accounting discipline itself) rests is found in the objective or goal of accounting activity.

This sphere in which man finds himself is a world of humans possessing the basic characteristic of wants. These wants are both dynamic and unlimited, contrasted, however, with an environment of resources which are fixed and limited. All social activity, which is essentially an interplay between man and his environment, is directed towards the satisfaction of human wants by an acceptable,[16] not necessarily an economical, allocation of the limited resources. Thus all institutions and disciplines find their social legitimacy and purpose in the extent to which they provide uniquely some aspect of this process. It is held that the institution of accounting finds its unique role in the provision of information.

The environmental observation of contrasted unlimited wants and limited resources further lends itself to a deduction that individual or collective behaviour centres upon choice: decisions must be made. Observing man (the decision maker as regarding resource allocation) as a being bounded in rationality[17] and motivation for search for alternatives,[18] we conclude that "individual choice takes place in an environment of 'givens'— premises that are accepted by the subject as bases for his choice".[19] There therefore exists a want in man for information to increase his "environment of 'givens'" so he can effect his decision under reduced uncertainty.[20] Accounting provides a certain type of information for a certain type of decision.[21]

Hence the premise, stated in section 1, is reasserted as the basis of this study: *accounting is an information-generating process; a discipline with the prime objective of providing information.*[22, 23]

The measure, then, of the utility of the accounting process is the degree to which this social function within society is fulfilled, that is, the informational content of the output of that process. Hence we have a standard, expressed in terms of objectives —a necessary and fundamental tool in the examination of alternative models in the process of synthesis.

The information-generating process: A functional categorization

In utilizing deductive methodology in building a theory, it is necessary to distinguish between the postulatory *objectives*—the purpose, aim, or goal—and the *functions* of the system, constituted by activities to attain the postulated goals.[24] The objective, and hence the standard for evaluation of the accounting process, has been prescribed as the provision of information. What then are the functions employed to attain this objective of information output? Information theory, concerned with "the nature and derivation of information, its presentation and communication",[25] supplies the answer. As Holmes maintains, "the relationship between accounting and information science is that of part to whole. Accounting theory therefore should consist of general statements from appropriate areas of information science related to aspects of economic events".[26]

Figure 1 presents an expanded version of Shannon and Weaver's classical communication model,[27] over which have been superimposed the results of research into the literature of data theory, concept formation, and other aspects of the philosophy of science. This description of the accounting process categorizes three accounting functions.

Stage I— Construction. Basic to the provision of information is the derivation of a data element (the construct). A choice must be made as to what environmental stimuli (transactions) to transmit to the decision maker, demanding in turn, a theory for the solution of his decision problem. This stage must also be seen to include matters of *classification,* that is, the determination of relationships between stimuli.

Stage II—Operationalization. The *constructs* so derived from the possible range of environmental observables must, before they can have empirical relevance, be reduced to a number of technical operations of which scaling or measurement is a predominant feature. Such operations make the constructs informationally more valuable. The distinction between stage I and stage II is derived from that drawn in the philosophy of science between "constitutive" and "operational" definitions.[28]

Stage III—Communication. Finally, the operationalized construct must be communicated to the decision maker. This is essentially a problem of minimizing the number of "bits" of data per unit of channel capacity making due recognition of the need of redundancy to cope with problems of "noise" in the channel.

Stage I of the process is based upon the primary criterion in information theory that an information input to a decision must be *relevant* to that decision.[29] Stage II is further developed from other information qualities, some of which are technical operations and some of which are metaphysical constraints. Among these are quantifiability, objectivity, materiality, and additivity. The process, producing a communicated, operationalized construct, finds support in the following:

> Several characteristics or conditioning influences are of interest. First the products of accounting are statements; the theory of accounting will therefore concern itself with the conditions under which statements are interpretable—the problem of *communication.* Second, the products of accounting are quantitative statements; the theory of accounting will therefore concern itself with *measurement* procedures. And of course there must be a set of constructs related, however abstractly, to the recipients and subjects of statements and measurements.[30]

While Williams and Griffin refer to measurement, the writer prefers the wider designation of "operationalization" for other operations beside scaling procedures must be applied to a construct to give it empirical consequence.

The present study is concerned primarily with stage I of the process (covered in sections 2 to 5). A discussion of accounting operations is contained in section 6, but the topic of communication is placed outside the scope of this writing.[31] It is hoped, in particular, that the examination of the processes of construction will reveal the nature of differences between accounting models and hence pave the way for the Age of Synthesis. Therefore the main portion of the study is devoted to this aspect of the information-generating system.

Epistemological processes in accounting information processing

The importance of the construction stage (stage I) cannot be over-emphasized. Constructs (or concepts)[32] are the "foundation of all human communication and thought",[33] and "since . . . science requires a greater precision in communication, the process of conceptualization must be much more consciously a part of science than is the case for most commonsense and everyday concepts".[34] If accounting is to hold the rank of a science,[35] then "the thought processes inherent in creative development of accounting require definition: What are the thinking habits necessary for generating truly new ideas?"[36] Further, the construction of concepts—a language—is the first step in utilizing deductive methodology in scientific investigation.[37] This step is necessary, even before the statement of postulatory objectives and the postulates themselves.[38]

Again, in relation to the information-generating process depicted above, construction is seen as the prerequisite of measurement and other operators: "Measurement presupposes something to be measured, and, unless we know what that something is, no measurement can have any significance."[39] Hence, measures have to be "conceived and sought",[40] that is, "one has first a concept of some quality and looks afterwards for quantitative expressions of it".[41] This position is taken in opposition to the operationalists.

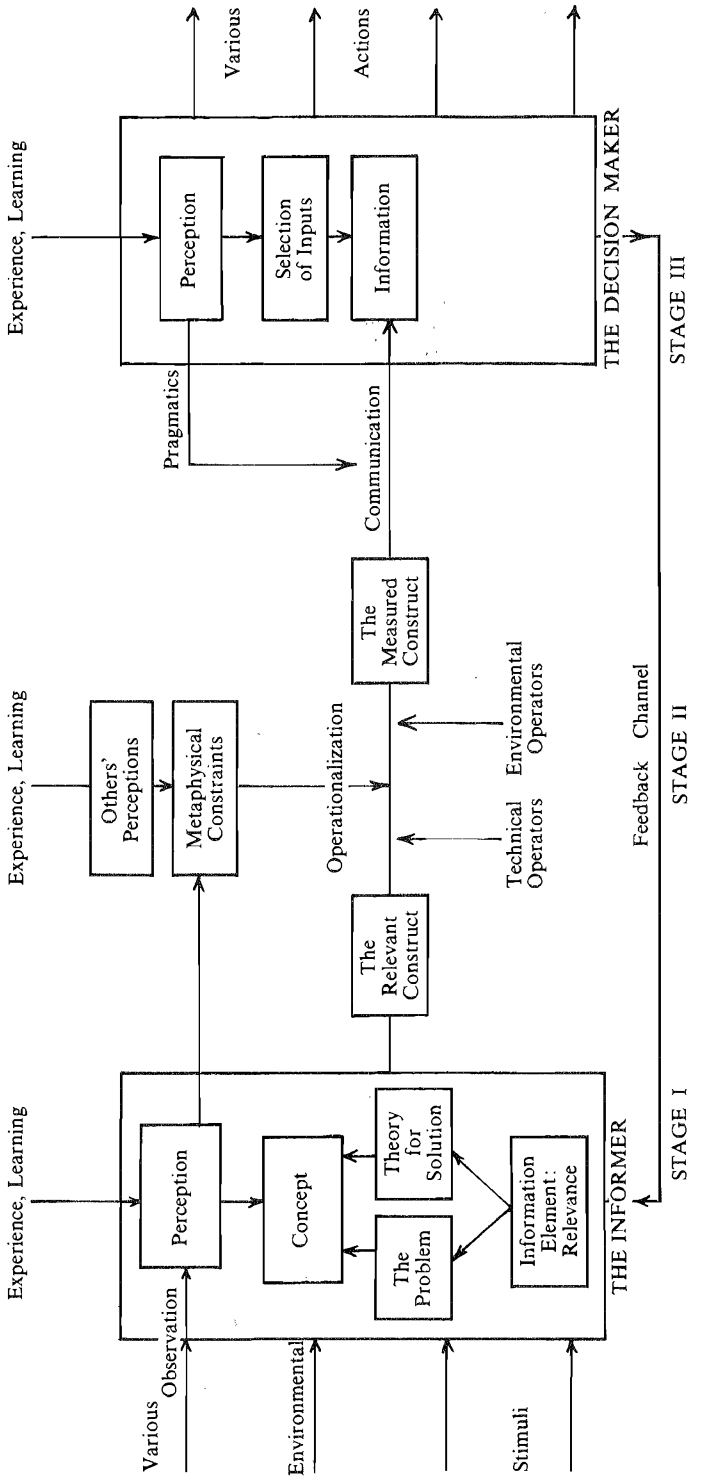

Fig. 1—The information-generating system

How, then, is a language of specialized concepts constructed? The literature classifies three areas of study:[42]

(*a*) *Syntactics*, concerning the relationships between signs. These relationships are developed on the basis of the central core of philosophical thought-logic principles found in mathematics and metaphysics which provide the rules for logical processes.

(*b*) *Semantics*, the problems of developing signs as representations of real world phenomena; and

(*c*) *Pragmatics*, which studies responses in individuals to signs communicated to them.

The present discussion is confined to the area of *semantics*, although the matter of syntactics must receive incidental mention. In the area of semantics, the scientific philosophers have again demanded four steps in setting up the set of signs, symbols, concepts, or propositions with which a field of inquiry is concerned.[43]

(*i*) The initial selection of a set of notions accepted as undefined to avoid circularity in definition. Examples of such *primitives* are "point" and "line" in plane geometry, and "debit" and "credit" in accounting.[44]

(*ii*) The derivation of concepts or propositions utilizing these primitives to explain real world events. Distinction must be drawn between those propositions which are derived by observation of the environment--the so-called empirical propositions, and those which are derived on an *a priori* basis by use of syntactical rules—the so-called analytic propositions.[45]

(*iii*) The verification of concepts thus developed in the real world.[46]

(*iv*) The expression of the verified concepts in the form of definitions to give them explicit meaning. Definitions may be classified as descriptive or stipulative,[47] real or nominal,[48] conceptual ("constitutive") or empirical ("operational").[49]

Again, the present study restricts itself to the examination of one only of these steps. The adoption of primitives is assumed and the verification of accounting concepts examined is deferred to later (empirical) research. The concern here is the investigation of the derivation of constructs. Further, no attempt will be made to suggest explicit definitions for the concepts reviewed. Nevertheless, it should be emphasized that all steps are necessary in the derivation of a language of accounting and thus this study must be seen as only a partial discussion of stage I.

Responsibility for the construction function

Before the process of construction is investigated, a word should be said regarding responsibility for the construction function. Who must determine the property to be measured? While some accounting theorists appear to dismiss such responsibility,[50] they do so in neglect of the principles of information and communication theory.

Consider figure 1. Responsibility for determining what is relevant for each decision can rest upon one of two people in the information-communication system: the transmitter (informer) or the receiver (decision maker). However, that onus can only be placed upon the latter if an efficient feedback channel exists between the two, that is, if the decision maker can communicate to the informer the particular information requirements for his various decisions. It is argued that the weakness of the feedback channel in the accounting context due to time lags and dispersion and remoteness of decision makers as well as the volume of noise in the channel, suggests that "the locus of the relevance criterion is at the transmission source".[51] This is further enforced by the logical circularity of the notion of feedback: feedback is a function of information received.

Accounting, then, is not only a measurement and communication discipline,[52] but also an explanatory one; an awesome responsibility rests upon the accountant to determine the properties to be measured and communicated. Hence "purposeful

theorizing or abstract analysis is part of the intellectual responsibility of the professional man".[53]

The theory of data

Information processing is basically a matter of selecting certain environmental sensations (or stimuli) and transmitting these to the decision maker.[54] The question posed above is: Which sensations in the construction stage does the accountant select and how does he view these? It is contended (and this will be demonstrated below) that the point of departure of alternative accounting models is caused by differing views as to what sensations are to be observed and thus what property is to be measured and communicated.

Clyde H. Coombs, in his impressive analysis of behavioural data,[55] has presented a framework for the construction of empirical propositions.[56] The process originates in the observation of environmental sensations and concludes with a chosen data matrix (model) to which are applied the principles of scaling theory. As depicted in figure 2, the process is divided into three phases:

Phase A. The scientist decides, firstly, what to observe;
Phase B. He then decides how to view the relationships between sensations—a classification problem,[57] and
Phase C. Given this basic classification, he detects the "relationships, order and structure which follow as a logical consequence of the data and the model used for analysis".[58]

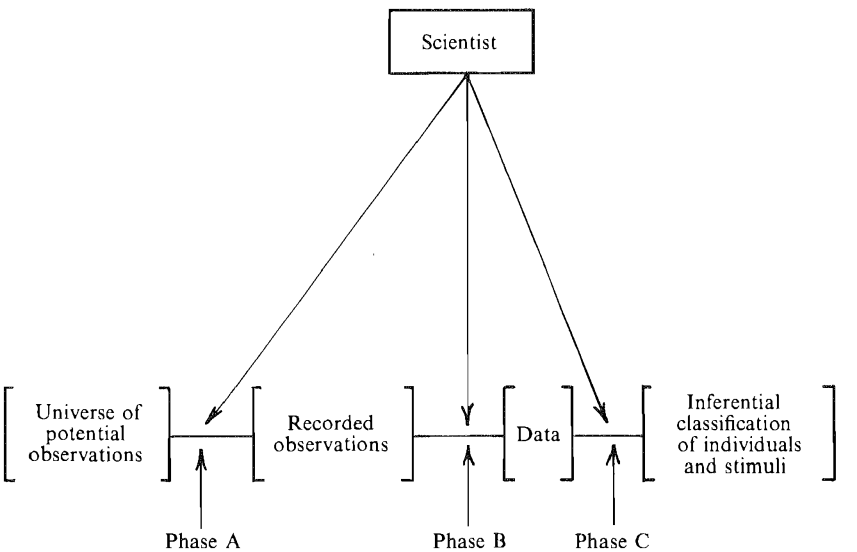

Fig. 2—Flow diagram from the real world to inferences
Source: Coombs, *Data*, p. 4.

The theory of data, then, is concerned with "the initial level (of theory) that provides the foundation for psychological measurement and scaling".[59] Interpreted within the context of the treatment of accounting data, the process of the construction stage (stage I) can be restated as follows:

Phase A. The accountant decides which sensations in the environment are relevant for the various purposes of decision makers.

Phase B. He then decides upon a classification of these observations in the form of logical or mathematical relationships.

Phase C. Finally, he builds the structure of his accounting model upon these basic relationships by uncovering further relationships to yield the final data models to which the principles of scaling theory may be applied.

Phase A, which may be called the *external construction* phase, concerns the external productivity of data—that is, the relationship of data to environmental phenomena. Phase B, which may be called the internal construction or *classification* phase, concerns the internal productivity of data—that is, the relationship of data elements amongst themselves. Phase C may be seen as a refinement of phase B—an expression of the further relationships contained in the fundamental mathematical or logical relationships in phase B.[60]

The identification of accounting as an *information*-processing activity, and the determination of the activities included in such a process, has been the subject of this section. Particular emphasis has been placed upon a discovery of the epistemological thought processes in deriving the subject with which accounting deals, that is, in producing a *construct* to be *operationalized* and *communicated.* The *theory of data* adopted provides the framework for the mental discipline of thought process in deriving that *construct.*

The section has no final conclusion of its own. Rather it provides the base for development in what follows. Extension of the framework of the theory of data into the accounting context will precipitate the ultimate and inevitable conclusions which themselves will, in turn, suggest a framework or pattern for synthesis.

3. CONSTRUCT FORMULATION

Phase A in the framework proposed for stage I of the information-generating system finds the scientist in the predicament of deciding upon what to observe. In the present context, this demands a decision by the accountant as to what element in the environment is relevant for decision makers in the context of their decisions. Given that this responsibility rests upon the accountant as demonstrated above,[61] this requirement means that he must develop a theory for the solution to each decision maker's problem with regard to each decision maker's goals. It is not proposed to discover those problems or goals here,[62] but rather to explain the thought processes in deriving the constructs to satisfy decision makers' problems and thus to provide the information inputs for the various decision models. This will provide the basis for an examination of the differences between constructs which have been proposed in the literature.

Perception, conception, and construction

The literature of accounting theory contains a confusing array of "concepts", "principles", "standards", "conventions", "procedures", and "rules" with which accounting is said to be preoccupied. However, no logical structure of such notions appears. In order to unify accounting theory into a logical framework, attention needs to be directed to methodology. This section investigates one concern of such a methodology—the matter of concept formulation. The processes by which (accounting) concepts are derived is not a simple one: "Establishing accounting concepts as a basis for logical development of accounting theory is, practically speaking, most difficult. The inductive process—surveying what is done in practice—cannot help us now, for the new concepts needed in accounting theory are hard to envision. They must be created or formulated."[63] How then, are (accounting) concepts formulated? Figure 3, which may be considered an enlargement of stage I in figure 1,[64] depicts the process.

The scientific philosophers have identified two ways of establishing the "givens" of the real world—the processes of theoretical abstraction and empirical experimentation.[65] While the conflict between the two schools of thought has at times been quite sharp,[66] it is generally felt amongst contemporary logicians that the methods are complementary:

> The entire history of scientific endeavour appears to show that in our world comprehensive, simple, and dependable principles for the explanation and prediction of observable phenomena cannot be obtained by merely summarizing and inductively generalizing observational findings [empirical experimentation]. A hypothetico-deductive-observational procedure [theoretical abstraction] is called for and is indeed followed in the more advanced branches of empirical sciences: guided by his knowledge of observational data the scientist has to invent a set of concepts—theoretical constructs, which lack immediate experimental significance . . .[67]

Devine lends support to this by maintaining that "scientific method is composed primarily of the interaction of deductive methods and the philosophical doctrine known as empiricism",[68] and quotes Bertrand Russell as saying "scientific method consists in inventing hypotheses which fit the data which are as simple as is compatible with this requirement, and which makes it possible to draw inferences subsequently confirmed by observation."[69] The process of verification is, of course, that which links the two approaches. Conclusions of the abstract analysis in the theory plane are validated by empirical investigation.

It is not the purpose of this writing to discover research procedures for the empirical appraoch.[70] Rather, the concentration is upon the abstract analysis in the derivation of constructs in the theory plane. However, it cannot be too strongly emphasized that what is discovered in the theory plane must be subject to empirical investigation if scientific reality is to be established.

