MORAL SCIENCE

Norman Henry Anderson

Preface

Dedication

Chapter Titles

Chapter 1. Functional Theory and Moral Science
Chapter 2. Deserving Theory: Fairness and Unfairness
Chapter 3. Blame Theory
Chapter 4. Legal Judgment as Information Integration
Chapter 5. Moral Development
Chapter 6. Methods, Models, and Measurement
Chapter 7. Issues In Moral Science
Chapter 8. Unified Science of Psychology
PREFACE

Information Integration Theory (IIT) follows a functional theme: thought and action are considered in terms of the functions they serve for goal-directed individuals. This functional theme appears in each of the three GOALS in the Integration Diagram. This functional approach is effective by virtue of three algebraic laws of Information integration that have been established in most areas of human psychology (see e.g., “A Functional Theory of Cognition” 1996).

The thesis of this book is that science of morality can be developed on a foundation of the three laws of information integration. Moral thought and action generally depend on joint operation of multiple variables, as in the ubiquitous conflicts of social life. The conjoint influence of these multiple variables has been shown to follow the three integration laws in many areas discussed in following chapters. These laws have substantial generality across specific areas, across age, and across cultures. This generality is possible because these laws allow and can measure personal values of each individual—true idiographic–nomothetic theory.

Moral science has two basic concerns: cognitive theory of moral thought/action and social betterment, as with education, self-fulfillment, and social healing processes. Work to date has been mainly concerned with cognitive theory but this has led to recognition of the importance of social betterment on which some efforts have been made.

Chapter 1 presents basic ideas of Information Integration Theory, including a brief overview of several obstacles that had to be overcome at the beginning. Chapter 2 presents experiments on fairness and unfairness, both basic social motivations. Chapter 3 takes up the ubiquitous social motivations of blaming and avoiding blame. Legal psychology is covered in Chapter 4 and developmental psychology in Chapter 5. Practical issues of experimentation and data analysis are discussed in Chapter 6. Twenty-eight issues of moral science are considered in Chapter 7, including deserving theory, goal theory, conflict, phenomenology, group dynamics, and social healing processes such as apology and forgiveness. Applications of IIT to social attitudes, learning/memory, and judgment-decision are discussed in the final Chapter 8.

Moral science can unify the field of psychology, which suffers proliferating fragmentation of which many have complained. Most branches of human psychology are important in moral thought and action: learning/memory in moral development across the life span, judgment-decision in ubiquitous social-moral conflicts, social-moral attitudes, and
education. These fragmented subfields can be unified by focusing on fundamental issues of moral science. Unification is feasible because the three integration laws operate in every area. This approach focuses on functional purposiveness, that is, on goal-directedness of living.

Devoted workers in many countries have contributed to development of Information Integration Theory. The acknowledgment in the Dedication is a tribute to these pioneers.

Information Integration Theory is a functional theory. It studies functions of goal-oriented thought and action. Functional views have been advocated by diverse writers who have been concerned with purposiveness of behavior. These approaches were well motivated but, owing to lack of analytic theory, they did not get very far.

Effective theory has been developed with the three laws of information integration. These mathematical laws of the internal world reveal theoretical simplicity underlying thought and action that is common to almost every area of psychology. These laws provide a base for unifying the fragmenting field of psychology.
DEDICATION

Information Integration Theory and Functional Measurement rest on extensive pioneering work by dedicated investigators in many countries. Their work has given substance and generality to the three laws of information integration. This acknowledgment is brief but it may at least recognize the many who have made this integration-theoretical approach solid and sustaining.

Foremost are my PhD students at UC San Diego. Margaret Armstrong’s (1984) landmark thesis presented several ingenious experiments that illustrate single-person analysis in wife-husband discussion and decision. Clifford Butzin did important work on algebraic laws in children’s judgment of fairness and understanding of ulterior motivation. John Clavadetscher showed how integration theory provided an effective base of algebraic laws for certain geometrical illusions, including a two-process analysis of the Miller-Lyer illusion. Diane Cuneo helped with an extensive series of experiments that revealed a general adding-type law in young children, which not only demonstrated the falsity of two basic premises of Piagetian theory but did so by presenting a constructive alternative. Her PhD thesis was remarkable for multiple-session experiments that allowed single-child analysis to verify the general-purpose adding-type law for judgments of quantity at age 3½ years. Arthur Farkas did several basic studies of integration laws of equity/fairness. Cheryl Graesser’s work established the validity of the social averaging theorem for group discussion and the invalidity of the competing theory of social decision schemes. Edward Karpp studied integration laws in intuitive physics. Manuel Leon revealed algebraic integration laws in fundamental studies of children’s moral judgments. Lola Lopes presented a number of results in judgment–decision theory, including the subrational confidence-proportional law in risky bets. Gregg Oden began his extensive studies of integration laws in language including the extension of fuzzy set theory from normative to psychological ground. Anne Schlottmann has continued with insightful studies of numerous issues of child development. Jim Shanteau was my coworker in developing and applying the linear fan theorem for multiplication models. He has since done outstanding work in diverse issues in judgment–decision theory. Invalidity in the then-dominant method of magnitude estimation coupled with validity of the method of functional rating was demonstrated in work with David Weiss. William Wright’s ingenious design showed that people do have personal knowledge of the causes of their actions, contrary to a once-prominent denial, after resolving two subtle difficulties that
had vitiated previous efforts. James Zalinski worked extensively to develop the Average computer program for estimating both weight and value parameters for the invaluable Average program. Shu-hong Zhu demonstrated cognitive reality of language prototypes using methods of cognitive algebra that can be generally useful.

Other students at UC San Diego also made significant contributions. Philip Moore’s clever experiments indicated an averaging law for integration of legal information and he has extended his approach, including applications to analysis of anxiety. John Verdi performed a notable pioneering study of algebra of social obligation. Marilyn Borges and Barbara Sawyers Canady ingeniously showed that verbal quantifiers such as many and some, obeyed a multiplication rule with a nonverbal numerosity response. Joe Farley did a remarkable thesis showing that food-shock integration followed a simple integration model that validated bar-press rate as a true linear response. An ingenious thesis by Leo Stefurak showed that red–green color contrast followed an additive law and that the method of functional rating was linearly related to relative activation of red and green cones. Jeneva Lane helped uncover an adding-type model for gratitude. Donald Blankenship presented evidence for a simple algebra of time judgment.

Postdocs and other visitors to UCSD have done a wide array of impressive work. Martin Kaplan developed a mood integration theory superior to prominent alternatives and has also done insightful studies of legal psychology. Friedrich Wilkening has done much fine work on children’s algebraic rules of naïve physics. Wilfried Hommers’ extensive studies of moral judgment led to theory markedly superior to Kohlberg’s stage theory and with practical relevance to legal psychology. Robert McBride made notable extensions of integration theory to the chemical senses. Extensive careful work by Ramadhar Singh has documented the same integration rules in India, solid evidence for cross-cultural generality of Information Integration Theory, including ingenious studies with Indian children. Several alternative formulations to Information Integration Theory were eliminated in penetrating early studies by Michael Birnbaum. Applications to geometrical illusions were made by Dominic Massaro. Extensive, insightful work by Sergio Masin has clarified certain theoretical issues, especially in psychophysics. Yuval Wolf has done important work on criminal psychology. Edward Carterette made useful contributions to integration psychophysics as did Larry Marks. Meticulous work by Rhoda Lindner revealed clear superiority of Information Integration Theory to social balance theory. Other cogent contributions have been made by Samuel Himmelfarb, and Peter Petzold.
At UCLA, Ann Norman Jacobson and Anita Lampel were my coworkers in early work on Information Integration Theory. Richard Boggart has presented several insightful studies. Dwight Risky’s PhD thesis solidly supported the interpretation of primacy as attention decrement, not change of meaning. Ralph Stewart, Steven Hubert, and Penny Brooke made very useful contributions. I wish to add personal appreciation to Richard Atkinson, who was instrumental in my getting my first academic job at UCLA.

Valuable investigations have also been made by persons in other institutions in the U.S. Foremost among these is Clyde Hendrick who cogently resolved several critical issues in the early theoretical development when the validity of the theory was an open question. Colleen Surber Moore continues making insightful contributions to developmental psychology. Several important contributions were also made by Thomas Ostrom. Jordan Louviere demonstrated the importance of Information Integration Theory for optimal scaling. Reid Hastie’s work also needs mention. James Jaccard showed the importance of functional measurement for studying social attitudes. Paul Sorum has made instructive studies in medical science, especially in collaboration with Etienne Mullet and Maria Teresa Muñoz-Sastre. Bill Jones did early pain integration studies. Edmund Howe did insightful work on legal judgments. Rhoda lindner’s PhD article obsoleted Heider’s balance theory.

