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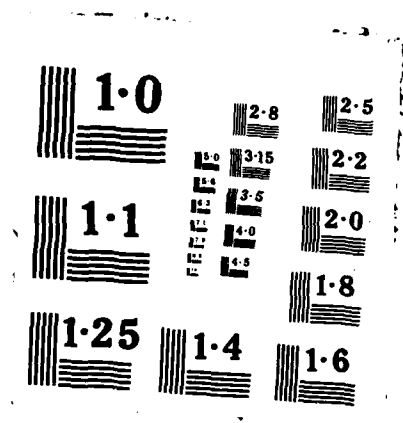
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CONTRACTING PRINCIPLES:
A CONCEPTUAL FRAMEWORK FOR THEIR
IDENTIFICATION AND VALIDATION

by

James A. Fawbush, Jr.

December 1987

Thesis Advisor:

David V. Lamm

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19. Abstract

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**Contracting Principles:
A Conceptual Framework for Their
Identification and Validation**

by

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Lieutenant, Supply Corps, United States Navy
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**Submitted in partial fulfillment of the
requirements for the degree of**

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from the

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ABSTRACT

This thesis addresses the process by which scientific principles of contracting can be identified and validated. This process is developed within a conceptual framework which considers: the morphology and functionality of laws and principles; the conduct of inquiry in the context of a generally-accepted scientific approach; and a number of fruitful research design methodologies having the capacity to expose and facilitate analysis of elemental aspects of law-like propositions. The validation process, once developed, is demonstrated to be applicable to testing hypotheses dealing with contracting phenomena. The writer concludes that contracting principles can be articulated and scientifically validated. Research in this area will support establishing contracting as a science.

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I. INTRODUCTION

A. PROBLEM STATEMENT

The field of research dealing with the contracting process and its associated phenomena has experienced dramatic growth over the past several decades. This prolific expansion of the scope of contracting research has led experts in both the academic and practitioner communities to recognize a need for a more systematic, and thus, effective approach in the conduct of inquiry respecting the field of contracting. To achieve this end, a movement within the research community has emerged which advocates establishing contracting as a science. Proponents of this notion maintain that widespread recognition and acceptance of a contracting science would be beneficial to the disciplinary field in three primary areas:

- 1) An enhancement of the degree of professionalism exhibited by practitioners of contracting. Such a need was expressed by members of the President's Blue Ribbon Commission on Defense Management. [1:68]
- 2) An expansion in the scope of contracting research by the academic community, which has heretofore been limited primarily to the domain of organizational and operational problem-solving. [2:30]
- 3) A deepening of the understanding of the phenomena associated with the contracting process, which could then be applied by both academicians and practitioners to improve the effectiveness and efficiency of the contracting process.

Contracting is not the first disciplinary field in which a movement developed which sought the conferment of scientific status. Marketing researchers and theoreticians have long been engaged in such a pursuit, and an extensive corpus of literature on the subject has been written. Much of this literature addresses the characteristics which typify a science. One such characteristic, identified by noted marketing theorist Shelby Hunt, is the presumption of the existence of underlying uniformities and regularities concerning the subject matter constituting a given disciplinary field. [3:13] Underlying uniformities and regularities equate to scientific laws or principles.

Accepting the premise that the establishment of contracting as a scientific discipline is partially predicated upon the existence of associated laws or principles, the need then is obviated to identify and validate such "invariable associations" for contracting phenomena.

B. OBJECTIVES

The purpose of this thesis is to develop a process by which contracting principles can be identified and validated. This process constitutes a conceptual framework built upon Hunt's model dealing with the morphology of scientific laws and its application within the context of the generally-accepted scientific approach to the conduct of

inquiry as it relates to the investigation of phenomena which comprise the subject matter of the behavioral and social sciences in general and the field of contracting in particular.

Specific objectives to be pursued in this research effort include:

- 1) An examination of laws and principles in terms of their elemental components and basic functional attributes
- 2) A determination of the requirements of the scientific approach as it relates to research conducted into behavioral and social phenomena
- 3) An examination of specific research design techniques which can be employed to test hypotheses for law-like properties and functionality
- 4) A discussion of the application of the principle-validation process to a set of "candidate" contracting principles formulated by another researcher
- 5) The determination of the degree of susceptibility to validation of each of the aforementioned "candidate" principles of contracting.

C. RESEARCH QUESTIONS

The following specific research questions were addressed during the study:

- Primary: Can proposed principles of contracting be identified, and how might they be validated?
- Subsidiary:
 - 1) What are the Hunt model requirements for a concept to be considered a law or principle?
 - 2) What, if any, refinements to the Hunt model are appropriate or necessary for its application in the field of contracting theory?

- 3) What are the results of validating candidate contracting principles through application of the validation process developed?

D. RESEARCH METHODOLOGY

To answer the research questions presented in the previous section, a two-fold approach was undertaken. The majority of the research effort consisted of an extensive review of literature pertaining to the philosophy of science and the conduct of inquiry into behavioral and social phenomena within the context of what is referred to in common parlance as "the scientific method". This review also encompassed several writings in the marketing field. Literature addressing the science conferment debate exists for the marketing field; however, a similar corpus for the contracting field is only just beginning to emerge. Drawing upon the marketing literature was deemed a viable, fruitful avenue of research because of the many parallels which exist between the marketing and contracting fields of discipline.

In addition to the literature review, ten recognized experts in the contracting field were contacted and were requested to participate in a survey dealing with proposed principles of contracting. The survey, in the form of a questionnaire, listed five proposed principles of contracting. The candidates were developed by Steven A. Park during his own thesis research conducted in 1986. The ten individuals to whom the survey was provided had all been

interviewed by Park, and had provided him with valuable input which contributed to his formulation of five hypotheses; i.e., law-like propositions or candidate principles. Participants in the survey were asked to assess the validity of the hypotheses being considered as principles of contracting. Space was provided on the questionnaire for comments justifying each assessment, as well as for providing an additional hypothesis for consideration. The survey of disciplinary experts figures prominently in the principle validation process developed as a part of this study.

Appendix A is a copy of the survey questionnaire. Appendix B is a list of the survey participants. Additional candidate principles provided by the respondents are listed in Appendix C.

E. ASSUMPTIONS AND LIMITATIONS

Summary of Assumptions

1. Principles of contracting can be discerned from underlying uniformities and regularities associated with contracting phenomena.
2. Experts in the field of contracting possess the requisite background knowledge and intuitive prowess to enable them to discern principles of contracting, if properly articulated.
3. Contracting phenomena possess characteristics common to other behavioral and social phenomena which make them susceptible to testing for the existence of invariable associations and relationships among componential variables.

4. A systematic, methodological approach to the conduct of inquiry into contracting phenomena is capable of exposing and validating operative scientific principles.

Summary of Limitations

1. A survey sample of ten recognized contracting experts is insufficient to establish the true degree of consensus among all members of the academic and practitioner communities regarding the existence of contracting principles.
2. Application of the principle validation process as developed in this study cannot be undertaken due to resource and time constraints within which this research effort must be conducted.

F. LITERATURE REVIEW

A literature search was conducted with two purposes in mind. One purpose was to find sources dealing with the philosophy of science. These sources were sought in order to acquire a basic understanding of the nature of science itself, in terms of the characteristics and activities which typified it, and its ultimate goals. Books consulted most extensively in this regard were Rescher's Scientific Explanation, Lastrucci's The Scientific Approach: Basic Principles of the Scientific Method and Dubin's Theory Building.

The second focus of the literature search was directed toward discovering sources which specifically addressed the conduct of scientific endeavor in those areas of discipline dealing with behavioral and social phenomena. Several books proved to be extremely valuable in providing insight into

the complexities and peculiarities associated with the conduct of inquiry in the behavioral and social sciences. Among these were Agnew's and Pyke's The Science Game: An Introduction to Research in the Behavioral Sciences, Kaplan's The Conduct of Inquiry: Methodology for Behavioral Science, and Brewer's and Collins' Scientific Inquiry and the Social Sciences, all of which were drawn heavily upon by this researcher. Literature on the science of marketing was selected as a specific point of focus since this particular branch of the behavioral and social sciences shares so many similarities with the field of contracting. The treatment in this study of the nature and functions of laws was developed substantially from Hunt's landmark work Marketing Theory: The Philosophy of Marketing Science.

G. ORGANIZATION OF STUDY

This study was undertaken to determine whether principles of contracting could be identified and, if so, subsequently validated. This task required the development of a conceptual framework within which a principle identification and validation process could be synthesized. Chapters II, III and IV discuss the elemental constructs which defined the nature of this framework. Specifically, Chapter II is concerned with providing an understanding of the nature of laws and principles in terms of their elemental morphological characteristics and functional

attributes. Chapter III examines the conduct of inquiry into behavioral and social phenomena within the context of the scientific approach and the order it supplies to investigative endeavors. Chapter IV discusses specific methodologies employed by behavioral and social scientists in their search to discern underlying uniformities and regularities associated with the phenomena comprising the subject matter of their disciplinary fields.