Reference to figure 3 reveals, within the theory plane, three stages in the building of the notions with which a discipline deals: perceptual, conceptual, and constructual levels of development. The process can be seen as a continual refinement of initial observations of environmental stimuli. The observer firstly identifies the sensations as "crude ill-defined percepts as to the nature of things".[71] These exist in his mind only as a "logical haze"[72] and thus require further "explanation" to derive more ordered ideas of the environment. *Concepts* are thus derived and these are further explicated to present the formal propositions—the real world *constructs*.[73] The distinction between a concept and a construct is made clear by Caws when he says: "A concept deliberately changed or modified to provide a better interpretation of the sensed world I call a *construct*; and a scientific construct, in particular, is a concept deliberately modified or invented with a view to erecting or improving a theory."[74]

The derivation of constructs constitutes the semantic aspect in the establishment of a (scientific) meta-language; and the semantical "rules of correspondence", as Margenau calls them,[75] follow a horizontal pattern in figure 3. The vertical relationships—those among constructs—indicate the syntactical aspect of the process. However, the rules of syntax not only determine the relationships among constructs, but also allow the derivation of further propositions: "There are relations among constructs, formal relations, which we impose in building a science. These relations include the formal structure of the science: the definitions and deductive relations which enable us to pass from the existence of one situation to the necessary existence . . . of another."[76] These relations may be intuitive (at the conceptual level) or formal and deductive (at the constructual level). The further propositions derived lead to the distinction between empirical and analytical propositions made in the previous section,[77] and to the demand that theoretical constructs must satisfy two requirements: a metaphysical requirement of logical consistency and the empirical requirement of sensational isomorphism.[78]

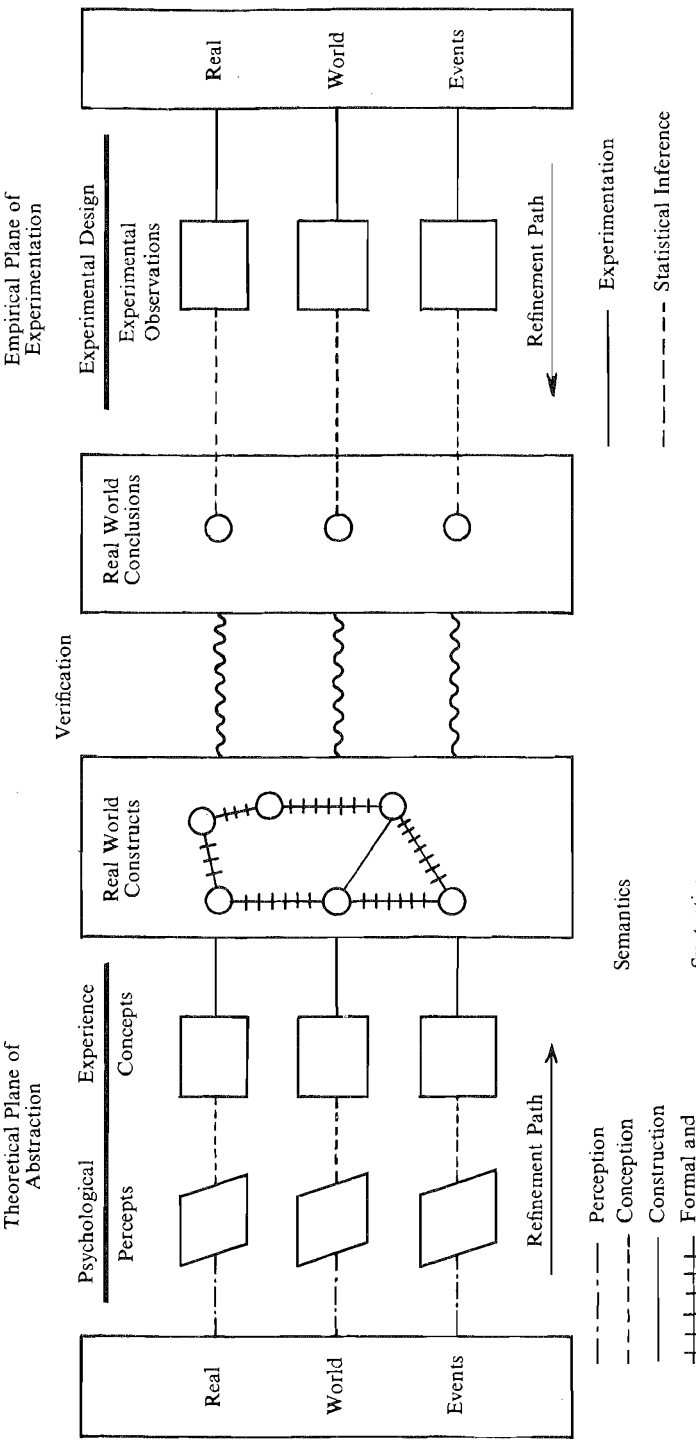

Fig. 3.—Discovery of the real world

Source: An adaptation and extension of a diagram presented by Kermit D. Larson, "Implications of Measurement Theory on Accounting Concept Formulation", *Accounting Review* 44 (January 1969): 41.

Sensory preconditioning

The above process is not an entirely objective one: "We do not have a simple event A causally connected with a simple event B, but the whole background of the system in which the events occur is included in the concept, and is a vital part of it."[79] The observer stands as a spectator of environmental events. The spectatorial doctrine of naive realism—a mechanistic view of the observer producing unbiased conclusions from the environment—has now been rejected by scientific philosophers[80] with the objection that "the knowing subject intrudes itself unpreventably into the objective scheme of things".[81] Hence the perceiver's own world—his psychological and sociological experience, producing as it does specific attitudes which, when organized, form a system of values and thus a frame of reference[82]—directly affects his interpretation of real world events. Thus "Carrying epistemological questions right into the heart of perception raises . . . the problem concerning the relations between the subject and the object during the development of perceptual processes."[83]

It is not the purpose here to discover the learning processes which produce the perceiver's frame of reference,[84] nor to discuss the interactions between the perceiver's world and sensory phenomena,[85] but rather simply to emphasize the necessity for the recognition of the governing notion in the process of construction—sensory preconditioning.[86] Constructs are "theory-laden"[87]—a joint product of past internal experience and present external experience.[88] The scientist can no longer talk of an objective theoretical construct developed according to a set of logical rules from the environment; such a proposition can only be interpreted in light of the perceiver's internal frame of reference.

For the researcher, several conclusions (and warnings) are evident from the above. Firstly, recognition of the relativity of constructs leaves no support for *solipsism*. Dogmatism and authoritarianism are notions which modern science has left behind. No longer can a "theory" as perceived by one person be maintained independently of the experiences of others. The experiences of others rank as verifacts of a researcher's own experience. The literature of accounting gives wide recognition to the detrimental effect to the development of accounting theory of doctrinal pronouncements and absolutism.[89] The survival of these ideas ensured the duration of the Age of Rationalism right up to 1960. However, while such obstacles have been recognized and have thus given motivation to the adoption of scientific method in the Age of Methodology, it is apparent that, as a result of the conflicting developments during the Age of Analysis and Construction and the attitudes of the architects of such developments, the new frustration, observed in section 1,[90] prevails. Unless solipsistic tendencies are abandoned, the Age of Synthesis cannot be entered.

A second conclusion identifies the essential reasons for variance among conflicting constructs in theory and thus provides a basis for synthesis. As the conceptual process is affected essentially only by two factors—the environmental sensation and the perceiver's internal experience—conflict in constructual developments can only occur either through the perception of different subjects or through perception of the same subject but obtaining a different construction of the universe through the interaction of the observers' psychological backgrounds. This conclusion is very relevant for the accounting theorist in the Age of Synthesis: the reason for the conflict among alternative accounting models is discovered. Either theorists are observing *different* decisions being made in the environment, and hence producing varying decision models for which are prescribed different informational inputs, or they are observing the *same* decision but the alternative information inputs prescribed are affected by each individual theorist's perceptions of that decision.

If the former conclusion is correct, synthesis involves empirical discovery of those decisions in each reporting environment and the presentation of multiple statements. If the latter is correct, that is, if it is concluded that different decision models are being prescribed because of differences in perception, the theorist is faced with the

agonizing task of "decentring himself from himself"[91] so that "the subject [the perceiver] manages to escape from factors which are called 'subjective' because they are deforming, and to adopt activities which are also called 'subjective' (but in another sense) because they are co-ordinating, and which allow him to achieve objectivity."[92] He must recognize that "to the extent that it [perception] attains the object [the informational construct] *here and now,* which is its original function, it runs the constant risk of deforming it."[93] Not only in himself should the theorist carry out such an introspective examination, but also make some attempt to understand the influences upon those of contrary opinion. This, however, presents obvious formidable problems and hence an alternative method of removing perceptive biases needs to be established so that synthesis can be obtained.

The need for empirical confirmation

Thus a final conclusion stems from the notion of preconditioning of sensory activity. If interpretation of a real world event is qualified by the perceiver's internal experience and hence a possibility of alternative constructions of that event exist, the further complementary process of scientific verification, depicted in figure 3, is demanded: "Processes of validation, when conjoined with the metaphysical requirements . . . create scientific knowledge. It is this . . . validation which removes from constructs the figmentary stigma which their epistemological genesis first attached to them."[94] Thus the process of empirical verification as pointed out above[95] serves as a furnace to remove the dross of preconditioning biases from theoretical conclusions; constructs—the conclusions of the theoretical plane of abstraction—become *verifacts* through application of experimental techniques to the real world in the empirical plane. Hence, scientific propositions—truths—upon which a theory and eventually practice are built, are established.

This conclusion has significance for the Age of Synthesis. It is the writer's "perception" that accounting science to date has largely been engaged in the theory plane—hence the alternative solutions to the accounting problem evident in the literature.[96] A vital step in the reconciliation of these alternative models is verification. So another voice is added here to the recurring pleas for empirical research in accounting.[97] All branches of modern science, it would appear, have undergone this transition from a strong emphasis on abstraction to a primary emphasis on empirical investigation. This new emphasis must be balanced, of course, by theoretical analysis to avoid the extremes of operationalism.[98]

The previous conclusion[99] suggested that, as a result of the conditioning influence of the perceiver's internal experience upon his interpretation of the environment, variance in the literature between accounting constructs was a result either of the observation of different decisions or the differing interpretation of the informational requirements for the same decision. Hence empirical research is recommended in two areas:

(*a*) The scientist must discover the decision(s) which users of accounting information make. Are these, for example, decisions to invest, decisions to adapt, or decisions in the appraisal of management or efficiency? This of course demands an analysis of goals.[100]

(*b*) Having discovered the decision(s), experiment needs to be conducted to ascertain the relevance of alternative information inputs in satisfying the decision criteria. This sweeps aside invalid interpretations as to the theory for the solution of the decision makers' problems and vindicates that theoretical construct relevant to the decision(s). The circuit from real world events, through theoretical abstraction and empirical verification back to real world events is thus completed and reality established.[101]

Beaver, Kennelly, and Voss lend support to this charter by also suggesting two directions for accounting research: "the first is to define the decision models (or processes) of potential users of accounting data . . . the second problem is even after the decision model is specified, it is not sufficient for determining which accounting measure produces the better decisions."[102]

For example, if by step *(a)* it is decided that the decision of the recipient of the output of the information process is to assess the stewardship of management, then step (*b*) may indicate (as a confirmation of a theoretical abstraction) that a statement of historical events may be the relevant input into the decision model.[103] The corresponding measure of this construct may be historical cost. Again, if the decision is established to be one of adaptation, the empirically-valid construct may be found to be "severable means in possession",[104] and the corresponding measure, current cash equivalent.

While the chief determinant in the theory plane is experience, that of the empirical plane is experimental design. Before engaging in research in the above two areas, the accounting scientist must firstly design his experiment. Hence a further requirement is placed upon the research before the empirical aspect of the synthetical process can be fulfilled. Experimental design is a frustrating process for the social scientist due to problems of remoteness, statistical error, unpredictable variables, experimental reproductibility, and inconsistency of human actions.[105] It is not therefore intended to tarry on this point here[106] except to emphasize its importance and influence upon empirical investigation.

The initial experience in the framework of the theory of data is the construction of the phenomena of the real world which are to be measured and communicated. This section has been an expansion of phase A of the data framework in stage I to describe the epistemological processes in deriving theoretical constructs. The abstractive levels of perception, conception, and construction have been identified as the progressions in sensory experience while the conditioning influence of the observer's past psychological experience has been stressed as a determining factor in the process. The conclusion drawn, in agreement with Coombs, is that "data is in part a product of the mind of the observer".[107]

This conclusion precipitates a number of further conclusions: firstly, independent tendencies must be resisted by accounting theorists; secondly, the discovery of the reason for variance among alternative accounting models provides a basis for synthesis; and thirdly, the need for empirical verification of the theoretically-derived constructs as an essential step in synthesis is emphasized and the main directions of such research are established.

4. ACCOUNTING CONSTRUCTS AND THEIR CORRESPONDING OBSERVABLES

Having discovered, in the previous section, the epistemological processes in the construction of real world events, it is now appropriate to turn specifically to investigate the constructs with which accounting deals. It would appear that no (logically) formal attempt has been made to discover explicitly the constructs which accountants operationalize and communicate: "It is no overstatement to say that the precise nature of 'things' measured in accounting has not been determined."[108]

Corresponding to the two common statements presented, financial accounting reporting has often been identified with two concepts—"financial position" and "periodic income". However such a classification of the observables with which accounting deals is confusing and misleading as the constructual basis of the information-generating system, for financial position and income are epistemologically one. Income cannot be perceived independently of financial position, and the reverse is true: income determination and asset valuation articulate because they are the operational expression of one construct. This shall be called the *wealth* construct.[109]

Financial position is wealth at a point of time; income is the increase in wealth over a period. Financial position and income are simply the application of the time factor in two different ways—respectively, the time factor is held as the constant at a point or for a period. It is possible that, for certain "purpose-orientated" reports, time be made the variable and welath the constant. [110] The distinction between the income statement and balance sheet then disappears. [111]

Financial accounting reports are, then, simply wealth models—the surrogates of certain real world events. Hence we discover the accounting construct which in the information-generating system is the foundation of accounting measurement and communication and which comprises the data in the theory of data framework in the accounting context. Section 3, in developing stage I, endeavoured to explain the processes of construction in phase A of the data framework; the present section seeks to analyse these processes in relation to the derivation of the accounting construct of wealth; and the following section will then apply phases B and C of the framework to the accounting context to complete stage I of the accounting information- generating system.

It is an assumption of this section that all financial accounting models are concerned with the representation of the environmental phenomenon of wealth in resources.[112] However, how the proponents of various accounting theories interpret this observable depends, as has been shown, on their interpretation of it in relation to decisions: "Accounting theorists have found it extremely difficult to come to a consensus concerning the best method of measuring the periodic income [wealth] of a firm. No one has been able to offer compelling evidence that his concept is superior to competing propositions."[113] Lack of forthcoming evidence can be attributed to the fact that lack of consensus is a result of the observation of different decisions or the effect of the interaction, in the perceptive process, of each theorist's internal psychological experience.

Two streams of accounting conceptualization

In order to investigate the variances in wealth models and thus discover the effect of internal experience upon each model, it is necessary to decompose the wealth (income) construct into its significant semantical elements. It will be shown that wealth (income) is a construct derived deductively from two other constructs which have a direct semantical relationship with the environmental sensations which they represent. [114] Only by reference to semantical constructs and their corresponding observables can the real nature of the wealth (income) construct be determined.

Figure 4, which is a simplified form of the theory plane in figure 3 as applied to accounting theory abstraction, demonstrates the building of the wealth (income) construct. The diagram is necessarily crude at this stage but will be developed later to correspond more exactly to figure 3.[115]

The semantical concepts[116] are identified as:

1. The asset concept, and
2. The capital concept.[117]

Wealth (and thus income) is a construct analytically derived from two more elementary concepts—the concept of an asset and the concept of capital. Unlike wealth and income, these concepts have a direct relationship with the environment (perception field or P-field) and correspond, in the diagram, to the environmental sensations, P_1 and P_2 respectively. These sensations observed at the perception line are respectively identified as "resources" and "investment".[118] Wealth and increases in wealth are determined by resources held, but can only have meaning when related to a particluar investment in those assets. Operationally, and more familiarly stated, wealth and income are a result of a net asset valuation and application of an index which results from a capital maintenance rule.

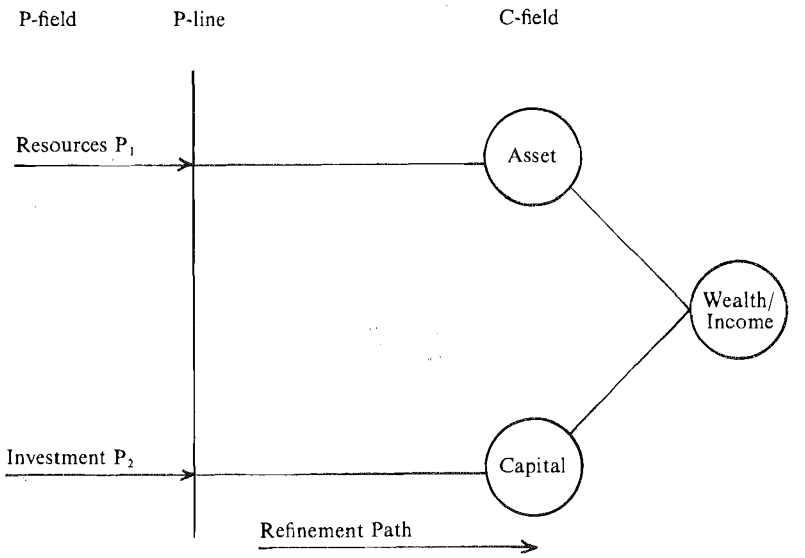

Fig. 4.—Derivation of wealth/income construct

It has been postulated that the architects of divergent financial accounting models are beholding the same environmental observables. The observables have been established as resources and investment and these give rise to an asset and a capital concept. Also, from the analysis in the previous section, it has been concluded that the differences in wealth and income constructs result from different interpretations of these observables in relation to the decisions being made by the recipient of information. This interpretation of decision variables which affects the choice of the information input can be attributed to one of two causes: either theorists are viewing different decisions, or the effect of the observer's value frame of reference preconditions his construction of the decision environment. We come to the conclusion, then, that there is not *one* asset concept or *one* capital concept, but rather a stream of asset concepts and a stream of capital concepts. Two streams merge to form the multiplicity of income concepts apparent in the literature today. Although taking a different line from the present study, Bedford maintains that "income is not a single concept at all, but a family of concepts",[119] and as long ago as 1938, it was maintained that "the abstraction 'income' . . . acquires meaning only in a particular setting in connection with a particular purpose."[120]

An observer's internal experience affects his perception (and hence concept) of assets and capital.[121] It is appropriate now to tabulate the various asset and capital constructs presented in the literature. This is merely a matter of collation, but is an obviously necessary step in synthesis. Having collected together the various constructions in the theory plane, understanding the reason for their differences, and submitting them to the empirical verification process, synthesis can be effected.

Asset constructs

A construct is merely a refinement of a concept. While theorists all appear to recognize the concept of an asset as related to resources, in their refinement of that general concept to obtain the accounting construct relevant to particular decisions, they follow different deductive paths. Figure 5, a more sophisticated diagram than figure 4, demonstrates the progressive refinement of the P_1 sensation to ultimately derive asset constructs.

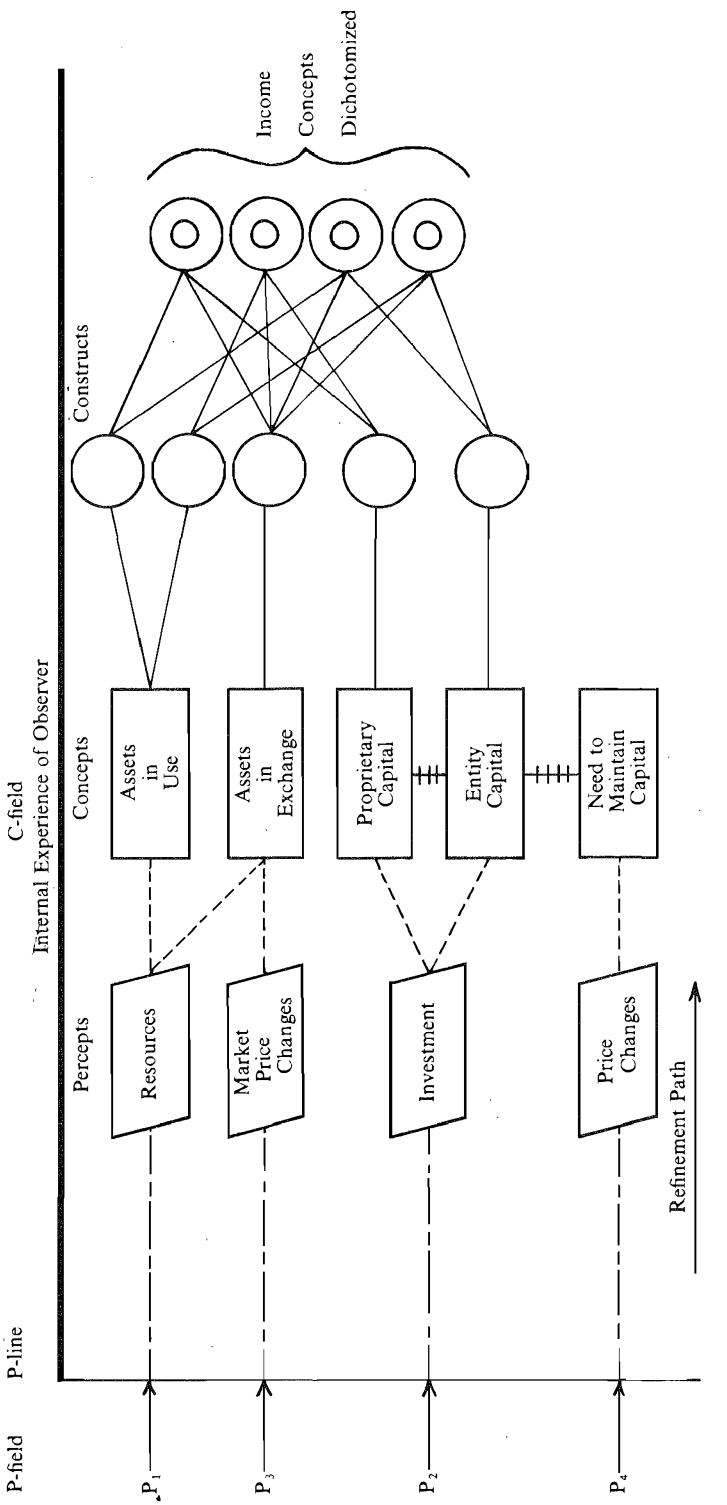

Fig. 5.—Alternative asset construction experiences in the theory plane

The figure indicates an agreement among theorists at the perceptual level that the P_1 sensation is a resource—a vague recognition that there is something of value, usefulness, or worth in relation to decision makers' goals. At the more explicit conceptual level, however, a divergence appears. Two concepts of a resource—an asset—appear. A distinction has been drawn in economics between value in use and value in exchange: "We are therefore forced to recognize two distinct though related major concepts of property value [wealth], the one referring to sale price, the other referring to value [wealth] to a specific owner or group of owners."[122] Resources possess wealth in two dimensions: an asset is of worth to its holder because of the services it provides in attaining his goals, and also because it has a value in the market in exchange. In other words, a resource contains wealth to its possessor because he can hold it during times of changing market prices and thus perceive holding gains (or losses) and he can also use it in relation to his goals in operations to increase wealth through economic activity. This division produces two streams of asset conceptualization:

1. Concepts of assets in terms of use. These shall be called "assets-in-use".
2. Concepts of assets in terms of market position. These shall be called "assets-in-exchange".