Investigators in other countries have made investigations of diverse issues. In Italy, Sergio Masin’s conjoint theoretical–experimental work clarified certain theoretical controversies, especially in psychophysics, and he also organized the first biennial International Conference on Information Integration Theory and Functional Measurement in Padua in 2007. Michele Vicovaro has reported neat work on naive physics of collisions. Giulio Vidotto and Marco Vincentini have applied functional measurement in pioneering work on interpersonal trust.

In Portugal, fundamental work on emotion has been accomplished in a series of articles by Armando Oliveira and his associates, including Ana Duarte Silva, Nuno de Sá Teixeira, Ricardo Viegas, Isabel Fonseca, Miguel Oliveira, Telmo Pereira, and Joana Gonçalves. Their work on face cognition has done much to clarify the long confusion over holistic cognition and reduced it to mathematical law.

In Belgium, Peter Theuns has made novel progress on the perplexing problem of comparing subjective well-being (Quality of Life) across different cultures with colleagues Barbara Baran (Poland), Greet Hellenbosch, Valerie Möller (South Africa), Habib Tiliouine (Algeria), and Rebecca Van Vaerenberg. Joeri Hofmans has made a cogent unification
of integration laws with cluster analysis for deeper analysis of individual differences. Hofmans also served as editor of the proceedings at the second and third international conferences on Information Integration Theory and Functional Measurement published in Psicológia (2010, 2012). Olivier Mairesse has studied homeostatic circadian rhythms in daytime sleepness as well as green cars. Good work has also been done by Laurence Turcksin and Daniel Neu. In the Netherlands, Frederik van Acker has studied breast feeding practices. In Taiwan, cogent studies by Mingshen Wang and Jen-Shou Yang have added to cross-cultural generality of Information Integration Theory.

In France, Maria Teresa Muñoz-Sastre has done insightful studies of a number of ethical life issues including physician-assisted suicide and physician confidentiality. Etienne Mullet has studied a remarkably diverse array of social and educational issues with innumerable collaborators who include: Badiâa Bouazzaoui, Gérard Chasseigne, Vincent Dru, Mélanie Esterle, Anne Fernandez, Stéphanie Frileux, Eric Fruchart, Alexandra Gamelin, Mélanie Gauché, Michèle Girard, Myriam Guedj, Laurence Guillet, Marco Heimann, Danièle Hermand, Catherine Hervé Ligneau, Valérie Igier, Véronique Léoni, Astrid Lhermitte, Laurent Liégeois, Anne Montcouquiol, Stéphanie Nann, Patricia Paques, Nathalie Przygotski, Bernadette Rogé, Patricia Rulence-Pâques, Natalie Teisseyre, Daniel Vidal, Geneviève Vinsonneau.

Etienne Mullet has also energized workers in other countries. Most striking is the work on forgiveness after the religious civil wars in Lebanon with Fabiola Azar (see Algebra of Forgiveness in Chapter 7). Others of his international coworkers include Aminata Ouédraogo in Burkina Faso (see her In Memoriam, p. 301 in my Unified Social Cognition), Lonzozou Kpanake in Togo, Felix Neto and Moriada Couceição Pinto in Portugal, Ioannis Makris and Dimitra Makri in Greece, Germano Vera Cruz in Mozambique, Shanmukh Kamble in India, Ernesto Lopez and Guadalupe Morales in Mexico, Cecilia Olivari in Chile, Orneilhia Zounon in Benin, and Gabriela Guedez in Venezuela, as well as Claudia Pineda Marin and Wilson Lopéz-Lopéz who have studied forgiveness in the civil wars in Columbia.

This brief acknowledgement does not begin to do justice to the earnest work and cogent contributions of these dedicated pioneers. It is fitting to conclude with Aristotle’s judgment on empirical science:

*Each one adds something to our knowledge of nature . . . and from the whole arises a certain grandeur.*
Chapter 1 Preface

FUNCTIONAL THEORY AND MORAL SCIENCE
nanderson@ucsd.edu Comments are most welcome.

Two self-evident propositions are basic in psychological science. The Axiom of Purposiveness recognizes that thought and action are functional, directed toward goals. The Axiom of Integration recognizes that thought and action depend on joint operation of multiple variables. Two cognitive processes—valuation of stimulus informers to construct their functional, goal-relevant values and integration of multiple values into a unitary response—are thus basic in thought and action (Figure 1.1).

By inestimable good fortune, integration has been found to follow three simple mathematical laws—averaging, adding, multiplying—in most areas of human psychology. These laws also solve the long-recalcitrant problem of true measurement, not only response measurement, but especially measurement of functional, goal-oriented stimulus values, including nonconscious stimuli. These integration laws are an effective foundation for unification of psychological science.

Moral science can be developed on this base of mathematical law. Dedicated investigators have made applications to deserving and fairness/unfairness (Chapter 2), blame and punishment (Chapter 3), legal psychology (Chapter 4), and moral development (Chapter 5).

Moral science can unify the fragmented field of psychology. Person science, social attitudes, learning/memory, emotion, judgment–decision, language, and life-span development are all important in moral thought and action. Unification has much to offer all (Chapters 7 and 8).

TWO AXIOMS FOR PSYCHOLOGY (3)
FUNCTIONAL THEORY (4)
PARALLELISM THEORY (7)
EXPERIMENTAL EVIDENCE (12)
UNIFIED FUNCTIONAL THEORY (16)
MORAL ALGEBRA (19)
MORAL SCIENCE (21)
NOTES (23)
Chapter 1

FUNCTIONAL THEORY AND MORAL SCIENCE

Copyright © Norman Henry Anderson
June 27, 2013
Comments are most welcome. nanderson@ucsd.edu

Psychological science requires a functional framework. People are purposive, oriented toward goals; thought and action are to be understood in terms of their functions in pursuing goals.

Psychological science thus differs essentially from physical science in which goal teleology has long been abandoned. Unfortunately, modes of thinking derived from physical science have obstructed recognition of goal-oriented function and induced narrow conceptual fixedness in major areas of psychology.

The thesis of this book is that moral science can unify the now-fragmented field of psychology—both substantively and theoretically. Moral considerations pervade all aspects of our lives including family, friendship, school, work, group interaction, politics, religion, and law. Fairness/unfairness, praise/blame, self-interest/obligation, and reward/punishment are ubiquitous phenomena of high importance to each of us.

It would be expected, therefore, that morality would be a primary concern of psychology. This is far from true. Moral learning, of high significance, is virtually unheard of in current learning theory which is grounded on conditioned reflexes and rote memory (see Functional Theory of Learning, Chapter 8). Moral attitudes are rarely considered in social psychology, which has lacked capability with functional analysis of strong attitudes (Functional Theory of Attitudes, Chapter 8). Personality theory remains entangled in factor-analytic typology that has distant relevance to moral thought and action and usually buries the individual person in a group average (see Person Science and Personality, Chapter 7). And judgment-decision analysis is heavily dominated by normative considerations and remains largely ignorant of its opportunities with functional measurement of subjective values (see Functional Theory of Judgment-Decision, Chapter 8).

Morality provides a substantive base that can unify all these disparate areas of psychology. Indeed, morality can free these areas from their narrow, historical ruts to help build a more human psychology.
Theoretical base for unifying psychology is available in Information Integration Theory (IIT). Three simple algebraic laws have been found in most areas of human cognition. In particular, these laws have done well in several areas of moral cognition as summarized in Chapter 2-5. These laws provide analytic capability to deal with two fundamental obstacles: multiple variables and true psychological measurement.

TWO AXIOMS FOR PSYCHOLOGY

Information Integration Theory (IIT) is grounded on two propositions whose self-evident nature warrants the term axiom. The Axiom of Purposiveness recognizes that thought and action are functional, oriented toward goals. The Axiom of Integration recognizes that thought and action result from integration of multiple determinants.

AXIOM OF PURPOSIVENESS

The purposiveness of our everyday activities is one manifestation of general goal-directedness of life. Purposiveness goes far deeper than consciousness to include biological and affective–cognitive processes developed in evolution. The Axiom of Purposiveness recognizes the bi-social functions of thought and action.

The Axiom of Purposiveness entails a functional perspective that focuses on goals. One major function of purposiveness is to place subjective, goal-oriented values on objective stimulus informers (see leftmost GOAL in the Integration Diagram below). Judgments of deserving, whether positive as in praise or negative as in blame, are one important function, common in daily life.

The Axiom of Purposiveness has an important analytical implication: purposiveness imposes a one-dimensional, approach–avoidance metric on much thought and action. This metric is considered to have an evolutionary origin in sensory–motor processes for survival in the external world. Approach–avoidance tendencies of everyday life, the moral right–wrong axis in particular, are hypothesized to involve melding this general metric sense with particular affective qualities (see Metric Cognition, Chapter 7).

Purposiveness has obvious attractions as a base for general theory. This teleological attractiveness appeared in Aristotle’s concept of final cause and reappears in modern attempts to understand thought and action in terms of their goals. Various conjectures about goal-oriented motivations in social science, hopeful analogs to the concept of force in physics,
are one manifestation. These conjectures pointed to important problems, but they lacked analytic power (see Goal Theory, Chapter 7). An effective approach is available with the three laws of information integration.