Chapter V describes the principle validation process developed within the conceptual framework as previously structured. Its application to a predetermined set of hypotheses is examined and an assessment is made regarding the susceptibility of these law-like propositions to validation testing. Finally, in Chapter VI, the research findings are summarized, conclusions are drawn, and recommendations for further research are offered.

II. LAWS AND LAWFULNESS

A. INTRODUCTION

The distinction between principles and laws can be considered to be strictly honorific. [4:158] Accepting the premise that principles are in essence higher-order laws associated primarily with a specific discipline, it becomes apparent that an understanding of the nature of laws is necessary before one can commence a search for and attempt validations of contracting principles.

This chapter will examine the nature of laws from two basic perspectives--their elemental criteria and their basic functions. The most fundamental requirement for a law is that it express an "invariable association". [2:42] Hunt's model of the morphology of scientific laws identifies four additional criteria: (a) associations are expressed in the forms of generalized conditionals, (b) laws have empirical content, (c) they exhibit nomic necessity and (d) laws are systematically integrated into a body of scientific knowledge. [4:157-163] From a functional standpoint, laws are established based upon their power to explain, predict and/or control the phenomena with which they are associated. [4:156].

The remainder of this chapter will be devoted to a closer examination of the aforementioned elemental aspects of laws.

B. GENERALIZED CONDITIONALS

Generalized conditionals stipulate some kind of "if-then" relationship. This aspect is associated with the scientific concepts of universality and causality as they relate to laws. Within the diverse corpus of literature on the philosophy of science there is expressed a school of thought that requires a concept to exhibit universality and causality before it can be considered a true law. It can and has been argued that this requirement is at best overly restrictive and at worst counterproductive to the advancement of scientific knowledge. Respecting the idea of universality, Kaplan asserts that every law has boundary conditions which restrict its range, field and scope. [5:96] Rescher has developed the concept of quasi-laws, which are limited generalizations exhibiting much scientific utility. Quasi-laws have historically been more closely associated with the social and behavioral sciences; however, they have been appropriately applied in the physical sciences as well. The areas of research dealing with the applied physics of turbulence phenomena, velocity aerodynamics and extreme temperature theory use quasi-laws extensively. [6:175]

The causality stipulation is not without its critics. Dubin states, "Empirically relevant theory in the behavioral and social sciences is built upon an acceptance of the notion of relationships rather than of the notion of causality." [7:94] Laws expressing causal relationships are indeed powerful scientific tools; however, they should not be construed as the only ones capable of advancing knowledge and understanding.

The "if-then" relationship specified by generalized conditionals in no way restricts limited, non-causal generalizations from consideration as possible laws or principles.

C. EMPIRICAL CONTENT

This elemental criterion requires laws to be based upon factual observations. Observation is the fundamental source of all scientific information. [5:220] Empirical content permits experimentation which Kaplan characterizes as merely controlled observation and interpretation. [5:162] Hunt asserts that laws cannot be extracted from empirical evidence, but they should never violate it. [4:176] He considers the empirical content requirement of laws to be that aspect which separates them from nonsense generalizations and purely analytical or tautological statements. [4:158] Popper links empirical content to his concept of a falsifiability requirement for laws and

theories. He contends that the "empirical content of a law or theory increases with its degree of falsifiability, since it says more about the world of experience the more statements it rules out." [8:113] By this he means that the more specific the assertion made by a law-like proposition, the more susceptible it becomes to being falsified through analysis of its empirical content.

The empirical content of laws is that attribute which enables them to be subjected to testing. Testing is the means by which laws are confirmed or, to use Popper's term, the means by which they can be falsified. Without detracting from the importance of empirical testing to the advancement of science, a cautionary assertion from Rescher seems appropriate to place the notion of empirical content in its proper perspective:

Lawfulness can thus never be wholly based upon observational foundations. Rather, it represents an imputation that is (or should be) well founded upon evidential grounds. (The key factors in this well-foundedness are the correspondence-to-fact aspect of empirical evidence and the systematic coherence of filling the generalization into a fabric of others that in the aggregate constitute a rational structure, an integrated body of knowledge that constitutes a "branch of science.") [6:120]

D. NOMIC NECESSITY

Nomic necessity can be restated as the invariable association requirement for a law. It is this attribute which separates laws from accidental generalizations and

counterfactual conditionals. [4:163] More importantly, nomic necessity "introduces the element of must, of inevitability." [6:98] It permits a scientist to answer "why" questions. [6:13]

Closely aligned with the concept of nomic necessity is that of hypothetical force. Hypothesis formulation is critical to the advancement of scientific knowledge since it allows the scientist to go beyond the realm of observed fact and into that of hypothetical counterfact. [6:102] Hypothetical force is not extracted from empirical evidence, but rather, it is supplied to it. [4:174]

A recurrent error on the part of many of those responsible for the development of the philosophy of science has been to equate nomic necessity with causality. This view is becoming less prevalent, however, as this body of knowledge continues to evolve. The rationale for divorcing causality from nomic necessity parallels that expressed above respecting generalized conditionals, thus it need not be repeated here. Kaplan makes a cogent point by stating that "causal laws are not preeminent or necessary to scientific advances." [5:112] Decoupling the concepts of nomic necessity and causality greatly facilitates the scientist's search for useful constructs (e.g., laws) to enable him to advance his knowledge and understanding.

E. SYSTEMATICALLY INTEGRATED

The requirement that laws be systematically integrated into a body of scientific knowledge accords them distinction from mere empirical regularities, according to Hunt. [4:168] This elemental criterion incorporates the notion of consensus into the morphology of laws. The criticality of consensus respecting validity of laws cannot be overstated. Ziman maintains that one of the primary goals of science is to acquire "a consensus of rational opinion over the widest possible field." [9:9] Dubin characterizes scientific validity as a "consensus that empirical indicators measure values on a stated unit." [7:206] It is the existence of a consensus among members of a particular scientific community as to a law's importance that elevates it to the status, albeit honorific, of a principle. The roles of consensus and convention as they relate to the conduct and products of science will be examined further in subsequent chapters.

F. EXPLANATION

Science can be considered as that uniquely human enterprise conducted in an attempt to better understand the infinitely complex universe. Laws are one type of tool employed by the scientist in his endeavors. The power of some laws to facilitate understanding lies in their ability to explain certain phenomena.

Explanation need not be absolute or all-encompassing to serve the purposes of science. Scientific explanations are incomplete in that they are always capable of change with increased knowledge and understanding. [6:23] Hunt asserts:

Explanation is always relative to a set of premises that logically imply what is to be explained. We stop explaining when we don't know anymore. There is no "ultimate" explanation. [4:428]

The explanatory power of laws is subject to the very limitations described above. The status of a law is not inherently jeopardized by acknowledgement of its limitations or susceptibility to change. This idea was succinctly stated by Kaplan when he wrote: " . . . the attainment of acceptable explanations is not the accumulation of eternal and absolute truths What has happened is that we have found something which serves the ends of inquiry at a particular time and place." [5:355]

G. PREDICTION

One of the greatest benefits derived from scientific pursuits is the ability to predict or extrapolate into the future. The importance of laws possessing the attribute of predictive power should therefore be obvious. Rescher maintains that laws allow the scientist to structure expectations regarding various phenomena under investigation. [6:135] The hypothesis, which is the basic growth factor of science, can be considered to represent a

prediction about given values of units of a theory. [7:212] Theoretical laws, which are fundamentally inferential extrapolations based upon force of logic, permit what Kaufmann terms "warranted" predictions, which are not eliminated by incidents of falsification. [10:220] Kaplan observes that " . . . the ultimate justification for any scientific belief will depend upon the main purpose for which we think scientifically--that of predicting and thereby controlling the future." [5:254]

The attribute of predictive power inherent in certain laws is viewed by many philosophers of science as that trait which best supports their argument that the scientific validity of laws is grounded upon their usefulness to the working scientist in his pursuit of knowledge and understanding of his world.

H. CONTROL

The accumulation of knowledge and understanding for their own sake is a goal of some scientific endeavors. But science is also concerned with attaining practical goals, one of the foremost among which is the ability to control phenomena under investigation. Laws permitting control must also possess predictive power; however, not all laws having predictive power exhibit the capacity to control. [5:348]

Rescher maintains an instrumentalist view regarding laws is appropriate. He asserts that because laws enable the

prediction and control of phenomena, the age-old philosophical debate centering on whether reality can ever be known with certainty ceases to be important in the development of scientific thought and activity. [6:134] Such an assertion would appear to remove the restrictions imposed by the concept of universality on the search for valid laws and principles which could ultimately serve the goal of scientific advancement of knowledge and understanding.

I. SUMMARY

The purpose of this chapter was to examine the nature of laws in terms of their elemental morphological characteristics and their basic functional attributes. Philosophers and practitioners of science are far from agreement on just what requirements must be met by a concept before it can be considered a law. An argument was developed advocating a broad range of considerations be applied in the search and validation of laws, based upon their utility value when employed within a given context of scientific inquiry. Laws should be determined by their functionality; i.e., their ability to serve as useful conceptual tools for the working scientist as he pursues the fundamental goal of all science--the acquisition of knowledge and understanding about the infinitely complex universe.