These two conceptual streams, like the independent streams of asset and capital concepts, are not, as will be shown, incompatible: they can be employed together in deriving the final wealth or income construct. It will be shown that the asset-in-use construct is the determinant of *total* period income; the asset-in-exchange construct merely dichotomizes that income into two sub-concepts of income, one attributable to the increase in wealth as a result of *holding* the asset in times of changing market prices.[123]

Asset constructs in terms of use

The first stream of asset conceptualization perceives and conceives resources in terms of their efficacy in satisfying the goals of decision problems—that is, in terms of their utility to their possessor in obtaining his ends. As those ends (or possibly, those perceived ends) differ, a number of alternative asset constructs at the formal constructual level appear to produce the flow of the asset-in-use stream.

A number of asset-in-use constructs have appeared in the accounting literature. In keeping with the methodological rather than substantive emphasis of this study, it is not intended to analyse these critically.[124] It is proposed merely to tabulate the alternative constructs and to re-emphasize the point made in the previous section[125] that the essential differences between them arise either from the observation of different decisions *or* from the various conditioning influences of theorists' internal reference frames in their sensory activity. A summary of the asset-in-use constructs appearing in the accounting literature, together with a list of their chief proponents, is presented to the accounting researcher in table 1 for the refining, empirical investigation process described previously.[126]

Asset constructs in terms of exchange

The second stream of asset conceptualization arises from the conception that resources have wealth in relation to exchange in the market. This is depicted by the P_3 sensation in figure 5. Market wealth is the product of three price dimensions:[127]

1. Price in terms of the form of the item valued. Three broad forms and thus three form prices can be distinguished:

(*a*) The present form price—the market price of the item in its present physical state.

(*b*) The initial form price—the market price of the economic inputs to bring it to its present state.

(*c*) The ultimate form price—the market price of the item on completion of the productive process (less market price of further inputs necessary for completion). The ultimate form of all assets are economic services.

TABLE 1
Asset-in-use constructs in the accounting literature

Asset-in-Use Construct	*Proponent*
Historical record of price aggregates	Paton and Littleton[a]
Revenue charges in suspense	Paton and Littleton[b]
	AAA 1936 Statement[c]
Economic value acquired in past	Paton and Littleton[d]
	AAA 1948 Statement[e]
Economic value sacrificed in past	AAA 1941 Statement[f]
Historical record in current terms	Mathews[g]
Sacrifice in acquiring service-potentials ("opportunity value", "value to owner")	Wright[h] and Solomons[i]
Economic power in the market	Philips[j]
Severable means legally possessed	Chambers[k]
Service-potentials (future economic benefits)	Sundry[l]

[a] Paton and Littleton, *Accounting Standards*, p.25.
[b] Ibid.
[c] Executive Committee of the American Accounting Association, "A Tentative Statement of Accounting Principles Underlying Corporate Financial Statements," in *Accounting and Reporting Standards for Corporate Financial Statements and Preceding Statements and Supplements* (Iowa City, Iowa: American Accounting Association, n.d.), p. 61.
[d] Paton and Littleton, *Accounting Standards*, p. 26.
[e] Executive Committee of the American Accounting Association, "Accounting Concepts and Standards Underlying Corporate Financial Statements, 1948 Revision," in *Accounting and Reporting Standards for Corporate Financial Statements and Preceding Statements and Supplements* (Iowa City, Iowa: American Accounting Association, n.d.),p. 14.
[f] Executive Committee of the American Accounting Association, "Accounting Principles Underlying Corporate Financial Statements," in *Accounting and Reporting Standards for Corporate Financial Statements and Preceding Statements and Supplements* (Iowa City, Iowa: American Accounting Association n.d.), p. 53.
[g] Russell Mathews, *Accounting for Economists* (Melbourne: F. W. Cheshire, 1962), pp. 142–50, and Russell Mathews, "Income, Price Changes and the Valuation Controversy in Accounting", *Accounting Review* 43 (July 1968): 509–16.
[h] F. Kenneth Wright, "Towards a General Theory of Depreciation", *Journal of Accounting Research* 2 (Spring 1964): 80–90, and F. Kenneth Wright, "Capacity for Adaptation and the Asset Measurement Problem", *Abacus* 3 (August 1967): 74–79.
[i] David Solomons, "Economic and Accounting Concepts of Cost and Value", in *Modern Accounting Theory*, ed. Morton Backer (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1966), pp. 117–27.
[j] G. Edward Philips, "The Revolution in Accounting Theory", *Accounting Review* 38 (October 1963): 696–708, and G. Edward Philips, "The Accretion Concept of Income", *Accounting Review* 38 (January 1963): 14–25.
[k] Chambers, *Economic Behavior*, p. 103.
[l] This construct appears frequently in the literature. See Penman, "Net Asset Value", pp. 335–36, for a short coverage of its development.

2. Price in terms of a time point. Market prices can be:
(*a*) Past prices;
(*b*) Current prices; or
(*c*) Future prices.

3. Price in terms of the market from which it is extracted. Two markets are evident, yielding:
(*a*) Entry (or buying) prices; and
(*b*) Exit (or selling) prices.

The combination of the above dimensions gives the 3 × 6 market value matrix presented in table 2. The combination of three form prices, three time prices, and two market direction prices as inputs to the table, provides eighteen possible market value outputs and hence eighteen possible asset-in-exchange constructs. However, quite a number of these are considered irrelevant, leaving eight pssible asset-in-exchange constructs.

TABLE 2
The market value matrix

Value date, market \ Form of Asset	Initial inputs	Present form	Ultimate form
Past, entry			
Past, exit			
Current, entry	current costs	present costs	
Current, exit		opportunity costs	current values
Future, entry	possible replacement costs	possible replacement costs	
Future, exit		possible selling values	expected values

Source: Edgar O. Edwards and Philip Bell, *The Theory and Measurement of Business Income* (Berkeley: University of California Press, 1961). Shaded areas indicate that the market value is irrelevant as a basis for an asset construct.

Hence we have two streams of asset constructs—asset-in-use constructs and asset-in-exchange constructs; and these two streams together determine the composition of the wealth (income) construct as will be seen later. The emphasis at this stage is on stressing a number of points in order that the reader may understand clearly the differences between the two streams.

The first point is a re-emphasis of the contention that the two streams arise because of the perception of assets in the two different ways described. The asset-in-use constructs are a result of perceiving assets in relation to holding them to attain goals. The asset-in-exchange constructs are a result of holding resources in times of changing market prices. While an asset may be perceived according (say) to its value of service-potentials, its value for adaptation, or its "opportunity value", it also can be seen as having a value in exchange. The increase or decrease in this exchange value can give rise to a perceived increase or decrease in wealth which has come to be referred to as a holding gain or loss.[128] Worked examples are given in the Appendix to indicate operationally the working of this dual classification of asset constructs and the calculation of holding gains and losses. These examples utilize certain asset-in-use and asset-in-exchange constructs. However, similar examples could be given using alternative combinations. For example, the asset-in-use construct of economic value sacrificed in the past could be used with the current cost, asset-in-exchange construct to give Edwards and Bell's "business profit" construct.[129] Wright appears to replace the current cost asset-in-exchange construct with present costs,[130] and also advocates "opportunity value" as the asset-in-use construct.[131]

Much confusion is apparent in the literature in not drawing the distinction between the two sets of constructs. Both the Committee on Concepts and Standards—

Inventory Measurement[132] and the Committee on Concepts and Standards—Long-Lived Assets[133] held, in agreement with the 1957 Committee, that assets are "aggregates of service-potentials available for or beneficial to expected operations".[134] Because of measurement problems, however, they suggest the use of current replacement cost as an approximation and add as support the requirement of recognizing holding gains and losses. This is confused reasoning, as service-potential is an asset-in-use construct and holding gains and losses are produced by the recognition of an asset-in-exchange construct. It has been demonstrated above from epistemological considerations that holding gains and losses can be recognized with any asset-in-use construct—not necessarily that expressed by current replacement cost. Further, these gains and losses can be recognized with other asset-in-exchange constructs than current costs. Sprouse and Moonitz's discussion on holding gains and losses in conjunction with current costs suggests the same error.[135] In their respective critiques of Edwards and Bell's contribution, Dickens and Blackburn[136] and Lemke[137] make the charge that, in recognizing holding gains and losses through the adoption of current costs, a departure has been made from the ideal of the economic service-potentials construct. As the Appendix illustrates, both current costs and service-potential constructs can be used together as they are constructs in two separate asset valuation streams. Perhaps this confusion can indeed be attributed to the haziness of the Edwards and Bell thesis on this matter. They fail to point out that the shift from "subjective value" to "current costs" to recognize holding gains and losses is, in fact, a shift from an asset-in-use construct to an asset-in-exchange construct. At their conclusion one is left with some doubt as to what is the asset-in-use construct in their "realizable profit" and "business profit". In the latter, it appears to be the traditional "historic cost concept". They could argue that they are neutral in the matter.

A second point that requires emphasis at this stage is one which follows from the first. Recognizing the asset-in-exchange construct must not be confused with the adoption of purchasing power in the market as an asset-in-use construct. Philips advocates as his asset-in-use construct, economic power in the market: "The value of an asset depends not only upon the future economic services they are capable of rendering but also upon the market's expectation of these services and the market's interest rate".[138]

However, although silent on the matter, he could adopt any one of the asset-in-exchange constructs as well in order to dichotomize his income.

A final point closes this section on asset constructs. As has been repeatedly emphasized, the building of constructs is a matter of perception. Perhaps due to internal psychological influences which produce a "blind spot", many theorists do not perceive the second stream of asset constructs and thus holding gains and losses are not recognized. The contribution, in this case, of the asset stream of conceptualization to income determination is simply the wealth in asset-in-use constructs.

Capital constructs

The second semantical component of the wealth construct is the capital construct. Figure 6 depicts the refinement path to produce capital constructs. The initial perception of the P_2 sensation is that of investment in resources. The observer-theorist perceives not only resources, but a claim to resources by virtue of investment in those resources. At the conceptual level this claim is further interpreted and imputed to specific persons or groups and finally a stream of capital constructs emerges. While it is recognized that there exists an infinite number of concepts of capital because each investor has different consumer patterns, two broad streams of capital conceptualization are proposed in the literature. These have been called "proprietary theory" and "entity theory",[139] designations which, though rather loose, are acceptable at the conceptual level. The former perceives investment from the viewpoint

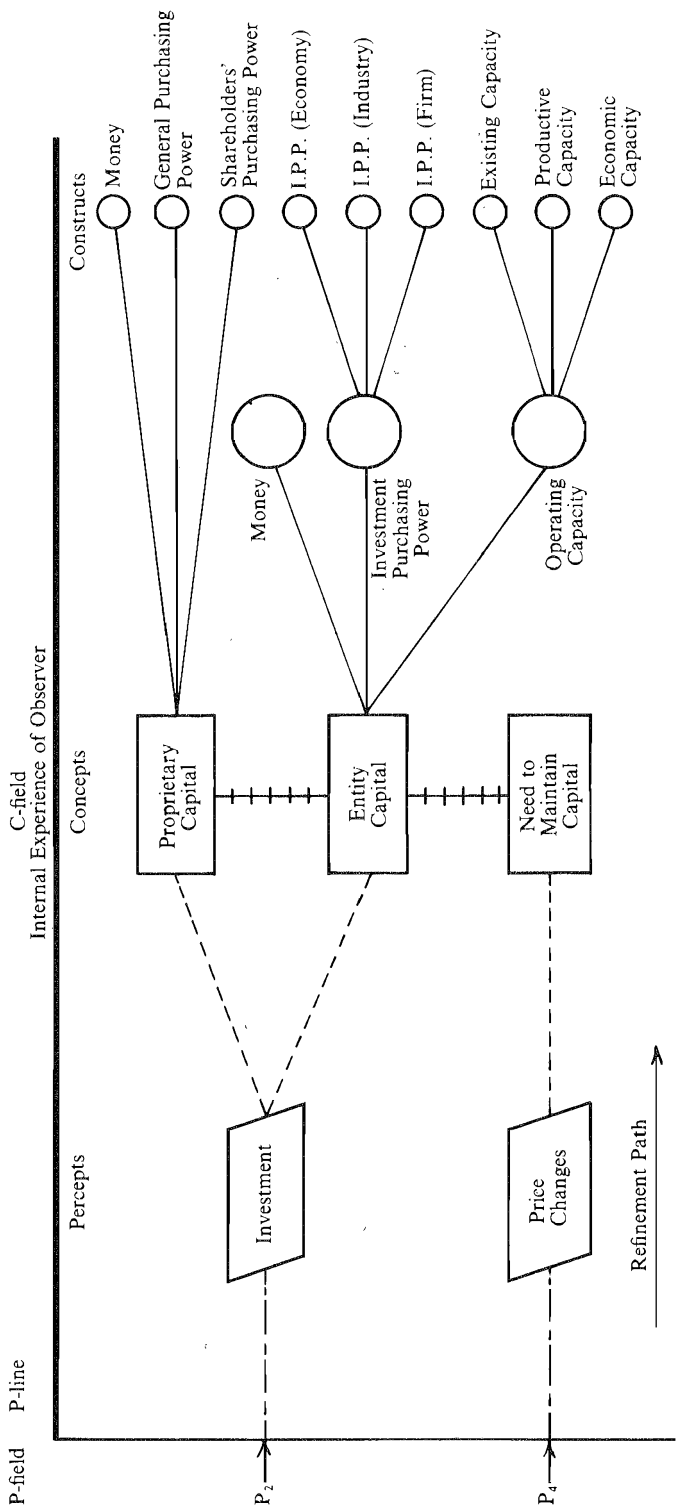

Fig. 6.—Alternative capital construction experiences in the theory plane

of the outside investors in a collection of assets or some classified group of such investors, while the latter perceives investment from the viewpoint of the "entity" which those assets comprise.[140]

A further refinement of the proprietary and entity concepts produces two streams of capital constructs. Those which have been put forward in the literature are incorporated in figure 6. As shown in the figure, these emerge deductively from the capital concept and from the recognition of another environmental phenomenon, P_4, which is perceived as changes in prices of commodities on which the "investor" spends his wealth. The P_4 phenomenon obviously affects the wealth in investment.[141] The money construct of capital caters for those who do not perceive price-level changes in the environment as being relevant for capital maintenance purposes.[142]

As with asset constructs, the reasons for existence of alternative constructs can be attributed to the effect of each theorist's internal frame of reference on his observational experience.[143] Unlike the two streams of asset constructs, the two streams of capital constructs are in conflict and cannot be employed together.

Income: An analytically-derived construct

The two streams of accounting conceptualization—the asset constructs and the capital constructs—determine the construct of wealth and hence income. Income is not a construct which bears a direct relationship with environmental phenomena—that is, an empirical proposition—but rather one derived from two other semantical constructs by logical, syntactical rules—that is, it is an analytical construct.

The definition of income as a syntactical proposition is traditionally attributed to Hicks: "It would seem that we ought to define a man's income as the maximum value [wealth] which he can consume in a week and still expect to be as well off at the end of the week as he was at the beginning".[144] There appears to be wide agreement with, and acceptance of, this definition,[145] but in giving it semantical correspondence with environmental phenomena—that is, in deriving a construct of "well-offness"—much conflict is evident. This depends on the asset and capital construct adopted. The problem of deriving an income construct is not a deductive one, but rather an inductive one. The purpose of this section has been to decompose the income and wealth construct into its semantical components. The combination of the asset construct and the capital construct as developed by the theorist from his observations of the environment as affected by his internal experience, deductively derives the income or wealth construct as depicted in figure 7. Because of the number of possible constructs, the diagram is restricted to a consideration of only two asset-in-use constructs, one asset-in-exchange construct, and two capital constructs, yielding a 2×2 income matrix or four income constructs. Table 3, which is a combination of table 1 and figure 6, depicts in summarized form all possible income constructs from the asset and capital constructs discovered in the literature.

Hicks defined income logically as increase in "well-offness"; we go a little further here to define income, again only as a syntactical rule, as the scalar of two vectors, assets and capital. *Wealth is assets as interpreted from a viewpoint as to claims to those assets. Income is the increase in that wealth over a period where time is held constant.* However, no general empirical construct of income can be stated for the epistemological reasons stated above.

The effect of each empirical construct on the income construct

An examination of the independent effect of the asset-in-use construct, the asset-in-exchange construct, and the capital construct upon the income construct will further clarify these relationships and provide an overall mathematical framework for income determination.