Moreover, these laws can dis-integrate an integrated response to measure goal-oriented values of each stimulus informer. This functional measurement solves the valuation problem, the primary function of the Axiom of Purposiveness.

AXIOM OF INTEGRATION

Information integration is fundamental in cognition. Thought and action generally depend on joint influence of two or more variables. Thus, blame for a harmful act may depend on intent behind the act as well as on amount of harm. A judge’s sentence, similarly, may depend on past record as well as present crime. Blame theory must address the problem of how intent and harm are integrated. Similar integration considerations hold for all thought and action.

The Axiom of Integration is basic in every field of psychology; multiple variables are generally operative. How are these multiple variables integrated to arrive at a unified response? An answer to this integration question was found with the discovery that much integration follows three simple mathematical laws: averaging, adding, and multiplying.

FUNCTIONAL THEORY

Every area of psychology faces the same two fundamental problems. The Axiom of Purposiveness recognizes that thought and action are goal-directed functions of each individual person. The Axiom of Integration recognizes that multiple variables must be valuated and integrated to construct thought and action. How these two problems are resolved is a basic issue for every branch of psychological science. The nature of this issue is shown in the Integration Diagram of Figure 1.1.

INTEGRATION DIAGRAM

The Integration Diagram of Figure 1.1 sets out the problems posed by the two axioms. Physical stimuli, $S_A$ and $S_B$, impinge on the person and are transmuted into goal-oriented, psychological values, $\psi_A$ and $\psi_B$, by the valuation operator, $V$. These psychological values are integrated to construct a unified response, $\rho$, by the integration operator, $I$. Finally,
Figure 1.1. Information integration diagram. Chain of three operators, $V - I - A$, leads from observable stimulus field, $\{S\}$, to observable response, $R$. 

Valuation operator, $V$, transmutes stimuli, $S$, into subjective representations, $\psi$. 

Integration operator, $I$, transforms subjective field, $\{\psi\}$, into internal response, $\rho$. 

Action operator, $A$, transforms internal response, $\rho$, into observable response, $R$. 


this internal response is externalized by the action operator, $A$, to become the observable response, $R$.

The Axiom of Purposiveness is represented in the Integration Diagram by GOAL, which influences all three operations. Most important is valuation, which constructs goal-relevant functional values ($\psi_A$ and $\psi_B$) within the internal, psychological world of the individual.

The Axiom of Purposiveness entails a functional conception of psychological measurement. The psychological value of any stimulus informer depends on operative goals. The same stimulus may have different values relative to different goals. Measurement of functional, goal-specific values is essential for psychological science. Such functional measurement is possible with the three algebraic laws.

Purposiveness continues with the integration operation, which constructs a unitary, goal-oriented response, $\rho$, from the several values. Finally, the action operation transforms this internal response into some overt response, $R$.  

---

**INTEGRATION DIAGRAM**

```
GOAL  \downarrow
\hspace{1cm} \downarrow
\hspace{1cm} \rightarrow
GOAL  \downarrow
\hspace{1cm} \downarrow
\hspace{1cm} \rightarrow
GOAL
```

$$S_s \rightarrow \psi_s \rightarrow \rho \rightarrow R$$

$$S_b \rightarrow \psi_s$$

**VALUATION** \hspace{2cm} **INTEGRATION** \hspace{2cm} **ACTION**

**V OPERATOR** \hspace{2cm} **I OPERATOR** \hspace{2cm} **A OPERATOR**
INFORMATION INTEGRATION THEORY

Information Integration Theory (IIT) rests on three concepts.

1. Integration Graphs. An integration graph shows joint action of two or more variables, illustrated in Figure 1.2 below. Pattern in the observable response of an integration graph is a key to nonobservable cognitive processes by which the variables are valuated and integrated.

2. Functional Measurement. Observable responses may be biased—R being a distorted image of underlying response, ρ. How to avoid such bias and obtain true measurement of underlying response (R = ρ) had stymied psychologists for over a century.

Functional measurement methodology can eliminate such response biases. Then the observable pattern visible in an integration graph will be a faithful image of pattern in unobservable cognition.

3. Algebraic Laws. Each algebraic law corresponds to specific pattern in an integration graph. Most useful is the parallelism pattern, which corresponds to an add-ave law, as in Figure 1.2 below. Experimental studies by many investigators have revealed algebraic laws in almost every area of human psychology.

These algebraic laws are a base for unified psychology. The same laws found with young children also appear at older ages and in other cultures. These laws have been established in most areas of psychology, including person science, social attitudes, development, learning, language, emotion, and judgment–decision (see Chapter 8). These laws can unify our now-fragmented field.

BLAME THEORY

Blaming is the most common interpersonal moral judgment. To illustrate the problems posed by the Integration Diagram, consider the hypothesis that blame for a harmful act is the sum of two values, the intent behind the act and the harm it caused:

\[
\text{Blame} = \text{Intent} + \text{Harm}. \quad (1a)
\]

This is more properly rewritten in psychological terms of the foregoing Integration Diagram as

\[
\rho_{\text{Blame}} = \psi_{\text{Intent}} + \psi_{\text{Harm}}. \quad (1b)
\]
An experimental test could manipulate Intent of a rock throwing child (e.g., malice, carelessness) and Harm (e.g., bruised shin, black eye) as in Figure 1.2 below.

To test this blame hypothesis, somehow we must measure all three terms in Equation 1b to see if they add up. Can this really be possible? All three terms are subjective values, not directly observable. Some values are not even conscious. To establish the blame hypothesis as law, we need to develop a science of the internal world. This is possible with the following parallelism theorem.

**PARALLELISM THEORY**

Although the idea of moral algebra is age-old, it could not be established without capability for true psychological measurement, illustrated with the blame hypothesis of Equation 1b. The parallelism theorem offers a remarkably simple way to resolve this measurement crux.

**INTEGRATION GRAPHS**

An integration graph shows the response to two (or more) variables jointly manipulated, just an ordinary row × column factorial graph. The pattern in such a graph can reveal what law governs the integration of the separate variables into a unified response. This is illustrated with the adding-type law in Figure 1.2.

**Add-Ave Laws.** *Parallelism pattern* supports an adding-type integration, either averaging or strict adding. The integration graph of Figure 1.2 shows hypothetical blame judgments of two real developmental psychologists, F. W. and A. S., in an Intent × Harm integration design. Their task was to judge appropriate blame for a story child who threw a stone that harmed another child. Harm is varied across three levels listed on the horizontal: bruised shin, bloody nose, and black eye. The intent of the harmdoer is varied across the three levels listed by the three curves: intent to harm, intent to scare, and carelessness. Note that each point on this integration graph represents a different story child, unrelated to the others except through the common task situation.

Parallelism of Figure 1.2 supports the add-ave law of Equations 1. The scare curve lies a constant distance above the careless curve—scare adds a constant amount of blame, regardless of amount of harm. Every pair of curves shows a similar additive pattern. Parallelism is direct evidence for an add-ave law.
**Value Measurement.** Parallelism pattern can go further to reveal personal values of each person. Figure 1.2 shows that F. W. considers bloody nose and black eye equally bad; both points have the same elevation on his topmost curve. The same appears in each lower curve.

A. S., in contrast, considers black eye much worse; this point is much higher than bloody nose on each of the three curves. Perhaps she considered that a rock that caused a black eye could easily have put out the eye.

Second, F. W. considers intent to scare substantially less blamable than intent to harm, but substantially more blamable than carelessness. This is shown by the relative elevations of these three curves. A. S., in contrast, considers intent to scare only slightly more blamable than carelessness whereas intent to harm is much more blamable than either.

These personal values are measured by the integration graph. Thus, the top curve for A.S. in Figure 1.2 yields her personal values for the three amounts of harm. And—by virtue of the parallelism—these same relative values reappear in each lower curve. The same holds for F. W.

![Figure 1.2](image.png)

*Figure 1.2.* Parallelism analysis illustrated with hypothetical data. The three curves in each integration graph represent attribution of blame for bad deeds of story children specified by an Intent × Harm design. Intent is listed as the curve parameter, Harm on the horizontal. Parallelism reveals an adding-type model: Blame = Intent + Harm for both persons F. W. and A. S.. Different shapes of the graphs reflect different personal values of Intent and Harm. (After Anderson, 1990.)
These stimulus values are functional; these values functioned in each person’s blaming process. Empirical applications are given in Chapter 3.

PARALLELISM THEOREM

The graphical reasoning of the previous section is formalized with the parallelism theorem. Consider a two-variable, row × column integration design like that of Figure 1.2. Denote the row stimuli by $S_{Aj}$ and the column stimuli by $S_{Bk}$. Two premises are needed:

Premise 1: Additive integration: $\rho_{jk} = \psi_{Aj} + \psi_{Bk}$.

Premise 2: Linear response: $R_{jk} = \rho_{jk}$.