The identification and validation of laws and principles must be accomplished within the context of an accepted scientific approach. Chapter III will examine the requirements of such an approach, most often referred to as "The Scientific Method". Aspects of the behavioral and social sciences respecting scientific methodology will also be explored in an attempt to resolve methodological dilemmas associated with these branches of science.

III. SCIENTIFIC METHODOLOGY AND THE BEHAVIORAL AND SOCIAL SCIENCES

A. INTRODUCTION

As was stated previously, laws are the basic building blocks of science. Before conferring upon a concept the status of a law or principle, it seems necessary to establish that such a concept meets the requirements demanded by science. Such requirements are succinctly embodied in what is commonly referred to as "the" scientific method. This chapter will examine crucial aspects of this methodological approach as it applies to all areas of scientific endeavor in order to understand the nature of the requirements it imposes on the formulation, validation, and use of laws. Additionally, the issues dealing with the application of the scientific method to the behavioral and social sciences will be explored in an attempt to correct widespread misconceptions about the true scientific nature of these discipline areas. The intent of this chapter is to establish the validity of the behavioral and social sciences (which include the science of contracting) by illustrating the applicability of scientific methodology to advance knowledge and understanding associated with these areas of discipline. This, in turn, will justify the search for laws

governing those phenomena which constitute the subject matter of these sciences.

B. ESSENCE OF THE SCIENTIFIC APPROACH

The choice of the term "scientific approach" over the more common referent "scientific method" is a conscious decision respecting the heading of this section. Reasons for choosing the former should become clear as this chapter is developed.

There is a growing consensus among the philosophers and practitioners of science that there is no one scientific method. Various reasons for this belief can be found in the literature on the subject. Marketing theorist Paul F. Anderson expresses the following viewpoint:

. . . it should be clear that no consensus exists as to the nature or the very existence of a unique scientific method. . . . It is more important to ask what methodologies will convince the (scientific) community of the validity of a theory (or law), than it is to ask what is the "correct" method. [11:25]

Drawing upon ideas developed by several of his colleagues, Hunt provides more food for thought:

There is no one "right way" to do science . . . no rule, no prescriptive method will ensure success There are rules--many of them--but no single rule applies universally. [4:448]

Kaplan offers yet another perspective when he asserts that

. . . a definition of "scientific method" . . . is not sufficiently general to embrace all the procedures that scientists may eventually come to find useful. The emphasis by historians and philosophers of science that there is no such thing as "the" scientific method . . . is a public service. [5:27]

What should be obvious from the foregoing viewpoints is that the approach to science is relative, based upon the nature of the phenomena under investigation. The admonition is clear against being lured into tunnel vision by restricting the conduct of research and inquiry to "the" scientific method as associated most frequently with the physical sciences. To do so would preclude the scientist from fully exploiting innumerable opportunities to advance his knowledge and understanding of the universe comprised of uniquely human phenomena.

Without undermining the argument that the scientific approach can be characterized as "whatever works", it should be noted that the conduct of all scientific endeavors demands adherence to a common conceptual, procedural framework implicit in the process. This framework consists of a set of logical steps governing the formulation and execution of whatever methodology is appropriate to the specific inquiry. Lastrucci enumerates the following steps:
[12:109]

1. Formulation of an hypothesis; i.e., the problem statement
2. Explanation of the procedures to be employed; i.e., the research design
3. Accumulation of the data
4. Analysis of the data
5. Verification of the findings.

C. THE NATURE OF THE BEHAVIORAL AND SOCIAL SCIENCES

The status of the behavioral and social "sciences" remains to this day a matter for debate. A full recounting of the history and ramifications of this disagreement is beyond the scope of this thesis. The crux of this troublesome rift is based upon the nature of the phenomena comprising the subject matter of these disciplines and the degree of confidence regarding successful application of a scientific approach to their study. Lastrucci articulates the basic arguments of those skeptical about the status of the so-called "soft" sciences thusly: [12:62]

1. Social and psychological phenomena are inherently subjective rather than objective
2. Such phenomena are inherently too complex for analysis
3. Human behavior is inherently unpredictable due to the operation of a "free will".

These arguments can be refuted by establishing that the conduct of inquiry in the behavioral and social sciences can be accomplished in strict adherence with those previously-enumerated steps which typify all scientific investigations. This task will be undertaken in the remainder of this chapter.

D. THE CONDUCT OF INQUIRY IN THE BEHAVIORAL AND SOCIAL SCIENCES

The application of the step-wise progression to inquiry demanded by the scientific approach when used within the

behavioral or social science research problem is best explored by addressing each step in turn.

1. Hypothesis Formulation

As noted above, an hypothesis may be considered to be a problem statement. It is an expression giving form to an area of knowledge or understanding being pursued by the scientist. Lastrucci offers a functional definition by maintaining that an hypothesis

. . . is a proposition to extend verified knowledge beyond the present borders of any given field of theoretical knowledge the hypothesis is . . . the link between speculation and verification [12:110]

An hypothesis seeks to describe or relate some variables. In this respect they are functionally similar to laws with the difference being that they have yet to be sufficiently tested, established and accepted. [5:84]

The phenomena comprising the realm of the behavioral and social sciences present no inherent barriers to problem formulation. They contain variables which are governed by relationships. The one legitimate obstacle to hypothetical construction in these disciplines is based on the complexity of the phenomena involved. This obstacle is not insurmountable, however. One approach suggested by Lastrucci for overcoming this barrier is that complex phenomena can often be broken down into simpler, more manageable component parts. [12:63] This would greatly facilitate the hypothesis formulation process of the

scientist. The complexity argument of the skeptics appears to be an empty one.

2. Procedural Explanation

Once a research problem is defined with the formulation of an hypothesis, the next step of the scientific approach is the development of the research procedure or design. The laboratory experiment represents that form of research design most often associated with the physical sciences. Investigations in the behavioral and social sciences are oftentimes not easily conducted in a controlled laboratory setting. Researchers employ a multiplicity of procedural techniques to test hypotheses and theories. Chapter IV will examine the most commonly used and fruitful research designs utilized in the "soft" sciences.

Attributes common to most research designs are the standards by which their scientific value must be assessed. These attributes are objectivity, measurability and reproducibility. As will be discussed shortly, these considerations are operative in the remaining steps of the scientific approach as well. A rigid interpretation of the demands these attributes make of a valid scientific research design is counterproductive. They must be considered within the context of the area of discipline under study. Behavioral and social phenomena do possess these attributes

to some degree even though they may not be as easily discernable as in some natural or physical phenomena.

Regarding objectivity, Lastrucci writes:

Undoubtedly human behavior . . . is a consequence of mental or subjective stimuli ("ideas"); but the behavior itself may be quite objective The cause of a human behavior may remain subjective insofar as we do not know how to entirely objectify ideas; but this does not necessarily militate against the objectification of the resultant behavior Much human behavior is just as objectively demonstrable as is nonhuman behavior; and much of it can be described and measured in objective or empirical terms. [12:62-63]

Another view of objectivity is expressed by Kaplan: "The test of objectivity is said to be prediction--if the alleged pattern is the pattern, we can expect to find such and such other elements in these and those places." [5:335] These viewpoints lend credence to the idea that uniquely human phenomena are objectifiable to some degree even though an element of subjectivity is always present. The task of the scientist is to exploit that objectifiable component of behavior to advance his knowledge and understanding of the phenomena under study.

Measurability is a conceptual trap into which many skeptics of the validity of the inexact sciences fall. The criticality of this attribute to the conduct of science is a matter of debate. Kaplan argues that measurement allows standardization and a more precise description of phenomena; however, it is not critical to the conduct of science. [5:173] Quantifiability is desirable in the

formulation of laws and theories, but it is not a steadfast requirement. Rescher observes that "It is not exactitude that makes physical and social sciences true sciences, but objectivity." [6:166] Measurement can be considered a consensus formation process, especially in the realm of the inexact sciences. While acknowledging that scales of measurement are difficult to develop for behavioral phenomena, Agnew and Pyke maintain that efforts to do so should be focused on formulating scales which are shareable and commonly accepted by researchers in a particular field of study. [13:114] Yardsticks should be developed which are germane and flexible enough to serve a purpose in pursuing an investigation. [13:165] A similar view is expressed by Kaplan when he asserts that the need for measurements should be assessed in the context of the research problem:

. . . it is important, I think, for the behavioral scientist to be clear in his own mind which purpose is primary for him in a given context, and what his requirements are. Too often, we ask how to measure something without raising the question of what we would do with the measurement if we had it. We want to know how without thinking of why. [5:214]

Hempel observes the usefulness of using "derived" measurement in behavioral research where the scale is developed by "defining a new quantity by means of others, which are already available;" [14:70] Measurability, when useful, can be achieved respecting certain aspects of behavioral phenomena.