Shwayder has summarized the effect of the capital construct upon income. He shows that, given a particular set of operating facts, the capital construct:

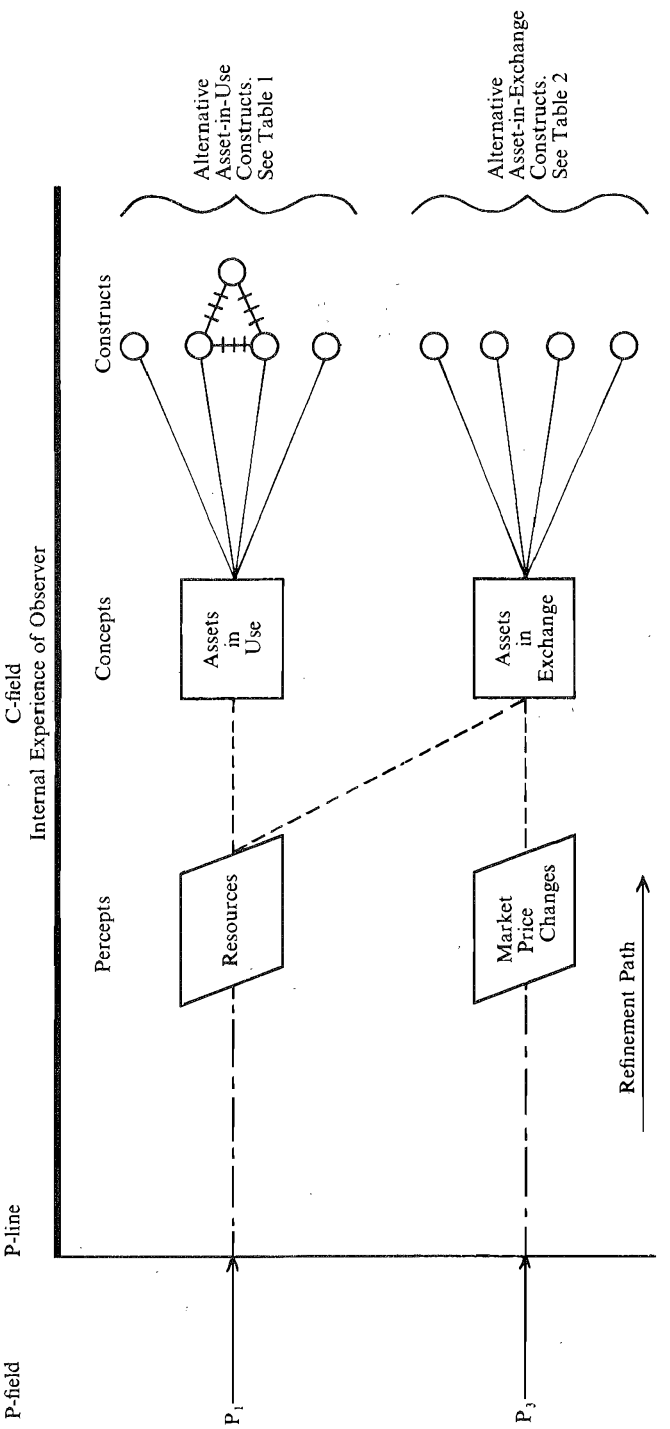

Fig. 7.—The income determination experience in the theory plane

TABLE 3
The income determination matrix

Capital Construct / Asset-in-Use Construct	Proprietary Constructs			Entity Constructs						
	Money	General P.P.	Share-holders' P.P.	Money	I.P.P. (Economy)	I.P.P. (Industry)	I.P.P. Firm	Existing Capacity	Productive Capacity	Economic Capacity
Historical Record										
Revenue Charges in Suspense										
Economic Value Past Acquired										
Economic Value Past Sacrificed										
Historical Record in Current Terms										
Opportunity Value										
Market Economic Power										
Severable Means										
Service-Potentials										

1. Is necessary, but not sufficient for calculating periodic income.
2. Is necessary and sufficient for calculating life-time income.
3. Can be evaluated independently of the net asset valuation rule used.[146]

In other words, the asset construct (in particular, the asset-in-use construct) does not affect life-time income but rather determines the allocation of that income to periods: it is a determinant of short-term profit. The capital construct alone is necessary for determining life-long income and hence different capital constructs will produce different long-term income constructs, and consequently different long-term income measures. Gynther arrives at a similar conclusion, but refines that of Shwayder by demonstrating the life-time income will be affected, not only by the capital construct, but also by the amounts of monetary items held.[147]

What effect does the asset-in-exchange construct have upon income? As with the asset-in-use construct, it can have no effect on long-term income. Its consequence, then, must be upon short-run profits. However, whereas the asset-in-use construct determines short-run income, the asset-in-exchange construct has no effect in determining period income but merely dichotomizes that income into sub-concepts. Edwards and Bell demonstrate this effect: adoption of the opportunity value, asset-in-exchange construct produces a dichotomy of "realizable operating profit" and "realizable capital gains",[148] while the current cost, asset-in-exchange construct divides "business profit" into "current operating profit" and "realized cost savings".[149] The relationship between the short-run income construct as determined by the asset-in-use construct and the sub-concepts determined by the asset-in-exchange construct is that of proper subset to set. That is:

$$I = \{i, j\}$$

and, if an operator (measure), n, is applied to both I, i, and j,

$$n(I \cap i) = ni \text{ or, } i \subset I$$

and

$$n(I \cap j) = nj \text{ or, } j \subset I$$

where I is period income, and i and j its components as determined by the asset-in-exchange construct.

We thus arrive at an all-inclusive statement as to the effect of the various constructs upon the income construct. The capital construct is the sole determinant of life-long income; short-run (period) income is the matrix output of two vectors—the capital construct and the asset-in-use construct; components of short-run income are determined by the capital construct, the asset-in-use construct, and the asset-in-exchange construct. The relationship between the last two constructs is one of proper subset to set. These elementary matrix and set builder relationships are presented to the mathematicians for further development.

A hierarchy among the semantical determinants of the income construct appears. The capital construct determines life-long income, short-run income and short-run income components (if any). The asset-in-use construct determines the short-run income construct and short-run income components (if any). The asset-in-exchange construct merely determines the short-run income components. Any of the semantical constructs are thus dependent upon the operation of a senior construct in the hierarchy. For this reason, where the asset-in-exchange construct (which arises because of market price changes) is identified with the same price-level sensation as the capital construct, no dichotomization of income occurs. Thus, in the case of the simultaneous use of an operating-capacity capital construct with a current cost, asset-in-exchange construct, no holding gains and losses can be recognized. However, holding gains and losses can be recognized with an operating-capacity construct if any other asset-in-exchange construct beside current cost is adopted.

Section 4 exposes the processes of construction in phase A of the data framework in stage 1 of the information-generating system as applied to financial accounting

models. The basic construct of wealth (or income) is identified as an analytically-derived construct traced to its empirical observables through the asset and capital constructs. These referent observables are seen to be "resources" and "investment" which produce two streams of accounting conceptualization: the asset stream and the capital stream. The asset stream is further divided into the asset-in-use and asset-in-exchange conceptual streams, and then the effect of each of the resulting three streams on the income construct ascertained to provide an all-inclusive statement of the derivation of the wealth or income construct. A framework is therefore presented, firstly for the development of any further financial accounting models, and secondly, and more importantly, so that the basic epistemological processes can be understood by the researcher attempting to attain accounting theory synthesis. Having discovered the thought patterns in the derivation of accounting constructs and the factors which affect those patterns, the researcher is better prepared to bring alternative accounting theories together.

5. DEVELOPING THE DATA MATRIX

Accounting has been depicted in this study as an information-processing system consisting of three stages of activity; in stage I the accountant conceptualizes the information requirements of various decisions to derive information constructs; in stage II he takes these constructs and makes them operational in a practical world; and finally in stage III he communicates his measured construct to the decision maker. By reference to a data theory framework, stage I—the construction stage—has been further dissected into three phases of activity: in phase A, the accountant develops in his mind constructions of real world phenonema which he will transmit to the decision maker; in phase B he recognizes the fundamental relationships between these constructs; and then in phase C he discovers the further relationships inherent in this fundamental relationship.

The aim of this study has been to propose a framework which will clearly demonstrate the thought processes in building financial accounting models. It is imperative, then, that the reader discern that we have presented here a nested framework—a framework within a framework. The broad framework has been called the "information-generating system"; however, stage I of that framework is described by a further framework—the data theory framework—consisting of the three phases outlined above. Sections 2 to 4 expanded phase A of stage I by demonstrating how accounting constructs are derived. The present section outlines phases B and C (in stage I) of the data theory framework.

Classification: A mapping process

The previous two sections have elaborated the process by which constructs, and in particular accounting constructs, are formed in the theory plane of abstraction in an observer's mind. However, constructs developed not only have external reference in their relationship to environmental phenomena, but also have internal characteristics in their relationship to each other. Before measurement principles can be applied, constructs must be identified with certain classes or categories and the relationship between them established.[150] Classification is a further structuring process, but a consolidating one, which builds constructs into a formal mathematical or logical pattern which can be called the data map or data matrix.

Coombs, in adapting a geometric viewpoint of data, proposes that "data may be viewed as relations between points in space".[151] Coombs compares the theorist's mind—which he calls "psychological space"—to a map. The theorist not only develops constructs of real world phenomena (in phase A), but also plots these on the psychological map of his mind in relation to each other, just as a geographer would plot natural features on a particular part of a map. "Classification is a purposive mental

action",[152] a process of plotting the psychological space of the theorist's mind. This is the preoccupation of phases B and C of the data framework. Constructs are plotted in the theorist's mind and the relationships between them noted. A data map (or matrix) of relationships is the product of these processes. This data matrix consists of a number of points in psychological space which are identified with developed constructs. These points give the fundamental dimensions of the matrix; that is, the dimensions of the matrix are given by the number of constructs which are mapped into psychological space.

The building of the matrix within these fundamental dimensions takes two directions. In order that the reader may envisage the matrix to be built, we shall identify these two directions as planes in the mind. Hence we have a horizontal plane in which the relationships of phase B of the data framework are established, and a vertical plane in which the relationships of phase C are discovered. There is no significance in the terms "horizontal" or "vertical", except to separate out two directions of building the matrix. In the horizontal plane, the relationships *among* constructs are established (phase B); in the vertical plane *each* construct is analysed to discover sub-classifications of the construct without reference to other constructs. The relationships within the data matrix, both horizontal and vertical, should not be confused with the syntactical deductive relationships referred to previously. The relationships which we refer to here have direct empirical correspondence and are discovered not by a deductive process but by observation of the environmental phenomena which the constructs represent.

An example from the field of physics will illustrate this. Let us assume that the constructs of pressure and volume of a gas are mapped into psychological space to give a two-dimensional matrix. Phase B, by a process of empirical observation, identifies the fundamental mathematical relationship between the two points as an inverse one. Hence a fundamental law of the kinetic theory of gases—Boyle's law—is established. Only a limited model can be built upon the constructs of pressure and volume when considered in isolation; however, in determining the relationship between them, a wider deductive theory can be derived—indeed the whole area of kinetic theory of gases in physics is built upon this fundamental law that volume is inversely proportional to pressure. In this case the matrix is two-dimensional.[153]

However, while this horizontal relationship between pressure and volume is established in phase B, phase C involves the sub-classification of each of pressure and volume.

Pressure is found to consist of the components of "force" and "area", and then force can be further fragmented into "mass" and "acceleration", and area into "length" and "breadth". Acceleration, in turn, can be fragmented into "velocity" and "time" components, and so on. Volume, on the other hand, can be seen to be the product of "area" and "height" and area the product again of "length" and "breadth". Hence we see in phase B a horizontal relationship between, and a classification of, pressure and volume and in phase C, vertical relationships between, and a sub-classification of, pressure and volume and their respective components.

Horizontal relationships in the accounting data matrix

Let us now discover the accounting data matrix—firstly in the horizontal relationships of phase B. The previous section identified two fundamental empirical constructs with which financial accounting models are concerned. These are the assets and capital constructs. Phase B of the data framework demands that these constructs be now mapped in the mind of the theorist and the relationships among them determined by empirical observation of their environmental referents.

Observation of the referents of assets and capital—resources and investment respectively—produces the relationship of a mathematical identity. This relationship cannot be proved here, as it is a matter of empirical observation. An appeal to reason, however, is made: the value of resources must be equal to the value of investment

in those resources. Hence a basic mathematical relationship of the equality of assets and capital, which has been recognized for centuries,[154] is again asserted. That is:

$$A = C$$

where C is capital of the investor and A is assets less any claim to those assets other than those of the investor.

It would appear, then, that the accounting data matrix is two-dimensional.[155] However, another construct, treated as a constant in the previous chapter, affects this identity. The identity only remains mathematically correct at a specified point in time. Hence *time* is introduced as a third dimension in the mapping of the accounting data matrix and thus:

$$A_o = C_o$$

where subscript o designates the time dimension. Bringing these three dimensions (assets, capital, and time) together, we can determine their joint effect on the wealth (or income) construct by reference to a Cartesian system of co-ordinates. Wealth (or income) can be described as the Cartesian product of an ordered triple. That is:

$$W_t = (A, C, t)$$

where t is the time dimension and W is wealth (or income, depending on whether t is held constant at a point or for a period). Wealth (or income) is hence also a point in psychological space, determined by a vector presentation of a three-element system. Although the time dimension was ignored, this is the same conclusion as that derived in the previous section.[156]

The horizontal relationship in phase B of the data framework in the context of accounting is established. This can be stated as a mathematical identity of assets and capital subject to a time element. The importance of this cannot be over-stressed.

"It is this property which creates an isomorphism between an empirical phenomenon and our basically two-dimensional mathematical construct".[157] Mattessich, in referring to the "two-dimensional property that permits double classification"[158] maintains that: "In our view, it is this syndrome—a mathematico-logical structure consisting of a set of assumptions—which makes us decide whether we are dealing with an accounting system or not. Every other criterion for delineating our discipline is too vague and will quickly perish when quantitative methods are introduced".[159] This receives the writer's full support. As Boyle's fundamental relationship forms the basis of the kinetic theory of gases, as do Newton's laws of motion the area of mechanics and kinematics, so "the duality syndrome"[160] forms the mathematical foundation of the accounting system. Accounting not only deals with constructs of real world events, but also the relationships between them.

Ijiri's work should receive mention at this stage. Ijiri maintains that "there is no logical reason why classificational double-entry should be double and no more".[161] In other words, Ijiri proposes that other constructs beside the asset and capital constructs be recognized to give a multidimensional matrix, the operational expression of which is multi-dimensional book-keeping.[162] Such other constructs may be location of assets, age of assets, and physical attributes of assets. Assent is here given to the possibility of extending the data matrix into other dimensions, but such an extension is not proposed because of the stated assumption that financial accounting models displayed in the literature at present are concerned only with wealth, as determined by asset and capital constructs. If other constructs are adopted and incorporated in the accounting information system (this is a matter of definition), then the data matrix here proposed can be extended to its multi-dimensions.

Vertical relationships in the accounting data matrix

The basic plan of the data matrix is given by the horizontal relationships determined in phase B of the data theory framework. However, once the area of psychological space covered by the matrix is determined, the matrix needs to be erected upon the plan of the horizontal plane: the vertical relationship of the matrix must be

determined. This is the preoccupation of phase C. Interpreted in the accounting context, the constructs assets and capital need to be fragmented into their sub-classifications and the vertical relationship between each class of asset and each class of capital determined.

It is not proposed here to discover what sub-classifications of assets and capital (and hence wealth and income) need to be identified. Rather the framework of such a classification and the criteria by which it should be judged are presented.

Structure of the vertical relationships

The vertical relationships in phase C are those of proper subset to set. Thus:

$$A = \{a_1, a_2, a_3, \ldots\ldots a_n\}$$

where $a_1, a_2, a_3, \ldots\ldots a_n$ are particular sub-classes of assets. For example, a_1 could be current assets, a_2 fixed assets, and so on. Similarly:

$$C = \{c_1, c_2, c_3, \ldots\ldots c_n\}$$

where $c_1, c_2, c_3, \ldots\ldots c_n$ are particular sub-classes of capital. For example, c_1 could be original capital, c_2 revenue, and c_3 expenses (to which a negative operator would have to be applied). Also, bringing in the third dimension:

$$T = \{t_1, t_2, t_3, \ldots\ldots t_n\}$$

where T is the *accounting period* or *accounting time-point* and $t_1, t_2, t_3, \ldots\ldots t_n$ are shorter time periods (weeks, days, hours) and time-points.

Ignoring the time dimension as a constant, it was demonstrated in the previous section that wealth is the matrix output of the two vectors, assets and capital. Hence:

$$W = \{w_1, w_2, w_3, \ldots\ldots w_n\}$$

where W is wealth at a point of time and $w_1, w_2, w_3, \ldots\ldots w_n$ are wealth elements, made up of asset and capital elements at the same point of time. Such a classification not only indicates total wealth but gives a representation of the structure of that wealth. Because of the identity relationship between A and C, some elements in the structure are positive and some are negative. Hence the sum of the elements of the wealth vector is always zero.

Once again, a parenthetical consideration should be given to the work of Ijiri. As well as extending the dimensions of the data matrix in the horizontal plane, Ijiri distinguishes between "two distinct types of double-entry which may be called *classificational double-entry* and *causal double-entry*".[163] Classificational double-entry is the transposition into operations of the fundamental identity emphasized in this section between A and C, assets and capital. Causal double-entry, developed from Ijiri's axiom of exchanges,[164] "recognizes the cause-and-effect relationship between an increment and a decrement"[165]: in other words, the decrease in an asset is related to a subsequent increase in an asset to determine income which is subsequently related to an investor's claim.[166]

How then does this relationship fit into the data matrix developed? Horizontal classification corresponds to Ijiri's classificational double-entry; vertical classification relates the dimensional points in the matrix to their components. Causal double-entry, it appears, is a diagonal relationship between the horizontal asset-capital relationship and the vertical asset vectors. A further matrix is thus envisaged on the diagonal and hence we have a set of horizontal, vertical, and diagonal relationships.[167] Present financial accounting models are built only on a matrix in two planes and this position is taken in this study.

Criteria for vertical fragmentation

Having seen the structure of the vertical relationships, it must be asked what criteria determine how far the asset and capital constructs must be fragmented. We have seen that

$$A = \{a_1, a_2, a_3, \ldots\ldots a_n\}$$

but also it may be possible to further decompose a into a number of elements so that

$$a_1 = \{a_1^1, a_1^2, a_1^3, \ldots\ldots a_1^n\}$$

For example, a_1 may be current assets and a_1^1, a_1^2 and a_1^3 respectively cash, debtors, and inventories. What criteria can be developed to direct us in this sub-classification process?

Information theory provides the answer. If the corner-stone objective of accounting is to provide information and if accounting is thus to be viewed as an information-generating system, then the criterion for any division to be made within that system is the effect the action will have on the quality or value of the information output of the system. The information criterion recognized for the construction process in the system is "relevance" to a decision; similar criteria are developed in the next section where constructs are operationalized; similarly a criterion for classification must be developed.[168]

The concept of information is concerned with the reduction of the decision maker's uncertainty. Information has value only to the extent that it reduces the uncertainty of the variables in the decision maker's decision.[169] Traditional information theory, in further recognition of the fact that for any decision problem there are a number of alternative answers, has thus attempted to ascertain the value of information by the comparison of the subjective probabilities assigned to possible outcomes by the decision maker before and after receipt of information. However, because of operational difficulties in the social sciences, Theil has developed an alternative to the mapping of probability distributions which can appropriately be applied to the classification problem.[170] By the decomposition of the information construct into its components and the division of such components by their total, a number of non-negative fractions that sum to unity and which can be regarded as probabilities are derived. Thus it can be determined how much each fragment of information is worth.[171]

The above analysis derives from the two propositions that greater fragmentation of informational constructs provides more information and that channel capacity is limited: hence a trade-off between the two is required. Classification is really a communication channel which can be classified as deterministic, lossless, or noisy. Lee and Bedford, as a supplement to Lev's work, present a mathematical model determining the loss of information value in each type of channel.[172] If classification is restricted, noise is introduced into the channel with a resultant communication loss.

Transaction data

The data matrix must not be considered a static thing. While the general pattern of the matrix, as developed above, remains the same, the values of the components of this matrix—wealth (income), assets, and capital and their fragmentary elements—are continuously changing. The reason for this, of course, is that the environment is continuously changing—the sensations P_1, P_2, P_3, and P_4 are repeatedly emitting impulses which affect asset and capital components of the matrix and thus the wealth component also. The picture, then, is of a dynamic matrix—dynamic in the sense that its outputs are continously changing by virtue of changing inputs.

Let us call an impulse from the environmental stimuli a transaction. It is the function of the accountant to determine the effect of transactions upon his data matrix—that is, the effect of a sensation upon assets and capital, and hence wealth. The mathematical identity of assets and capital demands that each transaction affect both simultaneously, and that the value effect to each is the same. Recognizing the time component in the matrix, it follows that each transaction, like the matrix, is the Cartesian product of a three-dimensional space.[173]

For clarity, we will again hold the time dimension as a constant. The framework of classification of transactions is thus as follows.[174] Let

$$X = \{x_1, x_2, x_3, \ldots\ldots x_s\}$$

where X is all transactions of a period, and x_1, x_2, x_3, ... x_s are individual transactions (for example, sale of merchandise on credit). The classification of a transaction

will depend upon the degree of fragmentation in the vertical plane of the data matrix. If both the asset and capital constructs consist of N fragments, then the number of possible classifications, k, of a transaction is given by $k = P^N_2$, where P signifies permutation. Hence transaction classification involves mapping an element, x, in the set, X, of which there are s possibilities, to an element, y, in the set, Y, shown as:

$$Y = \{y_1, y_2, y_3, \ldots\ldots y_k\}$$

where $y_1, y_2, y_3, \ldots\ldots y_k$, are possible classifications of the transactions. Such a classification process is operationally extended in the form of book-keeping procedure in the next section.

If wealth position before a transaction is given by

$$W_1 = \{w^1_1, w^1_2, w^1_3, \ldots\ldots w^1_n\}$$

and after the transaction by

$$W_2 = \{w^2_1, w^2_2, w^2_3, \ldots\ldots w^2_n\}$$

then the effect of the transaction on the matrix can be determined. All elements in W_1 remain unchanged except one (w^1_i) which has been chosen to correspond to the transaction classification. Hence:

$$w^1_i + f = w^2_i \qquad \text{or} \qquad f = w^2_i - w^1_i$$

where f is the value assigned to the transaction. If w is substituted for its semantical components, then:

$$a^1_i + f = a^2_i \qquad \text{or} \qquad f = a^2_i - a^1_i$$

and,

$$c^1_i + f = c^2_i \qquad \text{or} \qquad f = c^2_i + c^1_i$$

Hence, two approaches to the determination of income (or wealth) appear. We can either add to wealth at the beginning the value of transactions to obtain final wealth, or we can take the value of wealth at the end from that at the beginning to determine the value of the wealth increment by virtue of the transaction. The former has been called the transactions approach to income determination, the latter, the capital maintenance approach. If the transactions approach is adopted the emphasis in classification is shifted from wealth (corresponding to resources and investment) to increments in wealth. Thus, not only must the accountant have asset and capital constructs, but he must also develop thresholds for the recognition of wealth increments and decrements. The operational equivalents of these thresholds are often called revenue recognition rules and the matching process.