Premise 1 says that the response to the stimulus combination \{$S_{Aj}$, $S_{Bk}$\} in row j, column k of the integration design is the sum of their subjective $\psi$ values. Linear response in Premise 2 means that observable response, $R_{jk}$, is a faithful measure of unobservable response, $\rho_{jk}$ (Note 1). Granted these two premises, two conclusions follow:

Conclusion 1: The integration graph will exhibit parallelism.

Conclusion 2: Mean response in each row (column) of the integration graph measures the true value of $\psi_{Aj}$ ($\psi_{Bk}$).

Proof that these two conclusions follow from the two premises is simple and is omitted here.

SIX BENEFITS OF PARALLELISM

The parallelism theorem shows the logic of functional measurement: 

measurement is derivative from empirical law.

Pattern in an empirical integration graph can diagnose underlying process. The long-standing dual cruxes of psychological measurement—of response and of stimuli—can be solved with a pattern of parallelism. These and other benefits of parallelism are itemized next.

1. Additive Integration. Since the two premises predict parallelism, observed parallelism supports both premises, additivity in particular. Of course, no single experiment goes very far by itself. Confidence only builds up from a group of interrelated experiments.

2. True Response Measurement. Premise 2 (linear response) is critical. Premise 1 (additivity) refers to unobservable addition; $\rho = \psi_A + \psi_B$. Could you look inside the head of F. W. or A. S., you would see a parallel integration graph.
For this unobservable pattern to appear in the observable integration graph, you need a linear response measure. Conversely, observed parallelism supports Premise 2 of response linearity, that the observed R is a true measure of the unobservable ρ (see Note 1).

True response measurement had been unsuccessfully pursued by numerous investigators for over a century. Actualizing this goal depended on development of experimental procedures to eliminate certain response biases in the rating method, making it a true linear scale (Method of Functional Rating, Chapter 6). Most important, of course, actualizing this goal depended on empirical reality of algebraic law (Note 2).

3. True Stimulus Measurement. An almost magic property of parallelism theory is that only the response need be measured. This is enough to test additivity. Prior stimulus measures of ψA and ψB are not needed.

No less magical, true measures of ψA and ψB are available from the integration graph. This stimulus measurement follows from Conclusion 2, already illustrated in the discussion of Figure 1.2. This measurement capability is a godsend; stimulus values may not even be conscious. This measurement is called functional for it measures the values that were functional in the response.

4. Meaning Invariance. Observed parallelism goes further in analysis of information processing. Parallelism implies that the stimulus informers do not interact to change one another’s values. Each SA adds the same fixed amount, ψA, regardless of SB—contrary to strong introspectionist claims.

5. Cognitive Unitization. Complex stimulus fields can be treated as cognitive units by virtue of the parallelism theorem. Unitization allows exact measurement of effects of complex stimulus fields (see Analytic Context Theory; Chapter 7).

Unitization, which follows from the Axiom of Purposiveness and an algebraic law, is invaluable for cognitive theory. The valuation operation of a complex stimulus field may be unknowably complex, much of it not conscious. Yet all your complex processing is reduced to a single number in the algebraic law—which can be exactly measured.

One notable example of cognitive unitization is given with Armstrong’s study of wife–husband assignment of blame (Figure 3.2). The parallelism in her figure implies that the discussion of each spouse, however complex, may be measured as a single number in the integration law.
Unitization is a fundamental property of information processing. It would seem hard to pin down without an algebraic law. Once established, however, unitization may be hypothesized to hold more generally in situations that do not follow any simple integration rule.

6. Idiographic–Nomothetic Theory. The integration laws are idiographic; they apply to individual persons. And they are nomothetic; the same laws apply generally across different persons, with exact allowance for individual values. These laws thus offer a proper foundation for areas such as social attitudes and personality theory which have typically obscured the individual person in an agglomerate group average. Similarly, these laws are a base for cross-cultural analysis.

AVERAGING

Averaging has been by far the most common integration process in empirical studies. Most tasks that were expected to exhibit strict addition have instead exhibited averaging. Two variants of the averaging model require comment.

Averaging Model With Equal Weights. The averaging model for two variables with equal weighting may be written

\[ \rho = \frac{\omega_A \psi_{Aj} + \omega_B \psi_{Bk}}{\omega_A + \omega_B}. \]  

(2)

Here \( \psi_{Aj} \) and \( \psi_{Bk} \) denote polarity values of stimulus informers \( S_{Aj} \) and \( S_{Bk} \), as in the Integration Diagram of Figure 1.1. Their importance weights are denoted \( \omega_A \) and \( \omega_B \).

The numerator of Equation 2 is the weighted sum of stimulus values. This weighted sum is converted to an average by dividing by the sum of weights in the denominator (Note 3).

In Equation 2, all \( \psi_{Aj} \) have equal weight, \( \omega_A \), and similarly all \( \psi_{Bk} \) have equal weight, \( \omega_B \). With equal weights, the sum of weights in the denominator of Equation 2 is constant; hence it may be absorbed into the unit of the response scale. With equal weights, therefore, the averaging model obeys the parallelism theorem.

With equal weights, accordingly, all six benefits listed above for the parallelism theorem apply. The simplicity of parallelism analysis and its several benefits suggest using experimental procedures conducive to equal weighting. Most important would be to equalize amount of infor-
mation across different $S_{A_j}$ and similarly across different $S_{B_k}$. Further details on experimental procedure are given in Chapter 6.

**Averaging Model With Unequal Weights.** Equal weights will not always obtain. If $S_{A_1}$ conveys more information than $S_{A_2}$, its importance weight will be larger. In Equation 2, $\omega_A$ would have to be replaced by $\omega_{A_j}$, $\omega_B$ by $\omega_{B_k}$ (see Chapter 6). Parallelism theory does not apply; unequal weights cause systematic nonparallelism (Notes 4 and 5).

Unequal weights was a blessing in disguise for it allowed analyses of what seemed intractable phenomena. Most striking, it predicted opposite effects—adding a positive stimulus informer may increase or decrease the response. Opposite effects might seem to rule out any algebraic model (see below). Moreover, unequal weights made possible measurement of importance weight ($\omega$) separate from value polarity ($\psi$), a stumbling block for nearly all previous attempts. Also, unequal weights showed that previous theories of psychological measurement were conceptually deficient (see *Measurement Theory*, Chapter 6, Appendix).

**EXPERIMENTAL EVIDENCE**

Information Integration Theory has done well in almost every field of human psychology. The parallelism theorem has succeeded across the age range from 4 years to old age and across diverse cultures. Some difficult problems had to be resolved, seven of which will be briefly noted (see *Twelve Theoretical Issues*, pp. 54-68, in Anderson, 2008; more detailed discussion is given in Chapters 2-4 in Anderson, 1981a).

A task of person cognition was used in much of this early work. Participants receive a list of personality trait adjectives that describe a person; they judge that person on likableness, a response that facilitates equal weighting and hence parallelism (see Chapter 6).

**MEANING INVARIANCE**

Meaning invariance, benefit 4 of the parallelism theorem, has been and sometimes remains unbelievable. To introspection, it seems compellingly clear that trait adjectives in a person description interact to change one another’s meanings. Some writers still adhere to this introspective change-of-meaning hypothesis despite repeated disproof with parallelism analysis (see also next section).

A different objection is that a given stimulus may have different values in different contexts. This is not actually an objection; the context
may influence the GOAL for the valuation operation in the Integration Diagram. Hence the context will also influence the value. Thus, the trait happy-go-lucky could be positive in a picnic companion but negative in a research assistant (Anderson, 1968a, pp. 232ff). Within either role, however, traits would have fixed value (see also next section).

Verbal reports can be priceless clues about conscious and nonconscious cognition. They can be obstinately wrong, however, as with the disbelief in meaning invariance (Note 6).

The psychological laws provide a validity criterion for verbal reports. These laws can adjudicate phenomenological claims, as with the change-of-meaning hypothesis. More important, such validity criteria can help develop *Science of Phenomenology* (Chapter 7).

**COMPLEX PROCESSING**

A specific objection to meaning invariance was that the personality adjective task may suffer from superficial processing. More natural complex processing, it was argued, would yield meaning changes that would produce deviations from parallelism.

To test this hypothesis, one group of participants was instructed to write a paragraph describing the person in their own words before they rated likableness. They are thus forced to interrelate the trait adjectives. Their integration graphs, however, still showed parallelism. Indeed, these graphs were virtually identical to those of the no-paragraph comparison group (Anderson, 1981a, pp. 168f).

**OPPOSITE EFFECTS**

The same stimulus may have opposite effects, additive or subtractive. Such opposite effects might seem to rule out any algebraic model. In fact, opposite effects is predicted by averaging theory: adding a medium stimulus will average up a low stimulus, average down a high stimulus.