Reproducibility considerations in development of a research design are important from the standpoint of verification. Skeptics consider this attribute to be lacking in the study of human behavior because of the operation of the "free will" factor. An examination of the nature of reproducibility within the context of the behavioral and social sciences will refute this argument. Reproducibility equates to replication. The perceived need of replication in the strict sense of the concept may be counterproductive in any science. Agnew and Pyke assert that replication is virtually impossible. The concepts of exportability and perishability of results are the important requirements of a research design. [13:130] In qualitative research, internal consistency of observations is the crux of verification, not strict reproducibility. [15:248] External validity of research results demands only that the scientist demonstrate similar results occur in different settings or that phenomenological processes are similar to processes that occur in other places with other people. [15:249] The requirements of internal consistency and external validity for research design results are not as onerous as those demanded by strict reproducibility; however, they are equally effective in establishing verifiability of a law or theory. The formation of a consensus among researchers is the goal sought by those

advocating rigid replication of results. Such a consensus can be attained with less rigorous demands. Moreover, seeking consistency and durability in results prevents the scientific community from committing the grave error of premature closure respecting the conduct of an inquiry or investigation into phenomena where strict reproducibility simply is not possible.

3. Data Collection, Data Analysis and Verification

These three steps of the scientific approach are treated together because the issues dealing with their applicability to the methodology of the behavioral and social sciences are common to them all. These issues are bias and error in the accumulation and analysis of data. The problems presented by bias and error are shared by all branches of science. Agnew and Pyke succinctly state their thesis about the nature of science:

Science, as we see it, is the process of construction or creation rather than discovery of pieces of the puzzle by bringing biased sensing devices--sense organs, brains, points of view, instruments--in contact with nature, and then fitting the constructed pieces together as best we can with the system of biases operating at the time and with the resources at our disposal. SCIENCE BECOMES THE GAME AND ART OF DESCRIBING A PATTERN WITHIN A SYSTEM OF SENSING AND CONCEPTUAL BIASES OR LIMITS. [13:173-174]

The essence of this view is found repeatedly in the literature of the philosophy of science. The crux of this notion is based on the fact that science is a human enterprise, and man by his nature does science within the

context of his limited cognitive abilities and inextricable prejudices. The humanness of the scientist is one source of error in the conduct of inquiry. Accepting the existence of bias and error as axiomatic, the issue becomes one of how to minimize the impact of these two inevitabilities when conducting research. Agnew and Pyke enumerated five sources of bias and error: [13:175-176]

1. Naturally existent in the data
2. A function of the sensing apparatus
3. A function of the conceptual apparatus
4. Inherent in the behavioral response system of the scientist
5. Present in feedback or results obtained from the research procedure.

There are several ways to account for and minimize the impact of bias and error in conducting scientific inquiry. The process of verification by fellow scientists is the most powerful method as well as the most pervasive throughout science. Popper asserts that scientific laws and theories can never be confirmed or verified, merely corroborated through independent testing. [8:315] More boldly, Lastrucci argues that the verification process of any legitimate science involves consensus among researchers. [12:235] Scientific laws, says Kaplan, have "conventional" as well as empirical content. [5:101] These and other views found in the literature all seem to espouse the belief that science is a social enterprise.

Bias and error can also be compensated for by what Brewer and Collins term as "robustness" of the methodology used in inquiry. Robustness is a concept of using multiple testing devices to study a phenomenon to ascertain the degree of invariance achieved across all methods employed. [15:126] Robust properties of variables or phenomena tend to be more easily detectable, less subject to bias or error, more explanatorily fruitful and predictively richer. [15:146] Striving to use robustness in the scientific approach enables the researcher to focus more attention on analysis and explanation of incidents of failure of invariance. [15:126]

Agnew and Pyke write that the effects of bias and error can be mitigated by improving the "durability" of patterns emergent in a research problem area. They offer several suggestions for enhancing durability of patterns in behavioral phenomena under study, which include: [13:178]

1. Focusing on small parts of the total data stream
2. Standardizing data collection methods, the operative conceptual apparatus and the behavior under inquiry to the maximum extent possible
3. Avoiding negative feedback in analysis of data obtained.

Bias and error may well be greater concerns for researchers in the behavioral and social sciences than for those in the natural sciences; however, techniques are available to the former for lessening their impact upon research results.

They do not present insurmountable obstacles to fruitful scientific inquiries in these areas of discipline.

E. SUMMARY

This chapter has attempted to refute the claims of skeptics denying the validity of the behavioral and social sciences because their subject matter does not lend itself to inquiry using a scientific approach. The well-defined steps characterizing the scientific approach to inquiry were enumerated and shown to be applicable to research endeavors in these disciplines. This was accomplished by examination of the functionality of the steps without concern for conformance with mere "rituals" so often cited by proponents as being the essence of "the" scientific method.

Chapter IV will deal with a number of research methodologies employed in the behavioral and social sciences to facilitate theory formulation and validation of laws and principles which theories attempt to relate.

IV. VALIDATION METHODOLOGIES

A. INTRODUCTION

Having examined the nature of laws and principles, and the applicability of the scientific approach to the conduct of inquiry in the behavioral and social sciences, the groundwork has been laid to permit an exploration of methodologies which can be employed to establish and validate laws and principles. This chapter will detail a number of the most commonly used and powerful research techniques associated with the behavioral and social sciences (among which is included the science of contracting). Treatment of those methodologies discussed will focus on their particular strengths and weaknesses respecting their capacity to establish laws and principles.

B. NATURALISTIC OBSERVATION

The essence of naturalistic observation according to Agnew and Pyke is

. . . the observation and description of events as they occur in nature or naturally. There is no manipulation of events, no controlled experimentation, but merely the observation of events as they occur in their usual surroundings. [13:54]

The viability of naturalistic observation as a scientific research technique hinges on four premises: [13:63]

1. Detailed observation of every aspect of behavior
2. Accurate recording in clear and concise terms
3. The observer must be a strict nonparticipant in the event or behavior under study
4. Development of a clear, meaningful system of classification or grouping of observed behaviors.

To the extent that the researcher can meet these requirements, naturalistic observation offers the prospect of yielding fruitful information with little expenditure of resources to conduct the inquiry. Training needed by the scientist is also minimal using this technique, although it would be beneficial. The major disadvantage of this technique is that it provides no inherent safeguards against observer biases respecting what is observed, recorded and classified. [13:63] A relatively uncomplicated procedure, naturalistic observation has the potential to permit the vigilant researcher to discern underlying behavioral uniformities and regularities across an unlimited range of subjects engaged in a specified event; however, it does not provide the scientist with answers as to why behaviors occur. Operative laws governing observed patterns must be inferred, but inferences can be potentially confirmed through naturalistic observation.

C. CASE HISTORY

The case history technique has and continues to be a widely used method of conducting inquiry in the behavioral

and social sciences. Since it is in essence an after-the-fact method it has two major shortcomings when employed by the scientist in an attempt to identify operative laws or principles. First, it is often difficult to verify the reliability of information available from the case history. Secondly, a case history often presents the scientific investigator with numerous possible causes for the behavior described. [13:71] Time distortion is the concept that most succinctly describes the weakness of the case history method. However, in defense of the usefulness of this technique Agnew and Pyke observe:

In spite of its limitations, do not reject the after-the-fact method of attempting to sift fact from fancy simply because it cannot guarantee to produce the correct suspect. In many situations it remains the best method we have. The method is useful in narrowing down the field of suspects so that we can at least make a decision--probably a more durable one than those produced by the rules of evidence of the armchair, the pub, or the afternoon tea party. [13:72]

To flatly reject the usefulness of case history methodology in the search for laws and principles governing behavior would open the scientist to charges of premature closure. That is a charge not to be taken lightly by those committed to avail themselves of every possible conceptual tool to advance knowledge and understanding in their field of scientific interest.

D. INTERROGATIVE DEVICES

The interrogative devices most widely used in behavioral and social science research are the interview and the

questionnaire. Lastrucci cites several perceived weaknesses of these devices when used as tools of behavioral and social scientific research: [12:143-146]

1. Discernment on the part of the researcher among questions of fact, attitude and opinion
2. Ease of administration of the use of such research instruments
3. The language or semantic problem associated with the use and interpretation of terms in both questions and answers
4. Reliability on the knowledge and memory of research subjects.

These appear to be valid concerns to be sure; however, the scientist can take steps to mitigate against or compensate for the aforementioned pitfalls associated with interrogative devices. These include careful selection of subjects, standardization of key terms or concepts being investigated; i.e., ensuring that all respondents know and understand meanings of critical words or ideas comprising the focus of the research study, and subjecting the device to a "pre-test" on colleagues engaged in similar research. The degree to which interrogative devices should be "scrubbed" depends primarily on the nature of the phenomena to be investigated. If the scientist has taken effective steps to improve the reliability, validity, practicality and pertinency of the interrogative devices he contemplates using, their viability as fruitful research tools is greatly enhanced. Interviews and questionnaires can be powerful

indicators of the existence of a consensus respecting a given research area. The criticality of consensus to the establishment of laws and principles has already been explained. The "whatever works" axiom of scientific methodology remains an operative guideline for the use of interrogative research devices.