The conceptual aspect of the accounting information system not only derives constructs but determines how these are to be related one to another. This section, by employing the principles of phases B and C of the data framework, has attempted to specify those relationships as a classificational problem. The relationships have been depicted in two planes. A horizontal relationship of a mathematical identity exists between the asset and capital constructs developed in the previous chapter to yield, when combined with a time element, a three-dimensional matrix. Upon this basic three-dimensional plan, the vertical relationships within asset, capital, and temporal classes are examined according to certain criteria proposed by information theory. The section concludes with the application of the data matrix to the dynamic situation and indicates the translation of environmental transactions into the data matrix to determine wealth and income outputs.

A framework does not consist of isolated parts; it is a characteristic of a framework or structure that its many parts are joined by functional relationships. The picture then is of a coherent whole. The previous section identified the conceptual aspects—the constructs—of accounting theory; the present section has then taken these basic components and related them one to another to form the data framework sought. The data framework having been built, stage I of the information-generating system is completed and the theorist can now proceed to make this framework operationally effective: stage II must be entered and then the process completed by activity in stage III.[175]

6. OPERATIONALIZATION OF THE ACCOUNTING DATA FRAMEWORK

Phases B and C of the data framework—the mapping of constructs into patterns of relationships—complete the conceptual aspect of the accounting function. Stage I of the information-generating system is described and stage II must now be depicted.

The necessity of the operational stage is patently obvious. Conceptual formulations by themselves are unproductive, having no empirical impact. All theorectical analysis finds vindication in its practical consequence, and if a theory cannot find operational expression, it must be discarded as useless for satisfying human wants. However, a proper balance needs to be struck between conceptual and operational approaches. In stressing the need for empirical consequence, one is in danger of another extreme, so characteristic of many of the operationalist philosophers,[176] which rejects conceptual constructions: "Omission of operational definitions leads to sterile speculation, to metaphysics in the sense of the detractors of that discipline; disregard of formal (or 'constitutive') definitions leads to that blind empiricism which misses the power and the beauty of modern physical science."[177]

Hence, operationalization lies at the junction of theory and experience.[178]

How, then, are conceptual constructions translated into their practical counterparts? We have noticed the development of empirical propositions and analytical propositions in the theory plane.[179] The problem at hand here is to transpose these into operational propositions. This is done by applying to the theoretical constructions an array of "operators"—otherwise called "reactor elements" or "empirical descriptors"[180]—as depicted in figure 8. These operators are in the form of empirical rules.

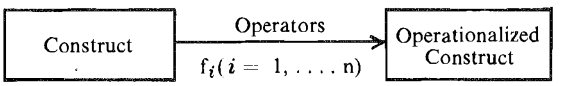

Fig. 8.—The operationalization of a construct
This is an adaptation of a similar diagram in Williams and Griffin, "Structural Approach", p. 644. The designation i identifies an operator which is one of a number of n operators which are employed.

The choice of empirical operators is guided, as was the construction process in stage I, by the objective of the discipline. In accounting, this objective has been postulated as the provision of information,[181] and accounting operators are discovered deductively from this goal. In other words, the criterion for the choice of an accounting operator is the extent to which it makes a theoretical construct informationally more valuable.

Two empirical constructs—assets and capital—and an analytical construct—wealth (or income)—have been developed as the epistemological ingredients of financial accounting models. What, then, are the operators to be applied to these to give them greater information content by rendering them practically useful? It appears that accounting operators can be classified as:

1. Technical operators;
2. Metaphysical operators; and
3. Environmental operators.

Technical operators specify the practical procedures in providing accounting information; metaphysical operators act as mental constraints upon that activity and give logical rules for operations; and environmental operators modify the theoretical construct for acceptance within the norms of human society. The discussion of these sets of operators here is necessarily brief and many of the associated problems are only alluded to. The reader is therefore referred to areas in the literature, indicated by

footnotes, where a fuller discussion of the respective operators may be found. The purpose here is merely to indicate some of the operators which must be considered.

Technical operators

All disciplines are characterized by a set of procedures which, in failure to recognize their conceptual background, are often mistakenly taken as a description or definition of the discipline. Two such procedures are found in the discipline of accounting.

Measurement

The quantification and ranking of constructs provides an information output which is more meaningful,[182] and hence this is a vital activity of the accountant. While there are many definitional disputes regarding measurement,[183] the traditionally accepted definition of Stevens adequately describes the process: measurement is "the assignment of numerals to objects or events according to rule—any rule".[184] Hence measurement applies a number of operational rules to accounting constructs. What then are these measurement operators which yield a measured construct? Measurement theorists have delineated a number of steps in the measurement process:

(a) The specific object or property of the object to be measured must be identified.

(b) A scale upon which the measurement is based must be chosen, and, if appropriate, a zero for that scale specified.

(c) A unit of measurement must be adopted.

(d) A measuring instrument must be provided.

Step *(a)* has received much attention in previous sections. The consideration here is of a measurement scale, a unit of measurement and the measuring instrument.

The pioneer work of Stevens[185] in regard to measurement scales has found adoption in various disciplines including accounting.[186] Stevens has identified four scales:

(i) The nominal scale merely groups properties into sets or classes. Numbers in a football team are an example of a nominal scale.[187]

(ii) The ordinal scale introduces a primitive ranking of properties. Hence "warm" and "hot" are ordinal scale designations as they give a comparison between two objects.

(iii) The interval scale introduces proportional elements into measurement. Thus, by use of a Fahrenheit temperature scale, one can indicate proportionally how much one object is hotter than another.

(iv) The ratio scale is similar to the interval scale except that it is based on a zero which has some representative significance with the property being measured. Thus, while Fahrenheit is an interval scale, the Kelvin scale, with its zero at the temperature at which all molecular action ceases, is a ratio scale.

The accountant must choose a measurement scale. The choice is determined by which scale gives the construct greater information content. The scale higher up the hierarchy is more favourable to this criterion and thus a ratio scale should be employed. However, many properties (for example, colour brightness, value) do not lend themselves to this scale and so the measurer must move down the hierarchy. Some accounting theorists, who may be accused of an excessive operational emphasis, would reject all scales other than the ratio scale as being outside the domain of accounting.[188] However, if accounting is an information-generating system, it can be argued that a construct poorly measured and relevant to a decision is informationally more valuable than a construct which lends itself to the ratio scale,

but has no relevance to the decision. Construction precedes operations; operations merely provide constraints on the presentation of constructs.

Selection of a unit of measurement or a measurement agent is determined again by the objective of the process. Financial accounting is concerned, we have postulated, with the presentation of assets, capital, and wealth-notions which are predominantly economic in nature.[189] Hence a measurement agent must be identified with utility in consumption. While the unit "utils" has been suggested, convention would have it that money (dollars) be the measuring unit. However, convention by itself is no argument: the adopting of dollars as a measuring agent is supported by the fact that it is the common expression of command over goods and services and has the utility of deriving such goods and services to satisfy consumer wants. By reason of this, the maximand of utility is money,[190] and thus money is chosen as the measuring agent of economic properties.

Not only does the measurer require a scale and a unit of measure, but also a means by which an operation can be carried out. The physicist uses a measuring rod, a speedometer, or an ammeter. As the accountant is concerned with economic notions, he must use the market as his measuring rod for it is here, by the compromise of supply and demand forces, that economic value is determined. Table 2 with the corresponding discussion[191] illustrates the number of possible market valuation coefficients which can be applied to accounting constructs (shaded areas in table 2 are to be ignored for the present discussion). All measurements are approximations,[192] and the market is indeed an imperfect measure due to constraints of knowledge, limitations in mobility, problems of additivity, and, in particular, the changing value of the measuring unit. This lack of standard, an essential condition for measurement,[193] is distressing to the accounting measurer. In the last decade or so, much has been written to take into account the question of changing prices. This phenomenon gives rise to a non-zero adjustment which must be performed upon the capital construct.

The operation of measurement is depicted above as the application of three operations to an accounting construct. The operations involve a measurement scale, preferably a ratio scale but not necessarily so, a measuring unit or agent in the form of the dollar, and a measuring instrument in the form of the market, albeit imperfect, in which economic values are generated.[194]

Data-processing operators

Having obtained a measured construct, the accountant must develop a technique for its recording and presentation. The data matrix, developed in the previous section, provides the framework for such a presentation: not only must the components of the matrix be given measures, but also the matrix itself must be operationalized into a coherent system of recording. This is the data-processing aspect which is essential to an (accounting) information system.[195]

Data processing is essentially a system of storage, of manipulation of data within storage, of input to that storage, and output from it. The data processor must store data in a series of data locations and then determine the techniques of getting data into storage (collection, transmission, representation, and validation procedures). After data has been manipulated within storage, techniques of retrieving and displaying data[196] need to be developed. Hence the operationalization of the data matrix demands the building of a set of storage locations in which the measured components of the matrix can be stored. Transaction data, classified according to the matrix pattern, then form the input to continually update storage to give it its dynamic character. From storage, accounting statements are extracted by a set of rules and thence communicated to decision makers.

Structuring storage locations follows directly from the classifications within the data matrix. Let each location be called an *account* and the structure of those accounts, a *chart of accounts*. Each account will be the operational representative of each subclassification of each of the asset, capital, and time dimensions of the matrix; and

because of the mathematical identity in the horizontal plane of the matrix, these accounts must receive a positive or negative operator. A positive operator may be called a *debit* and a negative one, a *credit*. A number of techniques appear in the literature for accounting data storage and manipulation and these are summarized here:[197]

1. *The conventional double-entry approach.* This is familiar in accounting practice.
2. *The network approach.* This is a schematic or graphic presentation of accounting recording.[198]
3. *The matrix approach.* This is a mathematical adaptation of the relationships in the data matrix by use of linear algebra.[199]
4. *The spread sheet approach.*[200] This is similar to the matrix approach in that it achieves dual classification by means of a single entry. It is, however, less mathematical in its presentation.

Processing input into storage is, among other things,[201] a matter of classifying transactions and thus identifying them with the storage locations which they must update. We have seen that transactions are ordered triples described by asset, capital, and time elements. Two techniques of classifying transaction input are discussed in the literature and these are summarized.[202]

1. *The journal entry form* which classifies transactions for input into conventional double-entry systems.
2. *The vector form,* which expresses the mathematical relationships, for input when other storage techniques are used. The vector is an array of asset, capital, and time elements.

Output retrieval from storage is the final problem of data processing. This is merely a read-out of data manipulated in storage and its presentation in a fashion which conserves channel capacity, minimizes noise in the channel and encompasses the pragmatics of the decision environment. Hence it is a communication problem which is expressly excluded from consideration in this study.

Metaphysical operators

All disciplines, in their operation, come under the central core of philosophical thought (logic, metaphysics, and mathematics) which produce constraints upon the operation of the discipline. These constraints, often called "common-sense" notions, affect the derivation of constructs in the theory plane by providing inductive and deductive rules for their development. However, they also provide rules for the application of theory in practice. A number of metaphysical constraints which are active as operators in the accounting practice are discussed here.

Uncertainty

The uncertainty operator acts as a constraint upon the measurement operation. The engineer, in his measurement of mechanical phenomena, specifies tolerance limits; the statistician, in his operations, indicates a confidence level; it would seem that the accountant, in presenting single-value estimates as in current practice, is "oblivious to the lack of certitude in the economic world that envelops him".[203] Economic phenomena exist in a world of uncertainty and the market measure of these phenomena is imperfect: this is particularly so when the phenomena contain futuristic characteristics. It is suggested, therefore, that financial accounting measures incorporate the uncertainty constraint by the incorporation of the many statistical and mathematical models—probability theory, simulation techniques, sensitivity analysis—currently presented in the literature of managerial accounting and other disciplines.[204]

Objectivity

We have noticed the importance of the metaphysical constraint of objectivity in the process of construction.[205] "As soon as we introduce the necessity of transformations we encounter the problem of objectivity":[206] the constraint also applies to the operationalization of constructs. Objectivity is an important consideration in information theory:[207] unless the recipient of information can be assured that his information input is reasonably free from personal biases, that information has little value to him. Constructs must be measured objectively: not only must decision makers be sure that information is relevant to their decisions, but they must also be persuaded that measurements are objectively carried out.[208] So objectivity appears as an important constraint in the measurement process.

Much has been written on this controversial notion in accounting theory, but it has received little operational definition. Paton and Littleton suggest objectivity is associated with "verifiable, objective evidence";[209] Moonitz attempts to purge subjective biases by the opinion of an independent investigator;[210] Arnett has defined objectivity as the measure of personal bias;[211] while Ijiri and Jaedicke,[212] and Sterling[213] propose the definition of the notion by reference to a consensus of opinion. The latter proposal has been operationalized by Ijiri and Jaedicke[214] in a mathematical form to provide a practical description of objectivity and this is proposed here as the accounting objectivity operator.

Mathematical axioms

There exist a number of mathematical axioms which come into operation in a measurement system. The application of these allows the manipulation of measures in order to make them informationally more valuable. The most common of these are the operators, "plus", "minus", "multiply", and "divide".[215] The imperfections of the market from which the accountant obtains his measures presents him with problems of complying with some mathematical axioms.[216]

Aggregation

One mathematical operator requires particular mention. Aggregation is the operational expression of classification dealt with in the previous section. It was indicated there that the classification problem (and hence the aggregation problem) is resolved by application of aspects of information theory. The operator which information theory has supplied to determine the degree of information loss through aggregation (reverse decomposition) is the measure of entropy (or disorder) in the information system caused by the aggregation.[217] Lev fully discusses the entropy notion and supplies an operational expression of it in the form of an information loss cut-off rate as a guide to accounting aggregation.[218]

The aggregation problem is related very much to that which is traditionally referred to as "materiality" in accounting reports. There have been attempts to operationalize the materiality constraint by providing certain guidelines,[219] but these attempts are rather unsuccessful. Relating the materiality constraint to information loss caused by entropy of the information system provides a more satisfying operational framework.

Periodicity

Users of accounting information cannot await the consummation of an enterprise's life to receive information. It follows that the life of the enterprise must be divided into arbitary periods and accounting operations performed on a periodic basis. This requires a repetition of accounting operations throughout the enterprise's life. Further, the periodicity constraint introduces a number of problems regarding the allocation to periods of resources which have a life longer than one accounting period. This allocation problem is common to most financial accounting models.[220]

Environmental operators

Beside technical operators and metaphysical constraints, there exist a number of factors in society which act further as constraints upon accounting practice. All activity, and especially the outworking of scientific knowledge, must be acceptable to the laws, norms, the attitudes, the morals and institutions of human society. It is not proposed to submit these environmental operators here to avoid commitment to political and social opinions. Perhaps one which could be given as an example is the operation of the law. A theorist may construct dividend payments as an expense, but for reporting purposes may be constrained by the law to present this as a distribution of income.

Theoretical constructions, by themselves, do not contain information value. In order to have practical consequence, they must be operationalized. A number of accounting operators are identified in this section. Three types of operators are discovered: technical operators, metaphysical operators, and environmental operators. Technical operators—the practical procedures with which accounting activity is associated—are measurement and data processing. Metaphysical operators —constraints upon accounting procedures demanded by logical thought—are listed as uncertainty, objectivity, mathematical axioms (with a particular consideration of aggregation), and periodicity (which produces the accounting allocation problem). Environmental operators—those conditioning standards of human society—are not listed to avoid moral, political, and social debates.

Operationalization is the activity of stage II of the information-generating system which is secondary to the construction process in stage I. Applying operators produces an operationalized construct which must then be transmitted to the decision maker in the communication process of stage III.

7. SUMMARY: A FRAMEWORK FOR SYNTHESIS

The methodological and substantive contributions to accounting theory over the last twenty years demonstrate that accounting is an emerging science. Many of the discovery patterns developed in the philosophy of the physical sciences and other branches of the social sciences are evident in accounting thought. However, accounting science remains at present an analytical science. Other disciplines have made, or are making, the transition from an analytical emphasis to the more positive one of synthesis: instead of breaking down the real world into its basic elements, the direction of mature scientific endeavour is becoming one of building up and bringing together to obtain all-inclusiveness. The broad proposal of this study is that accounting science should make a similar transition. The existence in the literature of many alternative financial accounting models, often with basic conflicts among themselves, calls for this proposal.

However, rather than demonstrating how the transition from analysis to synthesis should be made, and how alternative financial accounting theories should be synthesized into a unified theory of accounting, the study investigates a preliminary matter which is necessary before synthesis can begin: of utmost importance is the need to examine and understand the *structure* of financial accounting theories. That is, the theorist needs to discover the processes of theory construction. Before a heart can be transplanted from one body to another (an example of synthesis), the surgeon must have a detailed knowledge of the intricacies of the physiological and biochemical processes involved in human organs. Similarly, before the accounting theorist can synthesize two models, he must fully appreciate the thought processes in developing such models.

This thesis has attempted to provide a *framework* for the development of financial accounting theory models to fulfil this requirement. The ontological questions as

to the nature of accounting and the epistemological questions as to the thought patterns in the construction of financial accounting theories are those which find an answer herein. The literature of psychology and the philosophy of science has been researched to unveil the discovery patterns in theory construction.

The framework presented is briefly summarized as follows. Accounting is depicted as an information-generating system which can be categorized into three stages: construction, operationalization, and communication. The usual emphasis on accounting operations and lack of emphasis on conceptual formulations has been reversed to provide a concentration on the construction aspect of the framework. Upon recognition that theory construction—determining what is relevant to decision makers—is a vital aspect of the accountant's activity, a data framework of three phases is presented in order to analyse construction processes. The three phases of this construction data framework are firstly deriving theoretical constructs of real world events, secondly establishing a basic relationship between constructs so derived, and thirdly building and expanding a data matrix on these basic relationships as a classification process.

The first phase is depicted as a progressive refinement of initial perceptions of environmental sensations to derive formal constructs, and this process is applied to the accounting context to demonstrate the derivation of wealth and income constructs. It is shown that total wealth (or income) is derived syntactically from the combination of an asset construct and a capital construct. Further, the perception of assets as value in exchange in the market introduces another determinant of the income construct which receives little recognition in the literature at present. This third element decomposes the total income construct into sub-concepts. In the first phase of the construction framework, the influence of an observer's internal psychological experience is stressed as determinant of his construction of the real world. The recognition of this factor produces some strong recommendations for accounting theory synthesis, particularly in regard to empirical research.

The second and third phases build accounting constructs developed in the first phase into a matrix pattern which expresses the relationship between the constructs and their components. The accounting data matrix is found to be three-dimensional, consisting of assets, capital, and time elements. Considering time as a constant, a mathematical relationship of the identity of assets and capital is discovered as the basis of the matrix. Upon this fundamental relationship sub-classifications of both assets and capital are recognized to complete the building of the matrix and to finalize the construction process of the accounting information system. The result is a data framework of a pattern of relationships which is capable of operationalization (in the second stage of the information-generating system) and which then can be communicated to decision makers (in the third stage of the information-generating system). The operationalization process is depicted as the application of certain operators—classified as technical operators, metaphysical operators, and environmental operators—to the theoretical structure. The third stage—communication of the operationalized framework to the decision maker—has not been presented in detail in this study.[221]

In common with all branches of science, accounting is a discipline with both a substantive aspect and a methodological aspect. The substantive aspect, containing abstractions from the areas of finance, economics, and psychology, specifies the theoretical content of the discipline; the methodological aspect, derived from the areas of logic, mathematics, and metaphysics, specifies the structure or framework of the discipline within which the theoretical substance is manipulated. In the development of a discipline, a balanced consideration must be given to each aspect: if substantive contributions are attempted without regard to methodology, chaos results; to the contrary, concentration upon methodology to the exclusion of a consideration of the substance of the discipline merely produces an empty shell.