Such opposite effects have given extensive support to averaging theory (e.g., Figures 4.2 and 5.2). Besides the two cited figures, the numerous examples include attitudes towards U. S. presidents (Figure 6.1), judgments of persons described by personality traits (Anderson, 1981a, Figure 1.20, p. 59), females’ judgments of prospective dates (Lampel & Anderson, 1968), adjective–predicate language integration (Anderson, 1996a, Figure 12.4, p. 406), divorced women’s judgments of marriage satisfaction (Anderson, 1996a, Figure 5.12, p. 178), and children’s judgments of probability (Schlottman, 2000).
SET-SIZE EFFECT

A complication for averaging theory appeared with the set-size effect: more informers, all of equal value, will yield a more extreme response. An attractive interpretation, pursued by some writers, was with an adding model with diminishing returns.

Averaging theory can account for this set-size effect by including the concept of initial impression, an expectation prior to receiving information that is also averaged in with given informers. Then the importance weight of each informer should be constant, regardless of set size. This analysis succeeded (see The Set-size Effect, Section 2.4 in Anderson, 1981a; see also Prior State in Chapter 6).

HALO THEORY

Suppose you are given a set of personality traits that describe a person, make some integrated judgment of the person, such as likableness, and then judge the value of one specified trait of that person. This judgment will be closer to the overall judgment of the person than if it had been judged alone (Anderson & Lampel, 1965).

This effect might well seem solid proof of change of meaning. Instead, it is a halo effect; the integrated judgment of the whole reacts back on the subsequent judgment of the part. These two different interpretations imply different flow of information processing, shown in Figure 4.2, page 113 of Anderson (1996a) together with experimental evidence, especially benefit 4 of the parallelism theorem. Integration theory thus allows experimental analysis of halo effects, which have been a concern in personnel evaluation in business and industry but whose analysis has been hobbled by reliance on correlation analysis.

PRIMACY AND RECENCY

That first impressions have greater influence is a common belief, and was the essential base for the anchoring and adjustment heuristic of Kahneman and Tversky (see Kahneman, Slovic, & Tversky, 1982). This belief about first impressions is incorrect. IIT studies have shown instead that later information has greater influence in most tasks.

A known exception is the personality trait task. This task shows substantial primacy—greater effects of earlier adjectives (e.g., Figure 8.2). Meaning-change was one interpretation: the initial adjectives exert an assimilation effect on the values of the later adjectives. Instead, this pri-
macy effect was found to result from decreased attention to later adjectives (*Primacy Effect*, Section 3.3, Anderson, 1981a; Note 7 below).

**INTERACTION AND CONFIGURALITY**

The integration laws provide a base for studying interaction and configurality. The statistical interactions common in the literature are deviations from an additive model and are commonly assumed to have substantive reality, an assumption fostered by nearly all statistics texts. But these statistical interactions may merely be artifacts of a nonlinear response, devoid of empirical significance (see *Understanding “Interactions,”* Chapter 6).

One benefit of the many empirical findings of parallelism is their support for linearity of the *method of functional rating* (see Chapter 6). When this response method is used, deviations from parallelism may reasonably be interpreted as genuine. The negativity effect (greater importance of more negative information) was discovered from such a deviation from parallelism (Anderson, 1965).

**PSYCHOLOGICAL LAWS**

Can psychology aspire to true laws like those in physical science? The precision of the three laws of information integration and their generality across task and individual persons warrant a claim to an answer of *yes*.

This question was considered by the philosopher Silverberg (2003). Silverberg gave cogent, detailed evaluation of experimental evidence on Information Integration Theory and concluded (p. 299):

> N. H. Anderson and his colleagues’ achievements are relevant . . . to much discussion in philosophy of cognitive science. For example, there has been much controversy whether there can be a science of ordinary psychology, that is, of higher cognition and propositional attitudes, that would bear comparison with the sorts of developments that have been achieved in the natural sciences. There has been much controversy as to whether such a psychological science would contain laws.

> N. H. Anderson’s work presents strong grounds for affirmative answers to these questions.
UNIFIED FUNCTIONAL THEORY

The laws of information integration lead to functional modes of thinking throughout psychology. Thought and action are functional, goal-directed, as indicated by the triple GOAL of the Integration Diagram (Figure 1.1). The integration laws solve all three operations in the Integration Diagram: \textit{valuation} of external stimuli to construct internal, goal-oriented values; \textit{integration} of multiple values into a unitary internal response; and \textit{externalization} of this internal response to become observable. Lacking a foundation of integration laws, previous approaches had to adopt conceptual frameworks that, however useful, often led to conceptual fixedness that severely narrowed their usefulness and relevance. This conceptual fixedness is illustrated in the following five fields.

SOCIAL PSYCHOLOGY

Functional theory distinguishes between attitudes as enduring \textit{knowledge systems} (AKSs) and \textit{attitudinal responses} (ARs) constructed from these AKSs to meet demands of specific situations. The traditional view, in sharp contrast, conceptualized attitudes as one-dimensional evaluative reactions that represented enduring properties of individuals (see quotes from prominent authorities in Anderson, 2008, p. 109, Note 2).

This conceptual confusion of AR with AKS failed to understand the adaptive function of AKSs to deal with situational factors. This conceptual fixedness also roadblocked development of functional theory of attitudes, widely admitted to be desirable, beyond its original appearance in the 1950s (see \textit{Functional Theory of Attitudes}, Chapter 8).

This same conceptual fixedness also obstructed the study of integration of multiple variables, which is essential to understand situational construction of ARs from AKSs. Thus, in the fifth edition of the \textit{Handbook of social psychology}, Wilson, Aronson, and Carlsmith (2010, p. 79) called for a “new synthesis”:

\begin{quote}
Such a synthesis that will require . . . an emphasis on assessing the relative importance of several variables, which all influence an aspect of multiply-determined behavior . . .
\end{quote}

Such synthesis had been repeatedly demonstrated over the previous 40-odd years. “Multiply-determined behavior” is the essence of Information Integration Theory. Much multiply-determined behavior follows algebraic laws of information integration, especially in social psychology (Anderson, 1971, 1974b, 1981a,b).
LEARNING/MEMORY

Reproductive memory, assessed by accuracy of reproducing specific stimulus materials, has been the dominant conception in the field of memory. Functional memory, in contrast, is not assessed by reproductive accuracy but by the contribution of memory to other activities. It was long an “article of faith” that such contribution rested on the contents of reproductive memory.

A radically different view arose in early work on person cognition. Participants received a list of trait adjectives that described a hypothetical person, judged the person on likableness, and then gave casual recall of the adjectives that remained in memory. These two measures should show similar curves according to the “article of faith.” In fact, they showed very different curves.

The serial curve recall showed the standard recency, the most recent adjectives being best recalled. The serial curve of likableness, determinable from the integration law, showed the opposite effect, strong primacy, the earlier adjectives having greater effects (Figure 8.2). Functional memory, far more important than reproductive verbal memory, requires a different conceptual foundation.

New capability for functional theory of learning is provided by the integration laws. How informer stimuli given on one trial influence response on later trials can be exactly measured (e.g., Figure 8.3). Traditional learning curves can be replaced by methods that are not only more analytic but more relevant to the phenomena.

JUDGMENT–DECISION

Judgment–decision needs grounding on descriptive theory that studies how people actually function. Living involves a continuous sequence of judgment–decisions about the best of two or more courses of action. In principle, this is simple: calculate the expected value of each course of action and choose the one with highest expected value. Of course, success in analyzing such thought and action depends substantially on knowing the true values and probabilities involved.

Without capability for such true measurement, judgment–decision has been dominated by a normative approach based on simplistic situations in which the values and probabilities are assumed known, as in games of chance. This normative approach is attractive because it leads to definite mathematical results—of doubtful relevance to real life.
It would be more meaningful, of course, if the actual subjective values and probabilities could be measured. Such measurement became possible with the integration laws. As one example, the much-conjectured multiplication rule for Subjective Expected Value was established with the linear fan theorem of functional measurement (see *Cognitive Theory of Judgment–Decision*, Chapter 10 in Anderson, 1996a).

**PERSON SCIENCE**

Person cognition pervades everyday life: family, work, politics, TV, and self. These studies led to a theoretical framework very different from traditional personality theory.

Personality theory has been dominated by typological conceptions of traits as basic elements of personality and claimed success in establishing the “Big Five.” Unfortunately, this typological framework became fixated, much like the foregoing conception of social attitudes, and did not get very far in dealing with situation and context.

A more effective approach to personality is possible with the laws of information integration. These laws avoid the standard reliance on group data to define traits. These laws apply to individual persons. These laws open a path to developing functional theory—how persons function in dealing with the many problems, small and large, of everyday life (see *Person Science and Personality*, Chapter 7).

**PSYCHOLOGICAL MEASUREMENT**

The integration laws provide the first effective solution to the long-baffling problem of true psychological measurement. Warmth of a cup of coffee or heaviness of a lifted weight, for example, seem intuitively measurable but true measurement resisted solution. Heavier/lighter seemed no problem, of course, but equal units, as with gram weight, seemed unattainable. Indeed, a special committee of the *British Association for Advancement of Science* (Ferguson, 1940) concluded that true measurement was impossible in psychology.