E. SIMULATION MODELS

A simulation model is an artificial construct which may be either mathematical or physical, in which each real-world element is simulated by a representative object. The properties or relationships of the simulated objects is assumed to parallel those of their real-world counterparts. The scientist uses the simulation model to make predictions, indirectly, about the real-world phenomena under study. [6:203-204] Simulation models are one among a number of "pseudo-experimentation" techniques, so called because investigations are conducted through use of a model rather than in the real world. Rescher asserts that simulation modeling is a particularly fruitful technique with which to study the behavior of human organizations. It is a viable approach especially when real-world experimentation is too costly or physically or morally impossible. [6:204] The predictive power of any simulation model depends on the nature of the parameters and variables it is designed to

study. This necessitates a clear, unambiguous statement of the hypothesis by the researcher. [16:276] The hypothesis must deal with sufficient parameters or variables. Sufficiency is determined by the degree which the parameter or variable captures the effects of significant variations in real-world counterparts, thus enabling the former to be substituted for the latter to build a relatively simple model for the more complex real world phenomenon. [15:149]

One potential difficulty should be mentioned regarding the use of simulation modeling in which human subjects are involved (e.g., a role-playing model). Participants may be sensitized to the simulation itself, and this could produce biased behavior which would obscure data derived from the experiment. [15:238] The best precautionary measure that the scientist could take would be the careful screening and selection of the participants. Notwithstanding this potential weakness, simulation models are capable of yielding valuable information to the researcher seeking to gain insight into the attributes and dynamics of human behavior exhibited in a somewhat controlled experimental setting.

F. OPERATIONAL GAMING

Operational gaming is a particular type of simulation modeling technique that deserves separate examination. Game

theory models have widespread applications in the study of behavioral and social phenomena. Operational gaming focuses on the decisionmaking process of subjects operating in a context involving conflicting interests. [6:205] This makes it a particularly useful technique in the study of contracting phenomena such as bargaining or negotiations.

Kaplan observes:

What is especially remarkable about this class of models is that the mathematics used is essentially so elementary, while the behavior to which the models usefully apply is so subtle and complex. [5:292]

Essentially a role-playing model, operational gaming is most fruitful when subject matter experts are used as participants. [6:206] This point will be elaborated upon below.

G. USE OF EXPERTS

The use of experts to advance scientific knowledge and understanding of behavioral and social phenomena and the laws that enable their explanation, prediction or control is a recurrent theme in this research effort. That theme centers around the importance of consensus-building in the scientific approach to inquiry. Lastrucci distinguishes among three levels of consensus--authorities, schools of thought, and individuals--asserting that these are listed in descending order of criticality respecting their power to serve as an indication of validity of scientific methods and

findings. [12:126,239] Ziman echoes a similar view stating, "Science is unique in striving for, and insisting on, a consensus." [9:13] He further asserts:

In the end, the best way to decide whether a particular body of knowledge is scientific or not is often to study the attitudes of its professional practitioners to one another's work. A sure symptom of non-science is personal abuse and intolerance of the views of one (scientist) by another. [9:28]

Insight into why the use of experts is so important to the advancement of knowledge and understanding in the behavioral and social sciences is provided by Rescher:

. . . use of prima facie evidence must be tempered by reference to background information, which frequently may be intuitive in character and have the form of a vague recognition of underlying regularities The consideration of such underlying regularities is of special importance for the inexact sciences . . . because in this sphere we are faced with situations in which . . . information matters less than knowledge of regularities in the behavior of people or in the character of institutions Hence the great importance that must be attached to experts and to expertise in these fields. For the expert has at his ready disposal a large store of (mostly inarticulated) background knowledge and refined sensitivity to its relevance through the intuitive application of which he is often able to produce trustworthy personal probabilities regarding hypotheses in his area of expertness. The benefits derived from the use of experts in many of the techniques of scientific inquiry examined earlier in this chapter should be obvious. They provide a dimension of reliability to data gathered from interrogative devices and various simulation modeling techniques. Consensus among experts regarding the lawlike attributes or relationships observed in the study of behavioral and social phenomena supplies the element of collaboration which is deemed to be so critical to the establishment of scientific principles in these areas of discipline. [6:186-187]

H. COMPARATIVE TECHNIQUES

As the term implies, comparative techniques are analytical methodologies used to study two or more groups "presumably matched in all relevant and common attributes except one (the "variable")." [12:208] Comparative techniques are used to attempt to isolate the effects of a given variable on the phenomenon under investigation. This section will examine three widely used comparative techniques applied to the study of behavioral and social phenomena.

1. Control Group Method

This comparative technique is distinguished from others in that the variable under study is introduced to only part of the participants. Inferences are drawn about the effects of the variable on the subject phenomenon by analysis of the differences between those participants exposed to the variable and those who were not. Agnew and Pyke assert the control group method yields "durable" data superior to other comparative techniques for several reasons: [13:82-86]

- The variable under study is clearly identified at the outset
- Researcher biases can be minimized in the "double blind" variation of this technique, in which the scientist is unaware of which participants are dealing with the operative variable

- Participant sensitivity to the experiment is more or less leveled between the two groups, thereby minimizing its distortive effects on the experimental data
- The effects of time on the phenomena under study do not factor into the procedure and therefore cannot distort data derived from either of the groups.

The power of the control group method lies in its capacity to yield highly reliable evidence to establish causal effects of a variable in relation to a particular phenomenon.

2. Before-After Methods

These techniques consist of analysis of differences in behavior observed between the time before the variable was introduced and the time after its introduction. Before-after research designs, although easier to use and usually less costly than the control group method, have several inherent weaknesses. The degree of confidence that the variable under study is responsible for observed behavioral changes is debatable. Changes might have resulted from other unsuspected, uncontrolled and unaccounted for factors. [12:208] Other problems associated with the before-after technique run parallel but counter to the aforementioned strengths of the control group method--distortions in interpretations of data derived may result from researcher bias, participant sensitivity to being subjects in an experiment, and the effects of time on both the participants and the researcher. [13:73-80] The usefulness of before-

after designs is a function of the nature of the phenomenon under investigation. The inferential power of this technique increases as the number and effects of uncontrolled variables are known, compensated for, or eliminated. In circumstances where this technique is the only one available to the researcher, it should be employed. Care must be taken in the conclusion formulation process, so as not to infer more about the subject variable than is warranted, i.e., scientifically verifiable by other means.

3. Multitrait-Multimethod Matrix

This comparative technique was developed by sociologists D.T. Campbell and D.W. Fiske in 1959. Brewer and Collins explain this technique thusly:

. . . the adequacy of any measure of a hypothetical construct must be demonstrated in terms of two types of validity--convergent validity (the agreement between different methods of measuring the same construct) and discriminant validity (differentiation of results when the same method is used to assess hypothetically different qualities of the same objects). The results of analysis of the interrelationships among multiple independent measures of multiple constructs provide simultaneously, information on methods variance (the extent to which results from similar methods converge when they are supposed to be assessing different constructs) and information on trait variance (the extent to which results from different measures of the same construct converge in their ordering of a set of objects). The relative size of the trait variance to method variance, in turn, tells us something about the validity . . . of the psychological constructs under study. [15:168]

The multitrait-multimethod matrix appears to be a fruitful comparative technique to test the hypothetical force of a proposed law or principle which deals with complex,

multifaceted behavioral and social phenomena. Reliability of research results is enhanced through reduction of error and biases inherent in methodologies using multiple measurement techniques on one variable or attribute associated with a particular phenomenon. This eclectic approach to advancing scientific knowledge and understanding seems particularly applicable to research in the behavioral and social sciences.

I. STATISTICS

Statistical analysis is a research technique common to nearly all branches of science. This notwithstanding, there is disagreement among philosophers and practitioners of science regarding the validity and thus, the value of statistics as a viable tool to be used in the conduct of scientific inquiry. A discussion of this debate is beyond the scope of this research effort, however. Since statistics are widely used in the behavioral and social sciences, it is appropriate to examine the benefits they offer when employed as a research technique by scientists.

The essence of statistical theory is that "truths" about entire populations (objects or phenomena) can be discerned through analysis of attributes or traits of a representative sample of that population. The frequency of occurrence or observation of particular variables or relationships provides the empirical information which permits inferences

to be drawn regarding the likely (probable) existence of those variables or relationships across all members of the population.

Agnew and Pyke state that statistics are useful in identifying trends or patterns in objects or phenomena. [13:127] The power of statistics is more strongly asserted by Kaplan:

. . . statistical correlations are said to fall short of . . . universality. However, a correlation coefficient is just as exact, that is to say, just as public and palpable in its meaning as a law And, in a sense, it has even more generality than the general laws of nature When we have discovered a significant correlation we have surely enlarged our knowledge True, the knowledge cannot be applied with certainty to every individual instance. But neither, with certainty, can laws which are not explicitly statistical in character--if we were to demand certainty we should have to say that we have no laws at all, but only some more or less eligible prospects for that title. [5:256-257]

The capacity for prediction inherent in the use of statistics is enhanced as the number and diversity of samples taken under diverse conditions is increased. [13:129] Frequency distributions generated by statistical sampling techniques equate to instances of corroboration for the researcher attempting to establish a law or principle. The importance of statistics to qualitative research in the behavioral and social sciences cannot be overstated.