This study has observed an emphasis in the accounting literature, particularly that of the last decade, on the substantive aspect of accounting. The variances and

conflict evident between these contributions to financial accounting theory are suggestive of this emphasis to the neglect of accounting methodology. The proposal presented in the study is to bring these substantive contributions under one roof, that is, within the structure of one theoretical model. The contention is that this can only be accomplished by attention to the methodological aspect of the discipline: a methodology for accounting synthesis needs to be established.

The characteristic of a discipline—a field of knowledge—is that it is an organized body of thought, that is, its various elements are arranged in an orderly fashion to present a general picture, model, framework, or structure. Thought processes are then clearly understood. While not in any way decrying the many methodological contributions to accounting thought in recent years this study, in drawing from the contributions of the philosophy of science, has attempted to clarify the thought processes in financial accounting models by providing the framework summarized above. It is in this methodological structure that each of the substantive models finds common ground, for the thought processes in each are the same. Hence the study makes its contribution, not to the substantive body of accounting knowledge, nor directly to the methodology of synthesis, but rather to the understanding of the structure of financial accounting models. Having examined and understood the epistemological processes in theory construction, the theorist can then begin to critically evaluate and reconcile alternative accounting theories, and then, by a selection process, build a synthesized body of knowledge. Accounting will then come of age as a modern science.

The framework developed is presented to the accounting scientist as the basis for his research in the Age of Synthesis.

EPILOGUE

The main body of this study has been concerned with stage I (the construction stage) and stage II (the operationalization stage) of the information-generating system. Once a structural framework has been built and rendered applicable to the practical world by the application of certain operators, it remains to communicate the contents of the structure (information elements) to the decision maker. This has been described in the system presented as stage III of the information-generating system. Much has been written in the area of communication theory and so there is present here a mere sketch of the principles involved. Given that accounting is concerned with the provision of information, it must entail a study of and implementation of the principles of communication theory. A number of such principles are presented here for further enlargement:[222]

1. *Communication channels.* This involves the choice of a medium of transmission.
2. *Channel capacity* determines the number of "bits" of information which can be communicated.
3. *Coding* involves the reduction of information to a form which can be transmitted and which preserves channel capacity and yet maximizes the amount of information per bit.
4. *Noise* is an interference which destroys some part of the signal.
5. *Equivocation,* the average uncertainty per bit of information, gives a measure of the amount of information lost in the channel.
6. *Efficiency* is the measure by which channel capacity is utilized.
7. *Redundancy* defined as, 1—Efficiency, is regarded as an addition to essential information to allow for noise losses.
8. *Pragmatics* has to do with the meaning of signals to the recipient of information. Communication must allow for the particular connotations which the decision maker attaches to particular signals.[223]
9. *Decoding.* As the communicator codes the operationalized construct into a form for transmission, he also must provide a means by which the message is translated from its physical form once again into conceptual form.

The employment of these principles of communication theory in stage III of the information-generating system provides the final step by which the decision maker not only receives a decision-relevant construct (derived through the stage I process) which is operationalized to be of practical significance to him (stage II), but also the operationalized construct is transmitted to him in such a way that channel capacity is efficiently utilized, and in a way that is compatible with his perceptive and receptive abilities (stage III). Only then does the decision maker have information on which to base his decision.

APPENDIX

A demonstration of the respective effects of the asset-in-use, asset-in-exchange, and capital constructs on income determination

Section 4 has demonstrated descriptively the interplay of the asset-in-use, the asset-in-exchange, and the capital constructs in the determination of long-term income, short-term income, and the components of short-term income. The following provides journal entries to aid understanding and also to demonstrate how the theory is to be translated into practice.

Assume at point O the following balance sheet of an accounting entity:

Balance sheet at point O

Fixed Asset	$100	Investment	$100

Understanding is best gained by beginning with an example employing traditional accounting concepts and successively introducing refinements recognizing alternative asset-in-use, asset-in-exchange, and capital constructs. Assume throughout that revenues generated in period O to 1 are $40 and that these are invested in cash balances, and that the balance sheet value of the fixed asset at point O is in fact its cost price. Further assume straight-line depreciation of the asset at 20 per cent p.a.

Under these assumptions, the income statement for the period and the balance sheet at point 1, employing traditional procedures, are as follows:

Income Statement—period O to 1

Revenues	$40
Depreciation	20
Income	$20

Balance sheet at point 1

Fixed Asset	$100	Investment	$100
less Accumulated Depreciation	20	Income Period O to 1	20
	$ 80		
Cash	40		
	$120		$120

The reader will discern that in the above example we have in fact used an "historical record" asset-in-use construct and a "money" construct of capital (see table 3); an asset-in-exchange construct has not been employed.

Assume now that a "general purchasing power" construct of capital is adopted while the "historical record" construct is retained, and that the general index increased 10 per cent over period O to 1. Income statement and balance sheet would now appear as follows:

Income statement—period O to 1

Revenues	$40
Depreciation	22
Income	$18

Balance sheet at point 1

Fixed Asset	$110	Investment	$100
less Accumulated Depreciation	22	Capital Maintenance Reserve	10
	$ 88		$110
Cash	40	Income Period O to 1	18
	$128		$128

The journal entries to effect these statements would be:

1. To recognize the capital construct:

Fixed Asset	Dr. $10	
Capital Maintenance Reserve	Cr.	$10

(Restatement of opening investment in end-of-year dollars)

2. To effect the end-of-period asset-in-use valuation:

Depreciation	Dr. $22	
Accumulated Depreciation	Cr.	$22

(Depreciation of fixed asset restated in end-of-year dollars)

In the second example both an asset-in-use construct and a capital construct have been employed concurrently. It remains now to introduce the asset-in-exchange with the particular purpose of demonstrating its distinctiveness from the asset-in-use construct. The "current cost" construct (the current, entry price of the original inputs) is adopted. Assume that the current cost of the fixed asset (of cost price, $100) is $120. Once again the "historical record" asset-in-use construct and the "general purchasing power" construct of capital are adopted. Assume again the general index rises by 10 per cent. Income statement and balance sheet appear as follows:

Income statement—period O to 1

Revenue	$40
Depreciation	24
Operating Income	$16
Holding Gain	10
Net Income	$26

Balance sheet at point 1

Fixed Asset	$120	Investment	$100
less Accumulated Depreciation	24	Capital Maintenance Reserve	10
	$ 96		$110
Cash	40	Operating Income	16
		Holding Gain	10
	$136		$136

The journal entries to effect these statments would be:

1. To recognize the capital construct:

Fixed Asset	Dr.	$10	
Capital Maintenance Reserve	Cr.		$10

(Restatement of opening investment in end-of-year dollars)

2. To recognize the asset-in-exchange construct:

Fixed Asset	Dr.	$10	
Holding Gain	Cr.		$10

(Restatement of asset at current market input price)

3. To effect the end-of-period asset-in-use valuation:

Depreciation	Dr.	$24	
Accumulated Depreciation	Cr.		$24

(Depreciation of fixed asset calculated in terms of current inputs)

The reader will recognize the above as the Edwards and Bell formulation, producing the profit dichotomy of operating income and holding gains resulting from the dual factors of "operating moments" and "holding intervals", or, in terms of the exposition of section 4 of this work, from the recognition of both an asset-in-use and an asset-in-exchange construct. Income is derived from two activities: employing assets in production of revenue flows and holding assets in times of changing prices (related to changing prices which operationally define the capital construct). Therefore increases in wealth must be interpreted as deriving from one or other of these activities and hence a distinction must be made between the asset-in-use and the asset-in-exchange constructs.

Another example, employing asset constructs not used by Edwards and Bell, further demonstrates the conjunctive use of the asset-in-use and the asset-in-exchange constructs; in this example an asset-in-use construct of "service-potentials" and an asset-in-exchange construct of "present cost" are utilized. However, in order to highlight the relationship between the two asset constructs and to show their independence from the capital construct, a money concept of capital is employed (this can be interpreted as using any concept of capital and assuming the price index which affects the purchasing power of the investment to remain unchanged).

Assumptions:

Asset-in-use construct is service-potentials.

Asset-in-exchange construct is present cost (the current entry price of the asset in its present form).

A one asset firm and that asset is a fixed asset.

Cost price of asset at point O = $100.
Revenues generated in period O to 1 = $40, and these are invested in cash balances.
No change in price-levels affecting the purchasing-power of capital investment.
Measure of service-potentials at point O = cost price, and at point 1 = $80.
The present cost at point 1 is $120.
The balance sheet at points O and 1, and profit and loss statement for the period O to 1, are as follows:

Balance sheet at point O

Fixed Asset	$100	Investment	$100

Profit and loss statement
Period O to 1

Revenues	$40
Depreciation	40
	NIL
Holding Gain	$20
	$20

Balance Sheet at point 1

Fixed Asset	$120	Investment	$100
less Provision for Depreciation	40	Profit	20
	$ 80		
Cash	40		
	$120		$120

The journal-entries to record the asset-in-exchange valuation and the asset-in-use valuation would be:

1. To effect the asset-in-exchange valuation:

Fixed Asset	Dr. $20	
Holding Gain	Cr.	$20

2. To effect the asset-in-use valuation:

Depreciation	Dr. $40	
Provision for Depreciation	Cr.	$40

A few points should be noted from the above examples:

(a) For clarity, the refinements to express depreciation in average-of-the-period prices are omitted.[224]

(b) If a second or subsequent year of the asset's life is considered, and a historical cost measure is used for the asset-in-use construct, a "retrospective adjustment" must be made to the Provision for Depreciation Account.[225]

(c) With certain entity concepts of capital (namely, the operating capacity concepts), no holding gain would be recognized above. The whole of the $20 in journal-entry No. 1 of the last example would be credited to Capital Maintenance Reserve.[226]

NOTES TO THE TEXT

1 Louis Goldberg, "The Present State of Accounting Theory", *Accounting Review* 38 (July 1963): 469.

2 Among the significant individual contributions can be listed: Edgar O. Edwards and Philip W. Bell, *The Theory and Measurement of Business Income* (Berkeley: University of California Press, 1961); Robert T. Sprouse and Maurice Moonitz, *A Tentative Set of Broad Accounting Principles for Business Enterprises*, Accounting Research Study no. 3 (New York: American Institute of Certified Public Accountants, 1962), with its partner, Maurice Moonitz, *The Basic Postulates of Accounting*, Accounting Research Study no. 1 (New York: American Institute of Certified Public Accountants, 1961); Richard Mattessich, *Accounting and Analytical Methods* (Homewood, Ill.: Richard D. Irwin, Inc., 1964); Norton M. Bedford, *Income Determination Theory: An Accounting Framework* (Reading, Mass.: Addison-Wesley, 1965); Raymond J. Chambers, *Accounting, Evaluation and Economic Behavior* (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1966); Yuji Ijiri, *The Foundations of Accounting Measurement*, (Englewood Cliffs, N.J.: Prentice-Hall,Inc., 1967); and Robert R. Sterling, *The Theory of the Measurement of Enterprise Income* (Lawrence, Kansas: The University of Kansas Press, 1970). However, the major contributions appear through the interchange of ideas fragmented throughout the journals.

3 Delmer P. Hylton, "Current Trends in Accounting Theory", *Accounting Review* 37 (January 1962): 27.

4 Among these classics can be listed: John B. Canning, *The Economics of Accountancy* (New York: The Ronald Press Co., 1929); Stephen Gilman, *Accounting Concepts of Profit* (New York: The Ronald Press Co., 1939); Ananias C. Littleton, *Structure of Accounting Theory*, American Accounting Association Monograph no. 5 (Maddison, Wis.: American Accounting Association, 1958); William A. Paton, *Accounting Theory—With Special Reference to Corporate Enterprise* (New York: The Ronald Press Co., 1922); William A. Paton and Ananias C. Littleton, *An Introduction to Corporate Accounting Standards*, American Accounting Association Monograph no. 5 (Evanston, Ill.: American Accounting Association, 1940); and Thomas H. Sanders, Henry R. Hatfield, and Underhill Moore, *A Statement of Accounting Principles* (New York: American Institute of Accountants, 1938).

Also in this period must be placed the independent efforts of the American Accounting Association, initially through the Executive Committee and later through the various Committees on Concepts and Standards Underlying Corporate Financial Statements, and those of the American Institute of Certified Public Accountants through the *Accounting Research Bulletins*. Grady's work stands as a monument to this age. See Paul Grady, *Inventory of Generally Accepted Accounting Principles for Business Enterprises*, Accounting Research Study no. 7 (New York: American Institute of Certified Public Accountants, 1965).

5 The following writings of this period evidence the emphasis at that time on the research into ways of developing theory rather than the statement of theory: Raymond J. Chambers, "Blueprint for a Theory of Accounting", *Accounting Research* 6 (January 1955): 17–25; Richard Mattessich, "Towards a General and Axiomatic Foundation of Accountancy with an Introduction to the Matrix Formulation of Accounting Systems", *Accounting Research* 8 (October 1957): 328–56; Carl T. Devine, "Research Methodology and Accounting Theory Formation", *Accounting Review* 35 (July 1960): 387–99; Myron J. Gordon, "Scope and Method of Theory and Research in the Measurement of Income and Wealth", *Accounting Review* 35 (October 1960): 603–18; Norton M. Bedford and Nicholas Dopuch, "Research Methodology and Accounting Theory—Another Perspective", *Accounting Review* 36 (July 1961): 351–61; Nicholas Dopuch, "Metaphysics of Pragmatism and Accountancy", *Accounting Review* 37 (April 1962): 251–62; John W. Queenan, "Postulates: Their Place in Accounting Research", *Journal of Accountancy* 114 (August 1962): 29–33; William J. Schrader, "An Inductive Approach to Accounting Theory", *Accounting Review* 37 (October 1962): 645–49; Raymond J. Chambers, "Why Bother with Postulates?" *Journal of Accounting Research* 1 (Spring 1963): 3–15; and Milton H. Spencer, "Axiomatic Method and Accounting Science", *Accounting Review* 38 (April 1963): 310–16.

It will be remembered, also, that this was the period of rethinking of approach amongst research circles of the American Institute of Certified Public Accountants, giving rise to the *Accounting Research Studies* series. See Special Committee on Research Program, "Report of the Committee", *Journal of Accountancy* 106 (December 1958): 62–68.

6 For examples of such developments see n. 2, supra. To these may be added, Committee to Prepare a Statement of Basic Accounting Theory, *A Statement of Basic Accounting Theory* (Evanston, Ill.: American Accounting Association, 1966).

7 It is striking how closely this progression of theory development follows that of the philosophy of scientific discovery in the physical sciences. See William S. Beck, *Modern Science and the Nature of Life* (Harmondsworth, Middlesex: Penguin Books Ltd., 1961).

8 Gordon, "Scope and Method", p. 603.

9 An atmosphere of gloom pervades the profession (practitioners) at present. Compare the turn of the decade "stock-take" articles of 1970 with those of 1960. The position is the same in at least three countries: contrast Herbert H. Lank, "The Accounting Profession—Spokesmen for Free Enterprise", *Canadian Chartered Accountant* 78 (February 1961): 145–50, with Howard I. Ross, "Twilight of the Accountants", *Canadian Chartered Accountant* 96 (January 1970): 27–29; Charles P. Rockwood, "The Changing Image of a Profession", *Journal of Accountancy* 110 (October 1960): 35–43, with Abraham J. Briloff, "The Accounting Profession at the Hump of the Decades", *Financial Analysts Journal* 26 (May-June 1970): 60–67; and Reg S. Gynther, "'Accounting in the Seventies' (or 'The Decline in the Image of Accounting!')", *Chartered Accountant in Australia* 40 (June 1970): 4–11, with Reg S. Gynther, "The Future of the Accountant—and the Accountant of the Future", *Australian Accountant* 37 (July 1967): 373–82. The change in mood is from elation to gloom.

10 Richard A. Johnson, Fremont E. Kast, and James E. Rosenzweig, *The Theory and Management of Systems*, 2nd ed. (New York: McGraw-Hill Book Company, 1963), p. viii.

11 Ibid.

12 Pitirim Sorokin, in his presidential address to the American Sociological Association in 1965 stated:

> if sociology is going to grow as a basic science of sociocultural phenomena, it is bound to pass into a new synthesizing-generalizing phase. . . . stipulating certain conditions, we can reasonably expect a synthesizing sociology, unifying into a rich, logical and empirically valid system, all the sound parts of the existing analytical theories and integrating all the little and "middlerange" informities of today's sociology.

(Pitirim A. Sorokin, "Sociology of Yesterday, Today and Tomorrow", *American Sociological Review* 30 [December 1965]: 833.)

Further, one writer in the area of management sees the trend in his discipline:

> In the Age of Analysis, men were taking knowledge apart, sorting it into manageable portions, and struggling, almost desperately, to keep it in understandable isolated parts. Now, however, the driving force of actual fact is pulling things back together. Man may resist, but he is powerless to hold back the force which is producing the Age of Synthesis.

(James W. Culliton, "Age of Synthesis", *Harvard Business Review* 40 [September-October 1962]: 180.)

It is to be noted that organization theory also has developed from the bureaucratic, technological, human relations and decision-making schools, dealing, as they did, with only parts of the organization, to a concept of systems. See Daniel Katz and Robert L. Kahn, *The Social Psychology of Organizations* (New York: John Wiley & Sons, Inc., 1966), pp. 12–13 and 71–77.

The pattern is also obvious in the physical sciences. See Beck, *Modern Science.*

13 This would approximate some people's definition of "accounting". For example, see Chambers, *Economic Behavior*, pp. 96–99.

14 George R. Catlett, "Sound Accounting Requires a Solid Foundation", *Canadian Chartered Accountant* 82 (January 1963): 32.

15 Ibid. Emphasis added. For support of this proposition, see Eldon S. Hendriksen, *Accounting Theory*, rev. ed. (Homewood, Ill.: Richard D. Irwin, Inc., 1970), p. 102; Devine, "Research Methodology", p. 399; and William J. Vatter, "Postulates and Principles", *Journal of Accounting Research* 1 (Autumn 1963): 183.

16 Determination of what is acceptable to different and often opposing sub-groups of world society has caused the derivation of the governing social activity—the political institutions.

17 Herbert A. Simon, *Administrative Behavior*, 2nd ed. (New York: Macmillan Company, 1961), p. xxiv.

18 Ibid., pp. 80–96, and Harold J. Leavitt, *Managerial Psychology: An Introduction to Individuals, Pairs, and Groups in Organizations*, 2nd ed. (Chicago: University of Chicago Press, 1964), p. 89.

19 Simon, *Behavior*, p. 79. Also see James G. March and Herbert A. Simon, *Organizations* (New York: John Wiley & Sons, Inc., 1958), p. 139.

20 He will only accept information up to the point where he is *satisficing* and will ignore further information which may enable him to *maximize*. See Simon, *Behavior*, p. xxiv.

21 Just what type of information and decision the accountant is concerned with is a matter of debate touched on only indirectly in this study. For extreme and compromise views see Richard W. Leftwich, *A Critical Analysis of Some Behavioural Assumptions Underlying R. J. Chambers' "Accounting, Evaluation and Economic Behaviour"*, University of Queensland Department of Accountancy Paper, vol. I, no. 7 (St. Lucia: University of Queensland Press, 1969), p.217.

22 It is argued that there exists only one prime or top-level goal to each discipline which is found in the environmental want. This, of course, does not prevent the discovery of subsidiary lower-level goals which are fragmentations of the top-level goal. See John E. Field, "Toward a Multi-Level, Multi-Goal Information System", *Accounting Review* 44 (July 1969): 594.

23 Fortunately, there appears to be general agreement in the literature regarding this broad statement of objective. See Jacob G. Birnberg, "An Information Orientated Approach to the Presentation of Common Shareholders' Equity", *Accounting Review* 39 (October 1964): 963; Errol R. Iselin, *The Objectives of Accounting in an Accounting Theory Based on Deductive Methodology* University of Queensland Department of Accountancy Paper, vol. 2, no. 1 (St Lucia: University of Queensland Press, 1971), pp. 10 and 17, Chambers, *Economic Behavior*, p. 164; Leftwich, *Analysis*, p. 217; and Committee to Prepare a Statement of Basic Accounting Theory, *A Statement*, p. 4.

24 This is the distinction drawn in functional analysis in sociology. See Joyce O. Hertzler, *Society in Action: A Study of Basic Social Processes* (New York: The Dryden Press, 1954), pp. 5–10, and Dorothy Emmet, *Function, Purpose and Powers: Some Concepts in the Study of Individuals and Societies* (London: Macmillan and Co. Ltd., 1958), p. 95. For demonstrations of these distinctions in accounting, refer to William B. Barrett, "A Functional Approach to Accounting", *Accounting Review* 43 (January 1968): 105–112, and Stephen H. Penman, "The Objectives of Accounting and the Functions Derived Therefrom" (unpublished Honours paper, University of Queensland, 1969).