True measurement of psychological quantities is possible based on laws of information integration (e.g., benefits 2 and 3 of the parallelism theorem). These laws, however, require a different mode of thinking from that common in physical science. The essential difference is that people are goal-directed (see triple GOAL in Integration Diagram). Teleological theory is necessary for psychological science.
Traditional approaches to measurement theory focused on response measurement, failing to realize the vital role of stimulus measurement. Even had they succeeded, they would have missed half the problem. Success with both was possible with functional measurement theory.

This success was possible by an almost miraculous beneficence of Nature—algebraic laws of information integration. Establishing these laws was by no means as simple as the parallelism theorem seems to say. One obstacle was to find how to remove known biases of the common rating method. Other obstacles are noted above in Experimental Evidence and in Chapter 6. These experimental studies by many dedicated investigators are the true foundation of psychological measurement.

**MORAL ALGEBRA**

Moral algebra rests on solid empirical ground. Moral algebra is operative by 4 years of age and continues throughout the life span. Moral algebra has cross-cultural generality, even with nonliterate persons. Moral algebra offers powerful methods for studying social–moral cognition. A brief overview of issues covered in later empirical chapters is given here.

**FAIRNESS AND EQUITY**

The social maxim of fairness—people should get what they deserve—seems universal. But how do we judge what people deserve?

Systematic attempts to uncover algebraic rules of fairness and justice began in the 1960s but were roadblocked by lack of capability for true psychological measurement of deserving. This difficulty may be illustrated with the hypothesis that a person’s fair share depends on effort as well as actual contribution:

\[
\text{Fair share} = \text{contribution} + \text{effort}.
\]

Testing this hypothesis requires measurement of effort. But effort is not an objective variable; how can its functional value be measured? Just apply parallelism analysis (benefit 3 of the parallelism theorem).

Functional measurement theory revealed exact algebraic laws in several such tasks, even with young children (Chapters 2 and 5). This moral algebra led to a new conceptual framework. Moreover, unfairness, previously submerged under fairness ideals, was recognized as a basic social motivation. Unfairness also follows algebraic laws.
BLAME

Blame, ubiquitous in everyday life, follows the basic blame law for a harmful act committed with some intent:

\[ \text{Blame} = \text{Intent} + \text{Harm}. \]

Blame and other negative reactions are basic social tools. They deserve study to decrease their personal aversiveness and increase their social effectiveness. This direction has been pursued in extensions of the blame law to study apology, recompense, and extenuation (Chapter 3).

LEGAL PSYCHOLOGY

Moral algebra has done rather well in legal psychology (Chapter 4). Arduous, pioneering work by Ebbesen and Konečni uncovered sharpest contrast between Superior Court judges’ ideals and their practice. In setting bail, for example, judges ideally gave high importance weight to community ties; in practice, community ties were completely ignored. The cogent work of these two investigators is a powerful argument for conjoint experimental–field investigation in the moral field.

A scientific base for the 7-year age limit for responsibility in civil liability was begun by Wilfried Hommers using integration experiments. His method has notable advantages of simplicity and objectivity over prevailing idiosyncratic clinical assessment.

Understanding social–moral systems of sociological deviants and criminals is interesting in its own right and useful for improving social control. Integration experiments have advantages of objectivity and generality lacking in case reports as shown by Etienne Mullet, Yuval Wolf, and their associates. Their approach can reveal personality functioning of deviant individuals and criminals, a fascinating opportunity.

MORAL DEVELOPMENT

Moral development has central importance because social morality resides largely in the transitory knowledge systems of individuals who are born, develop, and die. Moral development is thus a foremost problem of moral science.

Piagetian Theory. Systematic study of blame was begun in pioneering work by Piaget who concluded that young children have strong cognitive
limitations. Given the harm caused by an act and the intent of the actor, they cannot integrate the two.

Instead, said Piaget, they center on one or the other and judge on the basis of that one alone. Young children thus have severely limited cognitive capabilities, not only in moral cognition but generally in cognition about the external world. Only at Piaget’s stage of formal operations, at 10–12 years of age, would integration laws be possible.

An entirely different picture emerged as soon as IIT was applied in the 1970s by Manuel Leon and Colleen Surber Moore. Young children can integrate very nicely—they follow algebraic laws in moral cognition, judgment–decision, and naïve physics. Such integration studies showed that young children have far higher cognitive capabilities than previously realized (Chapters 3 and 5).

**Moral Stage Theories.** Moral theory has been dominated by stage views that moral development progresses through a succession of distinct stages, each of which involves qualitative reorganization of the previous stage. These theories suffer crippling inadequacies, largely a consequence of their reliance on people’s verbal rationalizations for their choices in moral dilemmas (see Moral Stage Theories in Chapter 5).

**Information Integration Theory.** A new base for studying moral development was provided by finding algebraic moral laws at young ages. These same integration laws appear across the lifespan and in other cultures. Moral values differ widely, of course, but the integration laws allow for this. Indeed, these laws can measure values of individuals, a unique idiographic aid for cross-age and cross-cultural analysis.

**MORAL SCIENCE**

Cognitive theory is the main concern of this book. This work, however, is considered as a base for the more important problem of social betterment. A variety of issues in moral theory are discussed in Chapters 7 and 8. One class of issues concerns cognitive processes in moral thought and action. A second class of issues involve the dual, societal–individual functions of moral systems. Moral algebra has shown promise with many such issues, including deserving, both positive and negative, attitudes, conflict/compromise, and forgiveness.

Social betterment is the most important concern of moral science. Moral systems have improved markedly over the centuries but still leave much to be desired. Further progress requires empirical grounding to
which every area of psychology can contribute. Moral science offers an effective base that can unify the now fragmented field of psychology.

FAMILY LIFE

Family life is a fundamental domain for moral science. Basic components of our moral knowledge systems develop in infancy and childhood and have been studied by many investigators. Much of our moral thought and action develop and function in family life.

The family is a natural laboratory for empirical analysis with paramount importance. The family provides ample opportunities for many areas of psychology. No area of psychology has greater importance (see Family Life and Personal Design, Chapter 6 in Anderson, 1991c).

EDUCATION

Elementary schools do valuable work in teaching moral attitudes and moral behavior. This focus dwindles sharply in secondary schools whereas it should be increased. Here are unparalleled opportunities to improve the dual societal–individual functions of our moral systems.

Colleges and universities should similarly increase emphasis on now-neglected instruction, not only with adaptive transfer, their proper goal, but surely with marriage and parenting, which are a foundation for society (see Education in Chapter 7).

SOCIAL HEALING

Healing processes are needed to ameliorate negative feelings resulting from inequities inevitable in social organization and from selfishness, unfairness, and dishonesty, and maintain working levels of social interaction. Healing processes such as blame and apology (Chapter 3), expiation and retribution (Chapter 4), and forgiveness (Chapter 7) exhibit moral algebra.

Exceptional work on societal forgiving has been done by E. Mullet and his colleagues. As one example, Azar and Mullet (2001) showed that willingness to forgive a gunman who had shot a child during the civil wars in Lebanon was a neat additive function of four stimulus variables for all three Muslim sects and all three Christian sects. Forgiveness was substantial—nearly the same for gunmen of the same or opposite religion as the respondent (Algebra of Forgiveness, Figures 7.5 and 7.6).
UNIFICATION OF PSYCHOLOGY

Moral considerations operate at every turn of daily life, from simple courtesy to family interaction, in reactions to TV news on local and national politics, in balancing self-interest with other-obligation, and in seeking self-fulfillment. Morality should thus be a central concern in every social science, psychology especially.

But although dedicated work has been done by a number of persons, morality is hardly mentioned in the main fields of psychology. From learning to personality, morality is virtually ignored. Within each field, moreover, progress has led to increasing fragmentation, as several writers have complained.

Unification of most fields of psychology is possible by focus on the central problem of morality, to which every area can make valuable contributions. The three laws of information integration are an effective base for unifying the psychological field, discussed further in Chapter 8.

NOTES

Note 1. Mathematically, the parallelism theorem is simple and proof is omitted here. The real problem is empirical proof. Premise 1 of the parallelism theorem contains an implicit assumption that the stimulus informers have independent effects. Hence observed parallelism supports meaning invariance (benefit 4).

This independence assumption may need to be implemented with task instructions. In the personality adjective task discussed in the text, standard instructions state that each adjective that describes the person had been contributed by a different acquaintance who knew the person well (see further Chapter 6).

Premise 2 of the parallelism theorem is a simplified statement of response linearity. The complete statement is $R = c_0 + c_1 \rho$, where $c_0$ and $c_1$ are zero and unit constants. For simplicity, these constants are set at 0 and 1, respectively, here and in later chapters. This entails no restriction on the conclusions. Linear is a more appropriate name for what is often called an equal interval scale which derives from the physicalist conception of measurement as additive units (see Appendix in Chapter 6).