J. SUMMARY

This chapter has examined a number of the research designs and techniques widely employed by scientists conducting inquiries into behavioral and social phenomena.

With this accomplished, the conceptual framework in which the process of identification and validation of contracting principles must be conducted is now complete. Chapter V will directly address that process which constitutes the thrust of this research effort.

V. FROM HYPOTHESIS TO PRINCIPLE: THE PROCESS

A. INTRODUCTION

Having examined the substance and nature of laws, the application of the scientific approach to inquiry into the phenomena comprising the subject matter of the behavioral and social sciences, and validation methodologies used to advance knowledge and understanding of these phenomena, attention can now be focused on the application of this conceptual framework to achieve a specific goal. This goal is the development of a process to identify and validate principles of contracting. The approach to this task will involve the use of a predetermined set of hypotheses around which the process will be developed. Implicit in this approach is the idea that the validation process is somewhat "hypothesis-specific"; i.e., its form is partially determined by the nature of the hypothesis to which it is applied. However, the process is sufficiently generic to permit its tailored application to test the validity of a broad range of hypothetical propositions.

B. THE HYPOTHESES

The aforementioned set of hypotheses selected to serve as the illustrative conceptual basis around which the principle validation process will be developed was

formulated by Steven A. Park as part of his master's degree thesis research effort. [2:112] These propositions are presented in Table 1. For ease of reference throughout this chapter, the indicated abbreviation for each hypothesis will be utilized whenever appropriate.

TABLE 1
CANDIDATES FOR CONTRACTING PRINCIPLES

<u>Hypothesis</u>	<u>Abbreviation</u>
If the environment and assumptions on which a contract is negotiated are varied, then the contract process and effectiveness will change.	H1
If competition within a contracting action is missing, then a less effective contracting action is probable.	H2
If the nature of the good changes from standard to unique, then the price will change.	H3
If the mix of factors determining the price are altered, then the final price will change.	H4
If the motivations of a party to a contract are altered, then contractual behavior will change.	H5

Source: The Possibility of a Contracting Science by Steven A. Park

Park developed these five principle "candidates" from a series of personal interviews with eleven recognized experts in the contracting field from both the academic and practitioner communities. [2:99] The hypothetical propositions now identified, the remainder of this chapter will deal with the validation process.

C. THE VALIDATION PROCESS

The science of contracting concerns itself with the advancement of knowledge and understanding of a pronouncedly complex and diverse subject matter which encompasses a myriad of behavioral and social phenomena. The establishment of laws and principles governing interactions and relationships peculiar to these phenomena is an equally complex undertaking. Such an undertaking, if it is to be successful, must be conducted utilizing a multifaceted approach to inquiry. Careful selection of the conceptual tools and research designs most suited to productive study of the phenomena under investigation is critical. Such an idea is in keeping with the recurrent theme that the scientific approach is best defined by "whatever works" given the nature of the particular research problem.

Predicated upon this philosophy, the development of the validation process for principles of contracting will reflect an eclectic approach. The process will be structured around those elemental characteristics of laws

discussed in Chapter II and the application of validation methodologies commonly employed by researchers in the behavioral and social sciences, which were examined in Chapter IV.

1. Generalized Conditionals

Detection of an "if-then" relationship between or among phenomena is fundamental to the formulation of an hypothesis which asserts the existence of a law governing that relationship. Testing for the generalized conditional is best accomplished by the use of interrogative devices administered to experts in the particular field of discipline. Interviews and questionnaires should be carefully constructed to ensure that terms, parameters, variables and/or measurement scales contained in the hypothesis are clearly defined and understood by all participants. Experts are able to draw on their vast background knowledge which is often inarticulated and intuitive in nature (see Chapter IV) to discern the existence of generalizations or underlying regularities expressed in the hypothesis. The pronouncements of experts equate to personal probability statements, which in turn can be aggregated and subjected to independent statistical analysis. Statistical processing of sample results would enable the researcher to express in terms of a percentage, the degree of consensus among those experts queried

regarding the existence of an operative generalized conditional implicit in the hypothesis. Inconclusive or negative results from statistical analysis serve as an indicator to the scientist that the hypothesis is either erroneous or in need of revision. If the latter, he can then refine the proposition to enhance the clarity of its conceptual components and repeat the test procedure.

Park's set of hypotheses are expressed in the form of generalized conditionals, and therefore are susceptible to the above-described testing procedures. Results of testing could be made more meaningful by establishing clear definitions of several of the terms used in some of the hypotheses--e.g., "environment" and "assumptions" (H1), "effectiveness" (H1, H2), "mix of factors" (H4), "motivations" and "contractual behavior" (H5).

2. Empirical Content

There are several testing methodologies available to the researcher to establish the empirical content of a law-like proposition. Factual observations can be drawn from naturalistic observation, case histories, simulation models, the before-after comparative technique and statistical analysis. If quantification of empirical content is desired, the latter three methodologies can be employed to measure observed differences among instances of the subject phenomena. Quantification of empirical content can be

unnecessary and even counterproductive to qualitative research endeavors; however, when it is desired and appropriate, careful consideration of the measurement scales to be employed is critical to the compilation of data which will yield meaningful results.

Since H3 and H4 employ price as one of their expressions, these two propositions appear quite amenable to testing designed to quantify empirical content. However, quantification of individual testing instances is severely limited in the usefulness of its application across all possible contract pricing phenomena. The scientific benefit derived from quantification of individual price changes lies in the establishment of price-movement trends such empirical testing permits when statistically analyzed in the aggregate. Hypotheses H1, H2 and H5 appear much more susceptible to those validation techniques designed to elucidate qualitative empirical data unencumbered by the juxtaposition of meaningless and potentially controversial measurement scales.

3. Nomic Necessity

It can be argued that the nomothetic basis of a law is its most distinctive attribute, since it supplies the invariable association stricture to a phenomenological relationship. The validation techniques to test for the existence of nomic necessity must therefore be stringent

enough to clearly isolate and expose the operative variable contained in a law-like proposition, while simultaneously providing a filter against the effects of non-critical, potentially distortive forces attendant to the phenomena under investigation. Testing methodologies most capable of meeting this requirement are the control group and the multitrait-multimethod matrix research designs.

The control group technique accords maximum control to the scientist over how and when a given variable will be introduced into the experimental setting. Such control greatly facilitates the process of discriminating the effects of the variable on the phenomena being studied. Use of the control group technique within the context of an operational gaming research design lends itself particularly well to the investigation of contracting phenomena in which such variables as competition, product uniqueness, and certain other environmental factors come into play.

The benefit of employing the multitrait-multimethod design to research into the study of the contracting process is derived from this technique's capacity to isolate and differentiate the effects of multiple operative variables. Perceptible gradations in the effects of several variables simultaneously operative in a complex behavioral phenomenon can be discerned by the scientist through application of various testing mechanisms utilizing differing measurement

techniques. A thoughtfully constructed multitrait-multimethod matrix design greatly enhances the researchers ability to recognize subtleties of interrelationships among variables. Flexibility inherent in this methodology permits relatively easy adjustments to testing mechanisms to be made which can serve to accentuate or diminish effects of any controlled variable.

To validate the Park hypotheses with respect to nomic necessity, the control group technique appears the most potentially fruitful testing mechanism for H2 and H3. The control variables in these propositions would be competition and product uniqueness, respectively. Given the multidimensional nature of the parameters of environment, assumptions, pricing factors and motivations, the multitrait-multimethod matrix technique appears most promising in attempting to validate H1, H4 and H5. Both of these validation methodologies would produce more conclusive results if performed in a simulated, controlled experimental research setting, as opposed to a real-world contracting situation in which the scientist would exert little or no practical control over the introduction and removal of particular variables.

4. Systematically Integrated

This elemental attribute embodies the most discernible distinction between laws and principles (see

Chapter II). The most effective means of testing whether a law-like proposition can be established as a principle is through the use of experts. The consensus among experts in a disciplinary field is a reliable indicator of the degree to which the "truth" content of a proposition is considered to be pervasive throughout the research and practitioner communities. A scientist employs interrogative devices to gather data provided by experts. These data may then be subjected to relatively simple statistical analysis to generate a frequency distribution which represents the degree of consensus that exists regarding the hypotheses being examined. The larger the sample of experts queried, the more incidents of corroboration or refutation accumulated, and the stronger the inference that the researcher can make regarding the status of the hypothesis.

This researcher conducted a direct test to assess the systematic integration attribute of the Park hypotheses. As stated earlier, Park formulated his propositions based upon information obtained from a series of interviews with eleven contracting experts. The test conducted as a part of this research effort closely paralleled Park's hypothesis formulation approach. Ten of the eleven individuals interviewed by Park were sent a questionnaire listing the five Park hypotheses. The Hunt definition of a principle was provided as a part of the questionnaire. The

respondents were asked to indicate whether they believed each of the five propositions constituted a principle of contracting within the context of Hunt's generic definition of a principle. Appendix A is a copy of the questionnaire used. Appendix B is a list of the respondents (100% participation was achieved). The results of this limited test are presented in Table 2.