25 E.McL. Holmes, "Accounting and Information Science", in *Papers Presented at A.A.U.T.A. Conference 1966* (Australasian Association of University Teachers of Accounting, 1966), p. 123.

26 Ibid., p. 126.

27 Claude E. Shannon and Warren Weaver, *The Mathematical Theory of Communication* (Urbana, Ill.: University of Illinois Press, 1949), p. 98.

28 The operationalists propose "the definition of a construct in terms of the operations performed in its measurement rather than in terms of its properties or its general nature" (Floyd A. Beams, "Indications of Pragmatism and Empiricism in Accounting Thought", *Accounting Review* 44 [April 1969]: 385). Others prefer a more conceptual approach to definition. For a fuller discussion of operational and constitutive approaches to definition, see Henry Margenau, "Interpretations and Misinterpretations of Operationalism", in *The Validation of Scientific Theories*, ed. Phillip G. Frank (Boston: The Beacon Press, 1954); and, for an application to the accounting context, see Bedford, *Income Theory*, pp. 7–8, and Ian Tilley, "Some Methodological Considerations in Establishing the Science of Accounting" (unpublished Honours thesis, Department of Accountancy, University of Queensland, 1969), pp. 50–55. Operationalism is traditionally attributed to Percy W. Bridgman, *The Logic of Modern Physics* (New York: The Macmillan Company, 1927).

29 Gerald E. Nichols, "On the Nature of Management Information", *Management Accounting* 50 (April 1969): 11; Sterling, *Enterprise Income*, p. 46; and Committee to Prepare a Statement of Basic Accounting Theory, *A Statement*, pp. 7–10.

30 Thomas H. Williams and Charles H. Griffin, "On the Nature of Empirical Verification in Accounting", *Abacus* 5 (December 1969): 152. Emphasis added.

31 In order to give some indication of the principles in stage III, an Epilogue, which outlines the extension of the stages I and II developed in the body of the study, is provided. See infra, pp. 235–36.

32 The distinction between these two terms will become clear in section 3.

33 William J. Goode and Paul K. Hatt, *Methods of Social Research* (New York: McGraw-Hill Book Company, Inc., 1952), p. 43.

34 Ibid.

35 Such a view is held widely in the literature. See for example Raymond J. Chambers, "A Scientific Pattern for Accounting Theory", *Australian Accountant* 25 (October 1955): 33–39; Robert K. Mautz, "Accounting as a Social Science", *Accounting Review* 38 (April 1963): 317–25; and Spencer, "Axiomatic Method", pp. 310–16.

36 E. Colin Park, "Thought Processes in Creative Accounting", *Accounting Review* 33 (July 1958): 441.

37 Robert R. Sterling, "On Theory Construction and Verification", *Accounting Review* 45 (July 1970): 445; Spencer, "Axiomatic Method", p. 311; and Colin Cherry, *On Human Communication: A Review, A Survey and A Criticism* (New York: The Technology Press of Massachusetts Institute of Technology and John Wiley & Sons Inc., 1957), p.89. Cherry distinguishes between the meta-language—"the natural human language"—and the object-language—"the scientific language". We are concerned here with the partial construction of the object-language of the accounting scientist.

38 Iselin, *Objectives*, pp. 5–10.

39 Peter Caws, "Definition and Measurement in Physics", in *Measurement: Definitions and Theories*, ed. C. West Churchman and Philburn Ratoosh (New York: John Wiley & Sons, Inc., 1959), p. 3.

40 Ernst Cassirer, "Einstein's Theory of Relativity", supplement to *Substance and Function* (New York: Dover Publications, 1923), p. 358.

41 Caws, "Definition," p. 8. For further illustration of this point, refer to Hempel's famous "hage" example. Carl G. Hempel, "Fundamentals of Concept Formation in Empirical Science", *International Encyclopedia of Unified Science*, vol. 2, no. 7 (Chicago: The University of Chicago Press, 1952), p. 46, and Sterling, "Construction", p. 455. The relationship between a construct and a measure is that of principal to surrogate. See Ijiri, *Foundations*, pp. 4–6 and 22.

42 See for example Charles W. Morris, *Foundations of the Theory of Signs* (Chicago: University of Chicago Press, 1938), and Rudolf Carnap, *Introduction to Semantics* (Cambridge, Mass.: Harvard University Press, 1948), pp. 8–11.

43 Sterling, "Construction", pp. 446–47.

44 Hempel, "Concept Formation", p. 15, and Spencer, "Axiomatic Method", p. 311.

45 For a fuller discussion of this distinction see Carl G. Hempel, *Aspects of Scientific Explanation* (New York: The Free Press, 1965), p. 181, and Peter Caws, *The Philosophy of Science: A Systematic Account* (Princeton, N.J.: D. Van Nostrand Company, Inc., 1965), p. 46.

46 This process is elaborated upon in Carl G. Hempel, *Philosophy of Natural Science* (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1966), p. 30, and Williams and Griffin, "Verification", pp. 143–78.

47 Hempel, *Philosophy*, pp. 85–86.

48 Richard Robinson, *Definition* (London: Oxford University Press, 1950), gives a detailed discussion and criticism of this conventional classification.

49 This is the most common classification science chooses. See supra, p. 200.

50 See, for example, Ananias C. Littleton, *Structure of Accounting Theory*, American Accounting Association Monograph no. 5 (Columbus, Ohio: American Accounting Association, 1953), p. 9, and William L. Raby, "The Two Faces of Accounting", *Accounting Review* 35 (July 1959): 458. The traditional model implicitly assumes away this responsibility by retention of a closed model of reporting historical costs for all decisions. Chambers, *Economic Behavior*, pp. 154–56, in differentiating between "information relevant in general" and "information relevant in particular", explicitly excludes the latter from the domain of accounting, maintaining that "specific ends and the ranking of specific ends are beyond enquiry" (p. 56), and accounting information should be neutral, "uncoloured by any presupposition regarding its specific use" (p. 147). For a further discussion of this topic, see Iselin, *Objectives*, pp. 22–29.

51 Sterling, *Enterprise Income*, p. 54.

52 Paton's classical statement of the functions of accounting often acknowledged, includes only these

two functions. See William A. Paton, *Essentials of Accounting* (New York: The Macmillan Company, 1949), p. 1.

53 Park, "Thought Processes", p. 441. Support of this conclusion is also to be found in Kermit D. Larson, "Implications of Measurement Theory on Accounting Concept Formulation", *Accounting Review* 44 (January 1969): 45–47; Sidney S. Alexander, "Income Measurement in a Dynamic Economy", rev. David Solomons, in *Studies in Accounting Theory*, ed. W. T. Baxter and Sidney Davidson, 2nd ed. (London: Sweet & Maxwell Ltd., 1962), p. 128; Sterling, *Enterprise Income*, pp. 50–56; and Bedford, *Income Theory*, pp. 1–2 and 5–7.

54 Nichols, "Management Information", p. 9.

55 That accounting data is, *inter alia*, behavioural in nature is widely acknowledged. See Edwin H. Caplan, "Behavioral Assumptions of Management Accounting", *Accounting Review* 41 (July 1966): 496; Chambers, *Economic Behavior*, p. 14; and Thomas R. Hofstedt and James C. Kinard, "A Strategy for Behavioral Accounting Research", *Accounting Review* 45 (January 1970), 38.

56 Clyde H. Coombs, *A Theory of Data* (New York: John Wiley & Sons, Inc., 1964).

57 Coombs maintains that *data* arises at this point. Others refer to data as the recorded observation in phase A. This distinction is not critical to the present discussion.

58 Coombs, *Data*, p. 5.

59 Ibid.

60 One accounting theorist, in "referring to the perspective of the accountant who uses constructs in making observations from experience and in accumulating data", implicitly adopts the framework of the theory of data. Beams, "Accounting Thought", p. 385, identifies three factors in the construction process—the *referent* ("the subject matter of accountancy"), the *construct*, and the *data*. These factors approximate the "potential observations", the "recorded observations", and the "data" respectively in figure 2.

61 Supra., p. 202.

62 This of course, is a matter for empirical research. See infra., pp. 208–209.

63 Bedford, *Income Theory*, p. 5.

64 Supra., p. 201.

65 There are other methods of arriving at "truth" which have been rejected as foreign to *scientific* methodology. See William P. Montague, *The Ways of Knowing* (London: Allen & Unwin, Ltd., 1925).

66 The classical example is the revolt of Bacon (in his *Novum Organum*) and Galileo against the rationalism of Aristotle, Plato, and Descartes. It later fell to Boyle, Newton, and Locke to marry the two approaches.

67 Hempel, "Concept Formation", p. 37.

68 Devine, "Research Methodology", p. 392.

69 Bertrand Russell, *Human Knowledge, Its Scope and Limits* (New York: Simon & Schuster, 1948), p. 311. Further support is found in Andreas G. Papandreou, *Economics as a Science* (New York: J. B. Lippincott Company, 1958), p. 7; Stephan Körner, *Experience and Theory* (London: Routledge and Kegan Paul, 1966); and Hans Reichenbach, "Rationalism and Empiricism: An Enquiry into the Roots of Philosophical Error", in *Modern Philosophy of Science*, ed. Hans Reichenbach (London: Routledge and Kegan Paul, 1959).

70 For a discussion of empiricism in science, see Karl R. Popper, *The Logic of Scientific Discovery* (London: Hutchinson & Co., Ltd., 1959); Marian Przelecki, *The Logic of Empirical Theories* (London: Routledge and Kegan Paul, 1969); and John Anderson, *Studies in Empirical Philosophy* (Sydney: Angus and Robertson Ltd., 1962). Verification in science is discussed by P. Henry Van Laer, *Philosophico-Scientific Problems* (Pittsburg Pa.: Duquesne University Press, 1953), pp. 28–58, and Philipp G. Frank, *The Validation of Scientific Theories* (Boston: The Beacon Press, 1954).

71 Larson, "Concept Formulation", p. 41.

72 Henry Margenau, *The Nature of Physical Reality: A Philosophy of Modern Physics* (New York: McGraw-Hill Book Company, Inc., 1950), p. 72.

73 Rudolf Carnap, *Logical Foundations of Probability* (Chicago: University of Chicago Press, 1962), p. 3, calls this process "explication" and the resultant construct, the "explicatum". Hence he calls a concept the "explicandum" in the process. A further elaboration of the process is contained in Leonard K. Nash, *The Nature of the Natural Sciences* (Boston: Little, Brown and Company, 1963), pp. 6–28.

74 Caws, "Definitions", p. 9. It is acknowledged that the distinction between a construct and a concept is rather hazy and in fact some writers (for example, Margenau) fail to make the distinction. Larson, "Concept Formulation", p. 42, however, indicates that the distinction is useful in the accounting context.

75 Margenau, *Reality*, p. 60. The logical rules are inductive at the perceptual level and deductive at the conceptual and constructual levels.

76 Richard Schlegel, *Completeness in Science* (New York: Appleton-Century-Crofts, Inc., 1967), p. 14.

77 Supra., p. 202. Two empirical propositions may be: "diamond scratches glass"; "glass scratches lead". From this an analytical proposition that diamond scratches lead may be deduced. While this may be verified by empirical experimentation, it is not necessary to do so if firstly the original observations have been verified and secondly the deductive process is logically correct.

78 Margenau, *Reality*, pp. 99–100.

79 Bridgman, *Logic*, p. 83.

80 Einstein in his criticism of classical mechanics insisted that scientific observations are only

relative. No longer can the scientist talk of facts as did Boyle, Newton, and Locke.

81 Margenau, *Reality*, p. 52.

82 Daniel Katz, "The Functional Approach to the Study of Attitudes", in *Psychology in Administration*, ed. Timothy W. Costello and Sheldon S. Zalkind (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1963), p. 253.

83 Jean Piaget, *The Mechanics of Perception* (London: Routledge and Kegan Paul, 1969), p. 362.

84 The reader is referred to Melvin H. Marx, ed., *Learning: Processes* (London: The Macmillan Company, 1969), and Ernest R. Hilgard, *Theories of Learning* (New York: Appleton-Century-Crofts, 1948). There appears to be dispute in the area of learning theory. See Henry Goldstein, David L. Krantz, and Jack D. Rains, *Controversial Issues in Learning* (New York: Appleton-Century-Crofts, 1965).

85 This is dealt with in O. J. Harvey, David E. Hunt, and Harold M. Schroder, *Conceptual Systems and Personality Organization* (New York: John Wiley & Sons, Inc., 1961).

86 This is the nomenclature adopted by W. J. Brogen, "Sensory Preconditioning", *Journal of Experimental Psychology* 25 (October 1939): 323–32.

87 Norwood R. Hanson, *Patterns of Discovery* (Cambridge: Cambridge University Press, 1958), p. 19.

88 This, admittedly, does not present a complete statement of all the factors affecting perception. For a discussion of the physiological, temporal, and spatial as well as the phenomenological and psychological aspects, see Floyd H. Allport, *Theories of Perception and the Concept of Structure* (New York: John Wiley & Sons, Inc., 1955).

89 For example, see David Green, Jr., "Absolutism and Accounting Theory", *Aspects of Contemporary Accounting*, University of Florida Accounting Series, no. 4 (Gainesville, Florida: Department of Accounting, University of Florida, 1966), pp. 1–11; Raymond J. Chambers, "A Matter of Principle", *Accounting Review* 41 (July 1966): 449–50; Raymond J. Chambers, "Conventions, Doctrines and Commonsense", *Accountants' Journal* 41 (February 1964): 182–87; and Herbert F. Taggart, "Sacred Cows in Accounting", *Accounting Review* 28 (July 1953); 313–19.

90 Supra., p. 196.

91 Piaget, *Perception*, p. 365.

92 Ibid., pp. 365–66.

93 Ibid., p. 366.

94 Margenau, *Reality*, p. 105.

95 Supra., pp. 205–206.

96 Empirical support for this perception can be found in the speculative nature of the contributions to the Age of Analysis and Construction listed on p. 240. For example, Tilley, *Methodological Considerations*, p. 20, points out that while Chambers stands out as a forceful advocate of scientific method, he maintains that "the only tests to which theoretical propositions may be subjected are tests of the validity of the premises and tests of the validity of the reasoning" (Chambers, "Scientific Pattern", p. 432). His *Accounting, Evaluation and Economic Behavior*, applauded as a milestone in theory development (and rightly so), is largely speculative, lacking empirical confirmation and in fact relying upon areas of controversy in economics and psychology (see, Leftwich, *Analysis*). Edwards and Bell's contribution is also of this tone, relying upon theorizings of the Fisherian school in economics. Sterling's book is devoted to the analysis of a very restricted situation (the wheat-trader model) without empirical supporting evidence.

97 There is an increasing demand in the accounting literature for such activity. See, for example, John T. Wheeler, "Accounting Theory and Research in Perspective", *Accounting Review* 45 (January 1970): 10; Ray Ball and Philip Brown, "On Empirical Evaluation of Aecounting Income Numbers", *Journal of Accounting Research* 6 (Autumn 1968): 159–60; Committee to Prepare a Statement of Basic Accounting Theory, *A Statement*, pp. 69–71; Devine, "Research Methodology", pp. 395–97; and Mautz, "Social Science", pp. 317–25.

98 Such a progression in the physical sciences has already been referred to (supra., p. 205). It is also especially noticeable in the area of psychology and appears in economics and the other social sciences.

99 Supra., pp. 207–208.

100 It appears that there has been little or no attempt to date to discover (empirically) the goals and decisions of users of accounting information. Robert C. Culpepper, "A Study of Some Relationships between Accounting and Decision-Making Processes", *Accounting Review* 45 (April 1970): 322, makes the same observation.

101 Some work has been done in this area. See William H. Beaver, John W. Kennelly, and William M. Voss, "Predictive Ability as a Criterion for the Evaluation of Accounting Data", *Accounting Review* 43 (October 1968): 675–83; and Culpepper, "Decision-Making", pp. 322–32. Culpepper (p. 323) gives an extensive bibliography of research into the effects of accounting *methods* on decisions. Many of these research activities, with their excessive emphasis on operationalism, lack the background of theoretical abstraction. A more satisfying treatment of the relationships between accounting inputs and decisions is found in Yuji Ijiri, Robert K. Jaedicke, and Kenneth E. Knight, "The Effects of Accounting Alternatives on Management Decisions", in *Research in Accounting Measurement*, ed. Robert K. Jaedicke, Yuji Ijiri, and Oswald Nielsen (n.p.: American Accounting Association, 1966), pp. 186–99, and Ijiri, *Foundations*, pp. 148–65.

102 Beaver *et al.*, "Predictive Ability", p. 679. The writer, at this stage, would substitute for the surrogate term "measure" its principal, "construct".

103 Such is the conclusion of the abstraction of George H. Sorter, "An 'Events' Approach to Basic Accounting Theory", *Accounting Review* 44 (January 1969): 12–19. Sorter proposes empirical studies to support his position.

104 Chambers, *Economic Behavior*, p. 103. This is Chambers' construction of the required information input. It has yet to find empirical support.

105 Some research problems which accounting scientists face are dealt with in Robert K. Mautz and K. Fred Skousen, "Some Problems in Empirical Research in Accounting", *Accounting Review* 44 (July 1969): 447–56, and Jacob G. Birnberg and Raghu Nath, "Laboratory Experimentation in Accounting Research", *Accounting Review* 43 (January 1968): 38–45.

106 Approaches to experimentation are given by Carlo L. Lastrucci, *The Scientific Approach* (Cambridge, Mass.: Schenkman Publishing Company Inc., 1963), and Nash, *Natural Sciences*, pp. 138–69. A number of accounting researchers have also produced experimental models. See Hofstedt and Kinard, "A Strategy", pp. 38–54, and Robert E. Jensen, "An Experimental Design for Study of Effects of Accounting Variations in Decision Making", *Journal of Accounting Research* 4 (Autumn 1966): 224–38.

107 Coombs, *Data*, p. 4.

108 Larson, "Concept Formulation", p. 39. Larson (p. 40) quotes Robert K. Mautz, "The Place of Postulates in Accounting", *Journal of Accountancy* 19 (January 1965): 47, in support.

109 Alternatively, the terms, "value", "worth", "financial state", or "financial position" could be assigned to this basic financial accounting construct. The nomenclature is of little importance: an understanding of the epistemological processes is of great importance.

110 This approach to reporting has been suggested by Arthur C. Nichols and Dennis E. Grawoig, "Accounting Reports with Time as a Variable", *Accounting Review* 43 (October 1968): 632.

111 Support for the contention of the interdependency of income and wealth is found in Irving Fisher, *The Theory of Interest* (New York: The Macmillan Co., 1930), pp. 1–15, and Alfred Marshall, *Principles of Economics* (London: Macmillan and Co. Ltd., 1920), pp. 56–57.

112 A recent contribution is in disagreement with this assumption. See Sorter, "Events Approach", pp. 12–19. Empirical research (which Sorter proposes) will test alternative assumptions. Orace Johnson, "Towards an 'Events' Theory of Accounting", *Accounting Review* 45 (October 1970): 641–53, further develops Sorter's ideas.

113 Keith Shwayder, "The Capital Maintenance Rule and the Net Asset Valuation Rule", *Accounting Review* 45 (April 1969): 304.

114 For the distinction between semantical and syntactically-derived constructs, see supra., p. 202.

115 The "construct diagram" in figure 4 is similar to those presented in Margenau, *Reality*, pp. 85, 93, and 106. Margenau's distinction between the "P-field" (the environment of sensations) and the "C-field" (indicating the abstractions in the observer's mind) is utilized. The division between the two fields is called the "P-line" and environmental sensations observed are numbered, P1, P2, P3 . . . Pn. The designations "P-field", "C-field", and "P-line" are abbreviations for "Perception field", "Construction field" and "Perception line" respectively.

116 Assets and capital are referred to as "concepts" to allow for further refinement into the construction level when further development is undertaken. See supra., p. 205. for the distinction between "construct" and "concept".