With empirical data, of course, the row and column means are only estimates of the true values of the row and column stimulus informers. Deviations from parallelism may be tested with the interaction term from analysis of variance to obtain a proper test of goodness of fit (Chapter 6).

Note 2. Behavioral response measures have proved to be linear in some experiments with humans, bar press rate in rats, and peck rate in pigeons (e.g., Anderson, 1996a, pp. 104, 327, 401; 2002). Stimulus integration is important in infrahumans, as in sensory processing. Perhaps they also follow simple integration laws.
Note 3. Equation 2 for the averaging model omits the term $\omega I_0$, which represents the initial impression (prior state). With adding models or averaging models with equal weight, prior state acts as an additive constant and so may be omitted in parallelism analysis (see Prior State, Chapter 6). It must be included, however, to account for the set-size effect and for estimating weight and value with the Average program.

Note 4. Unequal weight averaging was troublesome in the early stages of IIT because it produces deviations from parallelism. These deviations could result from nonlinear response, from nonadditive integration, or from both together. Hence there was much uncertainty, because expectation for any simple model was low, because the rating method was widely condemned as being nonlinear, and because unequal weight averaging was not expected nor then considered desirable.

This tangle was unsnarled, in part because the averaging model with equal weights is common and yields parallelism, and in part because the procedures initially adopted for the method of functional rating (Chapter 6) were effective in eliminating nonlinear response bias. Most important, experimental manipulation of importance weights, as with amount or reliability of information, successfully predicted deviations from parallelism.

Note 5. With equal weights, averaging and adding models cannot be distinguished. The terms, add-ave model, or adding-type model, are accordingly used to avoid any implication of strict additivity in the integration process.

Note 6. Participants asked to explain their judgments in the personality adjective task typically give plausible accounts of how one trait adjective modified the meaning of another. The observed parallelism reveals the invalidity of these verbal reports. Instead, they appeared to be halo effects (see Halo Theory).

I regret that we have not made systematic study of these verbal reports. Aside from their interest for language cognition, deeper understanding of this difference between introspection and actual cognition would help develop science of phenomenology.

Note 7. Here are two of the 16 lists of personality trait adjectives used in the very careful experiment of Hendrick and Costantini (1971) to test whether the reliable primacy effect with this task of person cognition resulted from change of meaning, from inconsistency discounting, or from attention decrement:

- energetic, vigorous, resourceful, stubborn, dominating, egotistical
- energetic, vigorous, resourceful, withdrawn, silent, helpless

Primacy was assessed by presenting each set in high-low and low-high order. Note that the first and last three adjectives are consistent in the first list, inconsistent in the second. Hence change of meaning and inconsistency discounting predict greater primacy with the second list; attention decrement predicts no difference. Change of meaning and inconsistency discounting failed; attention decrement succeeded in this ingenious experiment, one of several basic articles by Clyde Hendrick in the early years of IIT. The adjectives and results for all 16 lists are given in Table 3.2, p. 189 of Anderson (1981a).
Chapter 2 Preface

DESERVING THEORY

Deserving, including equity and fairness, lies at the heart of social–moral cognition. The deserving schema—your deserts should be proportional to your deserving—is age-old. The idea of an algebraic model of proportionality goes back to Aristotle and was much discussed in the latter half of the 20th century in terms of equity theory. But to judge proportionality we must be able to measure how much people deserve. Lacking true measurement, proportionality remained qualitative verbalism.

This measurement problem was resolved with the functional theory of measurement. Moral algebra of deserving has done quite well.

These experiments led into a wider field of deserving. Previous work on positive deserving had been largely concerned with third-party judgments of fairness ideals in two-person groups. Major issues: first-person judgments, unfairness, and social comparison were neglected. These issues require expanded conceptual frameworks.

Cognitive theory is one direction for future work. Deserving theory exhibits the same cognitive processes and algebraic laws that have been found in person science, social attitudes, and judgment–decision. The present impoverishing fragmentation of these areas can be replaced by fruitful unification.

Social relevance, or outcome validity, is a second direction for future work. The third-party judgments of deserving and equity miss most of everyday life. Some workers have moved in this direction. Their work argues that immersion in everyday life is essential for social relevance.

DESERVING THEORY (2)
EQUITY THEORY (4)
UNFAIRNESS THEORY (10)
RELATED ISSUES OF DESERVING (15)
COMPARISON ALGEBRA (23)
GENERAL THEORY OF DESERVING (25)
NOTES (28)
Chapter 2

DESERVING THEORY

Copyright © Norman Henry Anderson
May 19, 2013
Comments most welcome: nanderson@ucsd.edu

Concepts of deserving pervade social–moral cognition. The principle that people should receive in proportion to their deserving may be universal. Attempts to formalize this proportionality principle were roadblocked without adequate tools to handle two problems—valuation and integration of stimulus information about deserving.

One foothold on deserving theory is available with Information Integration Theory (IIT). The long-standing conjecture that distributive justice follows algebraic models is shown to have some truth. This experimental work is discussed in the second main section of this chapter under Equity Theory. This work on equity also pointed up two more basic concepts: deserving and unfairness.

DESERVING THEORY

Information integration is a key problem for deserving theory: multiple variables typically operate in combination. How much another person deserves may depend on a complex of personal characteristics including ability, social role, need, past and present behavior, and so on. Multiple variables appear everywhere in judgment of deserving.

How are these multiple variables integrated into a unified judgment? Relevant variables have been demonstrated by many investigators but how do these variables co-act? Do they simply add up? If so, can this additive rule be established? Or does the influence of one variable depend configurally on other variables? How can context be handled?

This integration problem is central in deserving theory. Understanding and social progress both depend on capability to deal with this key problem—integration of multiple determinants. This problem can be solved in some cases with the laws of moral algebra.
COGNITIVE THEORY OF DESERVING

A conceptual framework for cognitive theory of deserving is given by the Integration Diagram of Chapter 1, repeated here as Figure 2.1. Three problems appear in this diagram (see figure legend):

Valuation: Objective stimulus informers, S, are transmuted into goal-oriented psychological values, ψ.

Integration: Multiple values are integrated into internal response, ρ.

Action: Internal response is externalized, becoming observable R.

The integration problem has obvious importance; thought and action generally depend on joint action of multiple variables. The moral value of helping, to take a common example, depends on various aspects of interpersonal and social obligation, on likely costs and benefits, as well as on context variables.

The valuation operation is fundamental. Valuation transmutes an objective stimulus, S, into a subjective value, ψ, in relation to the operative GOAL. Such construction of goal-oriented values is the foundation of adaptive thought and action.
This valuation problem might seem an absolute roadblock to solving the problem of multiple variables—it is their unknown personal values for each individual that are integrated. This roadblock of true psychological measurement is prominent in moral cognition, which can exhibit large individual differences and strong dependence on context.

Without capability for true measurement, previous investigators were mostly concerned with directional trends of single variables. Interesting results were obtained but this approach is not much help with the basic problem of integrating multiple variables.

An effective foothold is available. Integration of multiple variables follows algebraic laws in some important cases. These laws do double duty. First, they solve the integration operation, I, in the Integration Diagram. Second, they can measure the functional values constructed by the valuation operation, V (benefits 1 and 3 of the parallelism theorem).

This integrationist approach has been successful with several issues in deserving theory. Foremost are the first definite tests of the equity model proposed by Aristotle and its modern variants. These tests established the operative model, a relative of Aristotle’s.

**EQUITY THEORY**

What is fair distribution of an outcome produced by people engaged in some mutual activity?

- Should all get equal shares?
- Should those who contribute more get more?
- Should someone who doesn’t work very hard get less?
- Should someone who tries hard but contributes little get less?
- Should an expert or supervisor get more?
- Should someone who is less needy get less?
- Should someone who is more needy get more?

These and other questions of fair distribution have wide sociopolitical importance. “Equal pay for equal work” and health insurance are two of many examples. Similar problems of fairness pervade society from the family and everyday jobs to allocation of tax revenues. In science, many investigators feel their work does not get the recognition it deserves.

Problems of fair distribution go back to antiquity but a new era began with numerous empirical studies in the latter part of the twentieth century. This work often ran aground, however, from lack of adequate theory and method to deal with multiple variables. An effective foothold is available with the psychological integration laws.
THREE MODELS OF EQUITY

Moral algebra of equity began with Aristotle's equation for distributive justice. Consider two persons, A and B, engaged in some mutual activity. Denote their contributions (inputs) by $I_A$ and $I_B$, and their rewards (outcomes) by $O_A$ and $O_B$. Justice, said Aristotle, requires that their rewards be proportional to their contributions:

\[ \frac{O_A}{O_B} = \frac{I_A}{I_B}. \]  
\[ \text{(Aristotle) (1a)} \]

There the matter rested for two millennia.