TABLE 2
RESULTS OF CONTRACTING PRINCIPLES SURVEY

<u>Hypothesis</u>	<u>Percentage of Respondents Affirming the Hypothesis to be a Principle of Contracting</u>
H1	50%
H2	40%
H3	50%
H4	60%
H5	70%

Source: Developed by researcher

Respondents were invited to provide elaborative comments regarding their opinions as expressed. Comments received were indeed diverse, ranging from emphatic rejection of the notion that scientific principles of contracting exist, to qualified acceptance of the possibility, to unqualified conviction that principles are

there and need only be articulated. Survey results lend credence to the assertion that a consensus among experts regarding the existence of scientific principles of contracting is clearly in a developmental stage. Given more active research in this area, there is every reason to believe that additional findings will provide more conclusive evidence supporting the notion that this consensus continues to grow among members of both the academic and practitioner communities.

5. Explanation, Prediction and Control

To validate an hypothesis in terms of which of the three basic functional attributes it possesses, an eclectic approach continues to be applicable. To establish the explanatory power of a hypothetical proposition the use of experts appears to be the most fruitful methodology. A researcher can tap the background knowledge and intuitive powers of disciplinary experts through the utilization of interrogative devices. Potential cause-and-effect relationships are most easily discerned and their reliability confirmed by experts since they, by virtue of their knowledge and experience, are sensitive to underlying uniformities and regularities associated with particular phenomena. Experts are in the best position to supply the element of understanding to scientific inquiries into complex behavioral and social occurrences.

Respecting validation of a proposition's predictive power, again the use of interrogative devices and experts is productive, for the same reasons as mentioned above. Experts can be employed by a researcher to formulate "warranted" predictions (see Chapter II). In addition to the conclusions drawn by experts, the scientist can avail himself of other methodologies to test and confirm an hypothesis' power of prediction. Simulation models, control group experiments and before-after research designs all possess inherent features permitting effective testing of a proposition's predictive power. Findings can be subjected to statistical analysis to quantify the percentage totals of instances which confirmed the prediction expressed in the hypothesis.

The control attribute inherent in a law-like proposition can be argued to be the most useful of the three functional aspects to the scientist engaged in applied research activities in the contracting field. Control is a powerful tool facilitating the decision-making process inherent in contracting phenomena. Validation methodologies most effective in surfacing a proposition's control attribute would be simulation modeling, the operational gaming variant of this technique and the control group research design. Each of these testing devices enables the scientist to introduce critical variables into an

experimental setting and observe how its presence affects the dynamics of the behavioral phenomena under investigation. Findings generated in an artificially controlled setting are easily applied to real-world processes. The control attribute of a law, once validated, is a powerful tool in the hands of an informed decision-maker engaged in actual contracting behavior.

Although direct testing of the Park hypotheses for their functional attributes is beyond the scope of this research effort, an analysis of their potential for possessing one of more of these attributes is appropriate. All five propositions appear to exhibit some explanatory potential. The lack of specificity of terms in H1, H2, H4 and H5 would present obstacles to validation of their explanatory content. Such obstacles could be greatly diminished by restatement of the hypotheses using narrower, more focused variables in place of the more general and elusive concepts of "environment", "assumptions", "contract process," "mix of factors", "motivations" and "contractual behavior". Again, all of the hypotheses appear on the surface to possess predictive content. A clarification of terms would significantly enhance their susceptibility to validation testing for this attribute. Respecting validation of control content, H3 appears the most promising candidate from which conclusive findings could be derived.

To a lesser extent H1, H2, H4 and H5 exhibit potential for manifesting some degree of the control attribute. Their susceptibility to testing would be enhanced if, again, variables and measurement scales would be better defined.

D. SUMMARY

This chapter developed an eclectic approach to validation of principles of contracting. This approach stressed the use of various validation techniques selected for their inherent capacity to best isolate and expose a particular elemental component or functional aspect of a law-like proposition under investigation. Table 3 summarizes the validation process in matrix form.

The Park hypotheses were examined in terms of their potential for exhibiting the elemental characteristics and functional attributes inherent in laws and principles. Although direct application of the validation methodology developed was not possible due to resource and time constraints imposed upon this research effort, an analysis of the susceptibility to testing of these propositions was presented. This analysis is summarized in Table 4.

TABLE 3
PRINCIPLE VALIDATION MATRIX

	Naturalistic Observation	Case History	Interrogative Devices	Simulation Models	Operational Gaming	Use of Experts	Control Group Method	Before-After Method	Multitrait-Multimethod Matrix	Statistics
Generalized Conditionals	-	-	X	-	-	X	-	-	-	X
Empirical Content	X	X	-	X	-	-	-	X	-	X
Nomic Necessity	-	-	-	-	X	-	X	-	X	-
Systematically Integrated	-	-	X	-	-	X	-	-	-	X
Explanation	-	-	X	-	-	X	-	-	-	-
Prediction	-	-	X	X	-	X	X	X	-	X
Control	-	-	-	X	X	-	X	-	-	-

Source: Developed by researcher.

TABLE 4
ANALYSIS OF VALIDATION SUSCEPTIBILITY
OF THE PARK HYPOTHESES

	H1	H2	H3	H4	H5
Generalized Conditionals	o	o	+	o	o
Empirical Content	o	o	+	+	o
Nomic Necessity	o	+	+	o	o
Systematically Integrated	o	-	o	+	+
Explanatory Power	-	o	+	o	-
Predictive Power	-	+	+	+	+
Control Content	o	o	+	o	o

Legend: + highly susceptible
o somewhat susceptible
- marginally susceptible

Source: Developed by researcher

IV. CONCLUSIONS AND RECOMMENDATIONS

A. RESTATEMENT OF OBJECTIVES

This research effort was designed to support the argument that contracting can be considered a science insofar as it meets one of the prerequisites necessary for the conferment of science status upon a given discipline--the existence of underlying uniformities and regularities associated with its subject matter phenomena. This idea equates to the existence of scientific laws or principles. Specifically, this study addressed the issue of how contracting principles could be identified and validated. The research questions and objectives enumerated in Chapter I established the scope and direction of this thesis. They defined the substantive guidelines for the construction of a conceptual framework within which a contracting principle-validation process was developed. This framework was composed by considering the nature and functions of laws, the conduct of inquiry within the context of a scientific approach and an examination of selected research design techniques particularly applicable to investigations into behavioral and social sciences phenomena.

Once developed, the principle-validation process was shown to be applicable to a given set of hypotheses or law-like propositions which dealt specifically with contracting

phenomena. The demonstration of the applicability of a validation process to proposed principles of contracting enabled answers to the research questions to be formulated.

B. CONCLUSIONS

The significance of contracting as a force shaping economic, political and other social systems continuously grows in importance. The prolific expansion of contracting research in recent years attests to this fact. A recognized need for more effective and meaningful research in this dynamic and complex field has given rise to a movement advocating that contracting be studied and approached as a science. For this idea to become a reality, it must be established that contracting meets the requirements demanded of any disciplinary field seeking the conferment of science status. One such requirement is the existence of underlying uniformities and regularities associated with the field's subject matter phenomena. Underlying uniformities and regularities equate to scientific laws or principles.

Laws and principles are the building blocks of scientific theories. Theories are one of the most powerful and useful products of science. They are developed from a systematic, purposeful investigation into the properties and dynamics of observable phenomena. Theories are the conceptual tools used by the scientist to explain, predict

and control those phenomena under study. Explanation, prediction and control are those attributes of scientific laws, principles and theories which permit the researcher to advance his knowledge and deepen his understanding of the world around him.

To lend credence to the notion that contracting is a science, one task for researchers in the field becomes that of identifying and validating the existence of scientific principles of contracting. Before undertaking such a task a researcher must have an understanding of the nature of laws and principles, the scientific approach to the conduct of inquiry, and the research designs or methodologies available to conclusively expose and test the validity of law-like propositions or hypotheses.

Within this conceptual framework, research was conducted to develop a process whereby principles of contracting could be identified and validated. As a result of this research, the following conclusions were drawn.

1. The Hunt model defining principles in terms of their elemental characteristics is applicable to the study of contracting phenomena.

Underlying uniformities and regularities associated with contracting phenomena should be scrutinized to ascertain whether they exhibit attributes of principles as delineated in the Hunt model--generalized conditional form, empirical content, nomic necessity and systematic

integration into the professional body of knowledge. Concepts meeting these criteria should be subjected to further scientific investigation as potential principles of contracting.

2. The Hunt model requirements should be supplemented with techniques designed to examine the functional attributes of candidate contracting principles.

Any attempt to identify principles of contracting must incorporate research design techniques devised to expose the explanatory, predictive and/or control power inherent in given propositions. The identification of basic functional attributes of hypotheses is just as critical to the search for scientific principles as is discernment of their elemental morphological characteristics.