117 The decomposition of income into these two "sub-concepts" has been proposed by Shwayder, "Capital and Asset Rule", pp. 304–16, and further clarified by Reg S. Gynther, "Capital Maintenance, Price Changes, and Profit Determination", *Accounting Review* 45 (October 1970): 712–30. Shwayder refers to the "capital maintenance rule" and the "net asset valuation rule" from a measurement standpoint. The writer prefers a more conceptual approach to the definition of the two aspects in order to highlight the reasons for differences in perception.

118 The reader will discern the circulatory imperfection in assigning these designations to the environmental sensations. It would be preferred to assign the independent symbols, P_1 and P_2, to these as the terms "resources" and "investment" are already "concepts"—and thus "charged". Albeit, it is felt that the reader needs to have sor e indication as to just what in the environment is being observed. It will be noted that in figures 5–7 (in ra., pp. 212, 217, 219), the designations of "resources" and "investment" are given to percepts.

119 Bedford, *Income Theory*, p. 10.

120 Maurice C. Kaplan and Daniel M. Reaugh, "Accounting Reports to Stockholders and the S.E.C.", *Accounting Review* 13 (September 1938): 206.

121 In relation to capital concepts, this conclusion has been established by Reg. S. Gynther, "Accounting Concepts and Behavioral Hypotheses", *Accounting Review* 42 (April 1967): 274–90. There seems to be no attempt in the literature, however, to apply the conclusion to net asset concepts.

122 James C. Bonbright, *The Valuation of Property* (New York: McGraw-Hill Book Company, Inc., 1937), 16. While Bonbright here refers to "sale price", two market prices are in fact evident: market price can be either sale price or buying price. See infra., p. 214.

123 This treatment of asset concepts is similar to the analysis of Edwards and Bell, *Business Income*, pp. 71–73 and 81–82, who draw the dichotomy from a discussion of "production moments" related to operations, and "holding intervals" related to market price change over time.

124 A criticism of many of the constructs appears in Stephen H. Penman, "What Net Asset Value?—An Extension of a Familiar Debate", *Accounting Review* 45 (April 1970): 333–46, and L. R. Amey, *The Efficiency of Business Enterprises* (London: George Allen and Unwin Ltd., 1969), pp. 68–94.

125 Supra., pp. 207–208.

126 Supra., pp. 208–209.

127 Edwards and Bell, *Business Income*, pp. 74–79.

128 Ibid., pp. 10–11 and 73–74. Edwards and Bell's original contribution has received wide acceptance

in the literature. See Sprouse and Moonitz, *Principles*, pp. 17 and 29; Committee on Concepts and Standards—Inventory Measurement, "A Discussion of Various Approaches to Inventory Measurement", *Accounting Review* 39 (July 1964): 700–14; Committee on Concepts and Standards—Long-Lived Assets, "Accounting for Land, Buildings, and Equipment", *Accounting Review* 39 (July 1964): 693–99; and 1964 Concepts and Standards Research Committee, "The Realization Concept", *Accounting Review* 40 (April 1965): 312–22.

129 Edwards and Bell, *Business Income*, pp. 26 and 88–98.

130 F. Kenneth Wright, "Depreciation and Obsolescence in Current Value Accounting", *Journal of Accounting Research* 3 (Autumn 1965): 167–81.

131 Wright, "Capacity for Adaptation", p. 76.

132 Committee on Concepts and Standards—Inventory Measurement, "Inventory Measurement", pp. 706–708.

133 Committee on Concepts and Standards—Long-Lived Assets, "Land, Buildings, and Equipment", p. 695.

134 Committee on Concepts and Standards Underlying Corporate Financial Statements, "Accounting and Reporting Standards for Corporate Financial Statements, in *Accounting and Reporting Standards for Corporate Financial Statements and Preceding Statements and Supplements* (Iowa City, Iowa: American Accounting Association, n.d.) p. 3.

135 Sprouse and Moonitz, *Principles*, p. 29.

136 Robert L. Dickens and John O. Blackburn, "Holding Gains on Fixed Assets: An Element of Business Income?" *Accounting Review* 39 (April 1964): 315–17.

137 Kenneth W. Lemke, "Assett Valuation and Income Theory", *Accounting Review* 41 (January 1966): 35–37.

138 Philips, "Revolution", p. 701. For a further discussion of Philips' construct, see Penman, "Net Asset Valuation", pp. 335 and 336–37.

139 Some so-called neutral theories have been developed. Louis Goldberg, *An Inquiry into the Nature of Accounting*, American Accounting Association Monograph, no. 7 (n.p.: American Accounting Association, 1965), pp. 162–74, has developed the "commander theory"; William J. Vatter, *The Fund Theory of Accounting and Its Implication for Financial Reports* (Chicago: University of Chicago Press, 1947), the "fund theory"; and Waino W. Suojanen, "Accounting Theory and the Large Corporation", *Accounting Review* 29 (July 1954): 391–98, has proposed what has been designated as the "enterprise theory". However, the examination of epistemological processes has indicated that, in developing a construct (of capital), it is impossible to be neutral. These theories, in application, do adopt one of the concepts presented above.

140 For a further discussion of the two "theories", see Gynther, "Behavioral Hypotheses"; Reg S. Gynther, *Accounting for Price-Level Changes—Theory and Procedures* (Oxford: Pergamon Press, 1966), pp. 41–63; and Hendriksen, *Accounting Theory*, pp. 495–501. The classic debate surrounding the two concepts was between Professors Pigou and Hayek. Professor Hicks, to some extent, pointed out that the debators were arguing at cross-purposes and hence could not be reconciled. See R. H. Parker and G. C. Harcourt, *Readings in the Concept and Measurement of Income* (Cambridge: Cambridge University Press, 1969), pp. 123–38.

141 Some writers see another environmental phenomenon which affects capital. Shwayder, "Capital and Asset Rule", pp. 306–307, notes that investors have a time preference for cash because of interest factors and therefore capital should be time adjusted. This phenomenon is not built in here because it does not appear in any financial accounting model presented in the literature.

142 A full discussion of each construct appears in Reg S. Gynther, *Accounting for Price Changes—Theory and Practice*, Society Bulletin no. 5 (Melbourne: Accountants Publishing Company, Ltd., 1968), and Gynther, "Capital Maintenance", pp. 713–17.

143 Gynther, "Behavioral Hypotheses", examines this effect and suggests the behavioural backgrounds which produce each construct.

144 John R. Hicks, *Value and Capital*, 2nd ed. (London: Oxford University Press, 1946), p. 172. Many have implied from this definition a construct of economic value. This is not intended here.

145 See, for example, Henry C. Simons, *Personal Income Taxation* (Chicago: The University of Chicago Press, 1938), p. 49; Robert M. Haig, "The Concept of Income—Economic and Legal Aspects", in *American Economic Association Readings in the Economics of Taxation*, ed. Richard R. Musgrave and Carl S. Shoup (Homewood, Ill.: Richard D. Irwin, Inc., 1959), p. 59; Sidney S. Alexander, "Income Measurement in a Dynamic Economy", rev. David Solomons, in *Studies in Accounting Theory*, ed. W. T. Baxter and Sidney Davidson, 2nd ed. (London: Sweet and Maxwell, Ltd., 1962), p. 127; Sterling, *Enterprise Income*, pp. 7–12; and Gordon, "Income and Wealth", p. 606.

146 Shwayder, "Capital and Asset Rule", p. 304. Again, the writer would substitute "asset-in-use construct" for "net asset valuation rule". Shwayder (pp. 309–15) gives an example demonstrating his conclusion.

147 Gynther, "Capital Maintenance", pp. 721–22; Gynther (p. 722) also provides a supporting example.

148 Edwards and Bell, *Business Income*, pp. 80–88.

149 Ibid., pp. 88–97 and 111–15. See also Philip W. Bell, "The Measurement of Business Income", in *Modern Accounting Theory*, ed. Morton Backer (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1966), pp. 91–98.

150 Measurement theory demands classification as a prerequisite of scaling: see Coombs, *Data*, pp. 1–6; Mattessich, *Analytical Methods*, pp. 57–63; and Raymond J. Chambers, "Measurement in

Accounting", *Journal of Accounting Research* 3 (Spring 1965): 34–35.

151 Coombs, *Data*, p. 1.

152 Chambers, "Measurement in Accounting", p. 34.

153 In fact, the inverse relationship only holds true when temperature is held constant. If temperature is recognized as a variable and then plotted in psychological space, a three-dimensional matrix based on new relationships must be developed.

154 Double-entry book-keeping, which is founded on this equality, is traditionally attributed to Pacioli, *Summa de Arithmetica, Geometrica, Proportioni et Proportionalita* (1494). Mattessich, *Analytical Methods*, p. 101, suggests evidence of the two-entry system prior to Pacioli.

155 The dichotomy of the asset construct into asset-in-use constructs and asset-in-exchange constructs may suggest a further dimension. However it is to be remembered that the relationship between the two asset constructs is one of proper subset to set and hence this dichotomy does not affect our basic relationship. See supra, p. 222.

156 These time relationships can be expanded to present a more detailed matrix of the accounting structure and a mathematical method of recording accounting data. See Mattessich, "Matrix Formulation", pp. 328–56.

157 Mattessich, *Analytical Methods*, p. 20.

158 Ibid. Mattessich at a later stage (p. 34) recognizes the third dimension of the element.

159 Ibid., p. 26.

160 This is the designation which Mattessich gives for the relationship. See ibid., p. 27.

161 Ijiri, *Foundations*, p. 105.

162 Ibid., pp. 105–108.

163 Ibid., p. 102.

164 Ibid., pp. 80–84.

165 Ibid., p. 104.

166 For further description of causal double-entry see ibid., pp. 101–105 and 108–110.

167 It appears to the writer that a causal double-entry system could be built also on the diagonal between the horizontal asset-capital relationship and the vertical capital vector. This seems an obvious extension of Ijiri's ideas to give another data matrix.

168 Much of that which follows is based upon Baruch Lev, *Accounting and Information Theory*, Studies in Accounting Research no. 2 (Evanston, Ill.: American Accounting Association, 1969), and Lucy C. Lee and Norton M. Bedford, "An Information Theory Analysis of the Accounting Process", *Accounting Review* 45 (April 1969): 256–75.

169 The reader who is not familiar with information theory will derive a basic knowledge from Shannon and Weaver, *Communication* (the classic text); Stanford Goldman, *Information Theory* (New York: Prentice-Hall, Inc., 1953); and Norman Abramson, *Information Theory and Coding* (New York: McGraw-Hill Book Company, 1963).

170 Henri Theil, *Economics and Information Theory* (Chicago: Rand McNally and North Holland Publishing Co., 1967), and Henri Theil, *On the Use of Information Theory Concepts in the Analysis of Financial Statements,* Report 6722 of the Centre for Mathematical Studies in Business and Economics (Chicago: University of Chicago, 1967).

171 See Lev, *Information Theory*, pp. 1–17, for a fuller description.

172 Lee and Bedford, "Information Theory Analysis", pp. 258–63.

173 Mattessich, *Analytical Methods*, pp. 34 and 94–95.

174 This analysis is an adaptation of Lee and Bedford, "Information Theory Analysis", pp. 256–57. For a more detailed mathematical treatment, see Yuji Ijiri, *Management Goals and Accounting for Control* (Amsterdam: North-Holland Publishing Company, 1965), pp. 82–89.

175 Although excluded from the main body of the study, an outline of the substance of stages II and III is given in the Epilogue.

176 For a discussion of operationalsim, particularly as applied to the accounting context, see Stephen H. Penman, "Discovery Patterns in Theory Construction" (unpublished paper, Department of Accountancy, University of Queensland, 1970), pp. 6–7 and 27–31.

177 Margenau, "Operationalism", p. 40.

178 Henri Margenau, "Philosophical Problems Concerning the Meaning of Measurement in Physics", in *Measurement: Definitions and Theories*, ed. C. West Churchman and Philburn Ratoosh (New York: John Wiley & Sons, Inc., 1959), p. 163.

179 Supra., pp. 204–206.

180 Thomas H. Williams and Charles H. Griffin, "Income Definition and Measurement: A Structural Approach", *Accounting Review* 42 (October 1967): 642 and 649.

181 Supra., pp. 198–99.

182 Nichols, "Management Information", pp. 10–11.

183 Sterling, *Enterprise Income*; pp. 65–71 and 95–100, summarizes the disputes regarding the nominal scale, "fundamental" and "derived" measurements, the operationalist and non-operationalist debate regarding measurement, and the relationship of measurement, prediction and retroduction. Margenau, *Reality*, p. 22, discusses topological and metric measurement.

184 Stanley S. Stevens,"Measurement, Psychophysics and Utility", in *Measurement: Definitions and Theories*, ed. C. West Churchman and Philburn Ratoosh (New York: John Wiley & Sons, Inc., 1959) p. 19. Other definitions are found in Norman R. Campbell, *What is Science?* (New York: Dover Publications, Inc., 1952), p. 110; and Caws, "Definition", p. 5.

185 Stanley S. Stevens, "On the Theory of Scales and Measurement", *Science* 103 (June 1946): 677–80. See also Warren S. Torgenson, *Theory and Methods of Scaling* (New York: John Wiley & Sons, Inc., 1958), for a further discussion on scaling techniques.

186 For a discussion of measurement scales in the accounting literature, see Mattessich, *Analytical Methods*, pp. 57–77; Chambers, "Measurement in Accounting", pp. 35–37; Chambers, *Economic Behavior*, pp. 84–89; Harold Bierman, Jr., "Measurement and Accounting," *Accounting Review* 38 (July 1963): 501–507; and Ronald S. Lim, "The Mathematical Propriety of Accounting Measurements and Calculations", *Accounting Review* 41 (October 1966): 642–43.

187 There is some dispute as to whether the nominal scale is, in fact, a measurement scale. See Sterling, *Enterprise Income*, pp. 69–71.

188 Raymond J. Chambers, "Measurement and Objectivity in Accounting", *Accounting Review* 39 (April 1964): 267, takes this stand.

189 Some have suggested that accounting should deal with other than economic constructs. See Norton M. Bedford and Nicholas Dopuch "The Emerging Theoretical Structure of Accounting", in *Readings in Accounting Theory*, ed. Paul Garner and Kenneth B. Berg (Boston: Houghton Mifflin Company, 1966), pp. 64–76. Obviously, if accounting is defined to encompass psychological, behavioural, cultural, and other aspects, a different measuring unit is necessary.

190 Sterling, *Enterprise Income*, pp. 30–34, and Robert T. Sprouse, "The Measurement of Financial Position and Income: Purpose and Procedure", in *Research in Accounting Measurement*, ed. Robert K. Jaedicke, Yuji Ijiri, and Oswald Nielsen (n.p.: American Accounting Association, 1966), pp. 109–11.

191 Supra, pp. 213–14.

192 Margenau, "Measurement in Physics", pp. 136 and 165.

193 C. West Churchman, "Why Measure?" in *Measurement: Definition and Theories*, ed. C. West Churchman and Philburn Ratoosh (New York: John Wiley & Sons, 1959), pp. 88–92.

194 For further discussion of measurement in accounting refer to Richard H. Homburger, "Measurement in Accounting", *Accounting Review* 36 (January 1961): 94–99; Bierman, "Measurement and Accounting", p. 501; Chambers, "Measurement and Objectivity", pp. 264–74; Chambers, "Measurement in Accounting", pp. 32–62; Chambers, *Economic Behavior*, pp. 78–102; Mattessich, *Analytical Methods*, pp. 52–85; Ijiri, *Foundations*, pp. 3–31; and Robert K. Jaedicke, Yuji Ijiri, and Oswald Nielsen, *Research in Accounting Measurement* (n.p.: American Accounting Association, 1966).

195 Nichols, "Management Information", p. 11.

196 For a wider description of the data-processing activity, see Gene Dippel and William C. House, *Information Systems* (Glenview, Ill.: Scott, Foresman and Company, 1969), pp. 1–135.

197 It should be pointed out that none of these techniques imply a special method. Each could be adapted to manual, machine, or computer methods.

198 Ijiri, *Management Goals*, pp. 89–91; Mattessich, *Analytical Methods*, pp. 85–87; and Mattessich, "Matrix Formulation", pp. 328–56.

199 Mattessich, *Analytical Methods*, pp. 85–87; Ijiri, *Management Goals*, pp. 93–94; and A. Charnes, W. W. Cooper, and Y. Ijiri, "Breakeven Budgeting and Programming to Goals", *Journal of Accounting Research* 1 (Spring 1963): 16–44.

200 Ijiri, *Management Goals*, pp. 89–91 and 94–104, and Mattessich, *Analytical Methods*, pp. 90–94.

201 Procedures for collection, transmission, validation, and representation are not discussed here.

202 Mattessich, *Analytical Methods*, pp. 94–97.

203 Williams and Griffin, "Structural Approach", p. 648.

204 For an indication of such techniques, see G. G. Meredith, *The Accountant and Capital Investment Analysis under Risk and Uncertainty* (unpublished Ph.D. dissertation, University of Queensland, 1969).

205 Supra., pp. 207–208.

206 Chambers, "Measurement and Objectivity", p. 268.

207 Nichols, "Management Information", p. 11.

208 Committee to Prepare a Statement of Basic Accounting Theory, *A Statement*, pp. 10–11.

209 Paton and Littleton, *Accounting Standards*, p. 18.

210 Moonitz, *Postulates*, p. 41.

211 Hector E. Arnett, "What does 'Objectivity' Mean to Accountants?" *Journal of Accountancy* 111 (May 1961): 68.

212 Yuji Ijiri and Robert K. Jaedicke, "Reliability and Objectivity of Accounting Measurements", *Accounting Review* 41 (July 1966): 475–77; and Ijiri, *Foundations*, pp. 133–46.

213 Sterling, *Enterprise Income*, p. 46

214 Ijiri and Jaedicke, "Objectivity", pp. 477–78.

215 Lim, "Mathematical Propriety", pp. 643–45, lists and investigates these operators.

216 The problem of additivity (or "linear aggregation") in financial accounting is dealt with by Ijiri, *Foundations*, pp. 117–31. Kermit Larson and R. W. Shattke, "Current Cash Equivalent, Additivity, and Financial Action", *Accounting Review* 41 (October 1966): 634–41, deal with the problem in one particular model. Difficulties produced in accounting with other mathematical axioms in measurement are discovered in Yuji Ijiri, "Axioms and Structures of Conventional Accounting Measurement", *Accounting Review* 40 (January 1965): 36–53.

217 Nichols, "Management Information", pp. 12–13.

218 Lev, *Information Theory*, pp. 6–17. See also Baruch Lev, "The Information Approach to Aggregation in Financial Statements: Extensions", *Journal of Accounting Research* 8 (Spring 1970): 78–94. Irwin Bernhardt and Ronald M. Copeland, "Some Problems in Applying an Information Theory Approach

to Accounting Aggregation", *Journal of Accounting Research* 8 (Spring 1970): 95–98, pose some problems associated with Lev's operator.

219 For example, see Donald Rappaport "Materiality", *Journal of Accountancy* 117 (April 1964), 42–48; and Leopold A. Bernstein, "The Concept of Materiality", *Accounting Review* 42 (January 1967), 86–95.

220 For a discussion of the allocation problem, see Arthur L. Thomas, *The Allocation Problem in Financial Accounting Theory*, Studies in Accounting Research no. 3 (Evanston, Ill.: American Accounting Association, 1969).

221 The reader is again referred to the Epilogue for a brief outline of the third stage.

222 For a fuller discussion of these principles, see Shannon and Weaver, *Communication;* Goldman, *Information Theory;* Abramson, *Coding;* and A. K. Collins, *The Dynamics of Organization* (Melbourne: Sun Books Pty. Ltd., 1968), pp. 52–84. For application of the principles to accounting, see Norton M. Bedford and Vahe Baladouni, "A Communication Theory Approach to Accountancy", *Accounting Review* 137 (October 1962): 650–59; David H. Li, "The Semantic Aspect of Communication Theory and Accountancy", *Journal of Accounting Research* 1 (Spring 1963): 102–107; Chambers, *Economic Behavior*, pp. 166–85; William P. Birkett, "Communication—The Profession and Its Clients", *Chartered Accountant in Australia* 38 (February 1968): 642–56; and Sterling, *Enterprise Income*, pp. 39–63.

223 Pragmatics are often associated with semantics and syntactics. These principles in language structure were dealt with in stage I. It is felt they are more akin to information theory than communication theory.

224 For discussion of the appropriate entries to effect this, see Gynther, *Price-Level Changes: Theory and Procedures*, pp. 112–20.

225 This is demonstrated in ibid., pp. 120–29.

226 For the rationale behind this, see supra., pp. 221–22.

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