3. Research designs employed to conduct scientific investigations into behavioral and social phenomena are equally applicable to studies in the field of contracting.

Should contracting attain science status, it would be classified as a branch of the behavioral and social sciences. It stands to reason that research methodologies utilized by behavioral and social scientists to advance their knowledge and understanding of their respective disciplinary subject matters would be equally appropriate and productive techniques in the hands of skilled researchers in the field of contracting. Aspects of qualitative and quantitative research in contracting parallel those of any other behavioral or social science.

4. Principles of contracting can be identified and validated.

The identification and validation process developed in this study reflects an eclectic, scientifically sound approach to the investigation into underlying uniformities and regularities associated with contracting phenomena. Specific tests to expose, observe, measure and analyze the effects of variables and parameters comprising law-like hypotheses can be applied to determine whether such propositions possess the requisite morphological and functional attributes of scientific principles. The value of principles lies in their capacity to impose order and provide meaningful insights into the complex, multifaceted behavioral and social phenomena subjected to scientific study. Principles and laws permit theory building which is the mechanism by which science enables man to advance his knowledge and understanding of his world. Contracting principles, once articulated and accepted, will serve the purposes of science just as effectively as their counterparts in any other disciplinary field. They will facilitate more effective research by contracting professionals and lead them to achieve greater knowledge and a deeper understanding of the phenomena constituting the subject matter of their discipline.

5. The Park hypotheses are, to varying degrees, susceptible to direct validation testing as contracting principles.

The validation process as developed by this researcher was demonstrated to be applicable to the candidate contracting principles formulated by Steven Park. Although resource and time constraints precluded a direct application of this process on the hypotheses, an assessment was formulated of their susceptibility to validation testing. The degree of susceptibility to validation of each of the propositions was determined to be a function of the specificity of variables and/or parameters contained in the particular statement. Refinements to a number of the hypotheses to clarify meanings and narrow the focus of the researcher would enhance susceptibility to conclusive testing to establish them as principles. Park's attempt to initially articulate principles of contracting represents a significant milestone in the movement to establish contracting as a science.

C. RECOMMENDATIONS

The main objective of this study was to develop a process by which principles of contracting could be identified and validated. Within the context of the conceptual framework presented, this objective has been met. One specific objective, however, proved overly ambitious, and was unattainable due to constraints of resources and time. This was the generation of results from application

of the validation process to candidate principles. Given this fact, the following recommendations for further study are offered.

1. Academic and applied research should be initiated to apply the principle validation process as described in this study.

Validation testing for the existence of contracting principles is a process requiring a significant commitment of research resources and protracted dedicated effort. Many aspects of the validation process will yield the most conclusive results in a controlled experimental or simulation setting. These should be the focus of the academic sector of the contracting community. Other facets of the process are more amenable to research capable of being undertaken by practitioners in actual field settings. Research results generated from both sources must be shared if the goal of establishing contracting principles is to be most successfully and productively prosecuted.

2. Future research should focus on validating additional candidate principles formulated by contracting experts.

Those propositions provided by the experts surveyed as a part of this research effort (listed in Appendix C) are a ready set of hypotheses awaiting the application of the validation process. Given the number of recognized contracting academicians and practicing professionals, there

should be no lack of propositions which could be articulated and subsequently tested.

3. Research efforts should now expand their focus to begin to build a general theory of contracting.

This seems to be a logical extension of those investigative endeavors aimed at establishing laws and principles governing contracting phenomena. Theories can be viewed as a systematically-related set of individual laws and principles. Work in this area is already underway, as is evidenced from Dr. Robert Williams' contributions appearing in Appendix C.

D. SUMMARY

This final chapter presented conclusions drawn from the conduct of this research effort. Recommendations for further study were offered with the intent of gaining a better understanding of the nature and functions of contracting principles. Progress in this area of research has the potential to yield immeasurable benefits to the contracting research community. Ultimately more insightful research will lead to a deeper understanding of contracting phenomena, thereby facilitating a more effective and efficient process. Opportunities for dedicated researchers to establish contracting as a science have never been greater. The impact of such an accomplishment would be far-reaching indeed. The goal is a worthy one and requires the

dedication of men and women possessing the intellectual caliber needed to successfully meet this challenge.

APPENDIX A

CONTRACTING PRINCIPLES SURVEY QUESTIONNAIRE

PRINCIPLE: A higher order law, considered to be a fundamental truth or assumption, which is of extreme central significance or importance to a discipline, and for which evidence corroborating it is overwhelming.

Laws are invariable associations which exhibit the following four basic characteristics:

- 1) Laws specify relationships in the form of a generalized conditional, or if then relationship.
- 2) Laws have empirical content.
- 3) Laws possess nomic necessity, which implies that the occurrence of some phenomenon must be associated with some other phenomenon; the relationship cannot be, simply, by chance.
- 4) Laws must be systematically integrated into a scientific body of knowledge.

The above definition was formulated by Shelby Hunt and appeared in chapter four of his book, *Marketing Theory: The Philosophy of Marketing Science*, published in 1983 by Richard D. Irwin, Inc. in Homewood, Illinois.

Within the context of Hunt's definition, please evaluate the following five conceptual statements associated with the field of contracting as to whether they constitute principles of contracting.

- | <i>CONCEPT</i> | <i>PRINCIPLE?</i> |
|---|-------------------|
| 1) If the environment and assumptions on which a contract is negotiated are varied, then the contract process and effectiveness will change.
Comments: _____

_____ | Yes___ No___ |
| 2) If competition within a contracting action is missing, then a less effective action is probable.
Comments: _____

_____ | Yes___ No___ |
| 3) If the nature of the good changes from standard to unique, then the price will change.
Comments: _____

_____ | Yes___ No___ |
| 4) If the mix of factors determining the price are altered, then the final price will change.
Comments: _____

_____ | Yes___ No___ |
| 5) If the motivations of a party to a contract are altered, then contractual behavior will change.
Comments: _____

_____ | Yes___ No___ |

YOUR CANDIDATE: _____

ENCLOSURE (1)

APPENDIX B

LIST OF CONTRACTING PRINCIPLES SURVEY RESPONDENTS

Arvis, Paul, Ph.D., Professor, Florida Institute of Technology (Ret), Fort Lee, Virginia.

Beck, Al, Ph.D., Lt. Col., USAF (Ret), Instructor, Defense Systems Management College, Fort Belvoir, Virginia.

Hood, Joe, Ph.D., Assistant Director, Federal Acquisition Institute (Ret), Washington, D.C.

Judson, Robert, Ph.D., Senior Manager, Contracts and Grants, Rand Corporation, Santa Monica, California.

Lamm, David V., DBA, CDR, SC, USN (Ret), Adjunct Professor, Naval Postgraduate School, Monterey, California.

Martin, Martin D., Ph.D., Col., USAF (Ret), Associate Professor, School of Business Management, Western Carolina University, Cullowhee, North Carolina.

Pursch, William C., Ph.D., Lt. Col., USA (Ret), Chairman, School of Systems and Logistics, Air Force Institute of Technology, Wright-Patterson AFB, Dayton Ohio.

Sherman, Stanley, Ph.D., Professor, School of Government and Business Administration, The George Washington University, Washington, D.C.

Wells, Rita L., Professor of Procurement, Air Force Institute of Technology, Wright-Patterson AFB, Dayton, Ohio.

Williams, Robert F., Ph.D., Director, Army Procurement Research Office, Fort Lee, Virginia.

APPENDIX C

LIST OF PROPOSED PRINCIPLES OF CONTRACTING OFFERED BY SURVEY RESPONDENTS

- DR. ARVIS: If production capacity of a commodity sector is strained or excessive, then contract competition will vary.
- DR. LAMM: If the economic environment of the seller is changed, then contract performance will change.
- DR. SHERMAN: Risk of successful results in contracting is inherent in the work to be performed, but is modified by environmental factors and is allocated by contract terms and conditions.
- PROF. WELLS: There is a positive correlation between time pressure on a contract award (due to expiring funds, management "bodies", etc.) and (a) higher prices, and (b) errors in contracts: specs, delivery schedules, provisions and documentation.
- DR. WILLIAMS: Candidate Statements for the General Theory of Contracting Behavior
 - Contractual partners will act to accomplish their own objectives, while influenced by their internal and external environment and the behavior, the objectives and the environments of contractual partner.
 - Both parties will attempt to maximize their individual benefit-cost ratio.

- Both parties will have expectations that benefits will be reciprocated and that the level of benefit received is worth the effort.
- Parties have varying utility for different benefits.
- Both may attempt to get power or "leverage" over the other by commanding uniquely desirable resources to insure maximization of that ratio.
- Each party can also get power over the other in less direct ways.
- If one party has power over the other, such power will remain stable only if it is beneficial for both to continue the relationship and gain the benefits.
- The relationship will work best with agreed upon and congruent objectives to allow each to contribute to the benefit of most utility to the other.
- Each relationship will vary in intensity, i.e., number of interactions and amount of resources involved.
- Each party will look to a reference party to ascertain whether or not his interests are being adequately served.

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