New interest in equity algebra began around 1960, notably with Adams' (1965) insightful discussion of industrial psychology. Adams postulated a different model:

\[ \frac{O_A}{I_A} = \frac{O_B}{I_B}. \]  
\[ \text{(Adams) (1b)} \]

These ratios can be seen as piece rate pay on an industrial assembly line, which reflected Adams' substantive interests.

Adams' main contribution was to point up the many variables that could influence judgments of I and O in business and industry. Seniority, for example, is widely considered a determinant of deserving so new hires may get less for equal work. Again, one's title is often considered an outcome separate from pay. Later discussions of equity theory are indebted to Adams' wide-ranging discussion.

This work called attention to numerous social situations that involve distributive justice, including various status variables. However, the basic processes of valuation and integration were submerged in piece-meal studies of one or another variable. Validity tests of the two cited equity models were notably lacking.

One more equity model needs consideration. Averaging theory implies fair division should follow the decision averaging law. Outcome should be proportional to relative input:

\[ O_A = \frac{I_A}{I_A + I_B}. \]  
\[ \text{(Averaging) (1c)} \]
SOCIAL COMPARISON IN EQUITY THEORY

Equity judgments are social comparisons. Two loci of comparison are involved: within person and between person. These comparisons occur in opposite order in Adams and Aristotle. Adams’ model begins with two within person comparisons—of outcome to input for A and for B. These are followed by between person comparison of these two ratios.

The opposite comparison structure appears in Aristotle’s model. It begins with two between person comparisons—of $O_A$ to $O_B$ and $I_A$ to $I_B$. Averaging theory shows somewhat similar comparison structure.

ARE EQUITY MODELS TESTABLE?

Despite popularity, equity models were seldom tested experimentally. That the ratios of Equations 1ab were instead differences, for example, could not be tested without true measurement. Again, input $(I)$ was commonly assumed to be a sum of relevant variables, an assumption that failed its first experimental test (Equations 3 and 4 below).

**Measurement Crux.** The crux for testing equity models is psychological measurement. To test Aristotle's model involves true measurement of the subjective, psychological values of all four terms in Equation 1a; the same holds for Adams' model of Equation 1b. Nearly every investigator tried to pass by this measurement problem.

The most common passby was to show that some variable has a directional effect on judgments of equity. This approach has uncovered interesting results but it misses the heart of the matter. It is little help with integration. Or with valuation. Some workers used objective physical values for I and O, usually a mistake (*Measurement Pitfalls*, below).

**Functional Measurement.** The measurement crux in equity theory was resolved with the functional theory of measurement. Experimental participants were told how much persons A and B had contributed to their common job. They were instructed to divide a fixed sum, T, between A and B in a fair way. All three models imply

$$O_A = \frac{I_A}{I_A + I_B} T.$$  \hspace{1cm} (2)

This equation predicts a slanted barrel pattern for the integration graph. This prediction was supported in the study of Figure 2.2 (Note 1).
Figure 2.2. Fair division of total pay between two workers, A and B, each varied over five nominal levels of performance on a common job. The theoretical barrel shape is indicated by the vertical spread between the top and bottom curves: 28%, 33%, 34%, 31%, and 28%, from left to right. These values are statistically different and of the size predicted from the equity models. (After Anderson, 1976.)

This functional measurement analysis combines quantitative power with simplicity. Prior measurement of $I_A$ and $I_B$ in Equation 2 is not necessary. The integration rule is diagnosed from the pattern in the integration graph of the response alone. The functional values of $I_A$ and $I_B$, if desired, can be determined from this integration graph.

This result was promising. It does not, however, distinguish between Aristotle and Adams. Algebraically, their models are equivalent. Multiplying both sides of Aristotle's model by $O_B/I_A$ yields Adams' model. They cannot be distinguished using judgments of fairness. Nor can the decision averaging model of Equation 1c.

This equivalence is troubling because the models involve different social comparisons noted above. Such social comparisons have general importance in information processing.

The three models can be distinguished, however, by broadening the field to study unfairness (see below). First, however, the question of how multiple inputs are processed needs consideration.
TESTING THREE FAIRNESS THEORIES: INPUT INTEGRATION? FAIRNESS INTEGRATION?

Beside actual work performance, many other variables can influence judgments of fair division. Equality is one, with equal shares for all who contribute. Equality is frequent in business; those doing similar work often get equal pay despite unequal efficiency. Ability and need are also among the variables considered in the literature. But how such separate variables are integrated had eluded analysis.

Further comparison problems are raised by this fact of multiple input variables. How can a one-dimensional outcome be proportional to a multidimensional input (Anderson, 1976; Farkas & Anderson, 1979; Leventhal, 1980)?

Two answers have been put forward: input integration and fairness integration. To illustrate, suppose actual work performance, W, and effort, E, are varied for persons A and B. Participants judge A's share of some fixed total outcome, T.

Input Integration Versus Fairness Integration: Theory. The hypothesis of input integration assumes that the multiple determinants are first weighted and summed to obtain a one-dimensional value of input. This unitary input may then be used in any of the fairness models. Input integration, taken for granted by most writers, may be written

\[ O_A = \frac{I_A}{I_A + I_B} T = \frac{W_A + E_A}{(W_A + E_A) + (W_B + E_B)} T. \] (3)

An alternative hypothesis is also plausible—fairness integration. Make a fairness judgment separately for each input variable; the final judgment is a weighted sum of these partial fairness values. This hypothesis is attractive because it avoids any problem of adding inputs that are qualitatively different such as work performance and effort, W and E. This hypothesis of fairness integration may be written

\[ O_A = \frac{W_A}{W_A + W_B} T + \frac{E_A}{E_A + E_B} T. \] (4)

Different comparison processes appear in these two hypotheses, but both make similar directional predictions. To distinguish between them requires analysis of integration patterns.
**Input Integration Versus Fairness Integration: Experiment.** An easy test between these two hypotheses is available. Vary actual work performance, $W$, and effort, $E$, for persons $A$ and $B$. Each hypothesis makes specific predictions about the patterns of the integration graphs.

*Fairness integration* implies that $W_A$ and $E_B$ have additive effects, for they are separated by a $+$ sign in Equation 4. Hence the $W_A \times E_B$ integration graph should be parallel. *Input integration*, in contrast, implies nonparallelism since $W_A$ and $E_B$ are separated by division in Equation 3.

All four input variables were varied in the experimental test. The six two-variable integration graphs are shown in Figure 2.3.

![Integration graphs](image.png)

**Figure 2.3.** Social comparison for fair reward obeys cognitive algebra. Integration graphs support fairness integration (Equation 4), with separate calculation of fair reward for each of two input dimensions, Work performance and Effort. In each of the two experiments, barrel shapes of the two left panels and parallelism of four right panels agree exactly with theoretical prediction from fairness integration. (After Farkas & Anderson, 1974, 1979.)

Fairness integration is solidly supported. Fairness integration predicts parallelism in the four panels that show parallelism. And it predicts
a slanted barrel pattern in the other two panels, exactly as shown in Figure 2.3. Similar results were reported from India by Singh (1985). The input integration hypothesis did poorly; Equation 3 predicts all six graphs will be nonparallel. Input integration was supported, however, for the special case in which the two input variables were work contribution on two separate occasions. In this case, both variables are qualitatively similar and readily integrated into a one-dimensional input (Notes 2a and 2b).

UNFAIRNESS THEORY

Unfairness is a basic social motivation. Fairness is only a single point on a continuum of unfairness. Fairness is too narrow to get far on moral science, especially in social reality.

Unfairness should be a primary concern of deserving theory. Unfairness has been submerged, however, under the dominant concern with fairness ideals in equity theory. This concern glances by an important domain of everyday life.

THREE MODELS OF UNFAIRNESS

Each fairness model of Equations 1abc may be extended to a model of unfairness by taking the difference between the outcome and input ratios. Let $U_A$ denote unfairness to A. Then

$$U_A = \frac{O_A}{O_B} - \frac{I_A}{I_B}.$$  \hfill (Aristotle)  \hfill (5a)

$$U_A = \frac{O_A}{I_A} - \frac{O_B}{I_B}.$$  \hfill (Adams)  \hfill (5b)

$$U_A = \frac{O_A}{O_A + O_B} - \frac{I_A}{I_A + I_B}.$$  \hfill (Averaging)  \hfill (5c)

As written, a negative difference represents unfairness to A; a positive difference represents unfairness to B. Whether the subtraction operation in these models is justified must of course be determined through experimental analysis.
One simple test between these three models can be obtained with an integration experiment that varies $O_A$ and $O_B$. The three models predict different integration graphs.

In Adams' model, $O_A$ and $O_B$ are additive since they are separated by a minus sign in Equation 5b. Hence the $O_A \times O_B$ integration graph should be parallel. In Aristotle's model, $O_A$ and $O_B$ are separated by a division sign in Equation 5a. The integration graph should thus be a linear fan. And in averaging theory, the relative ratio of the decision averaging model implies a slanted barrel for the $O_A \times O_B$ integration graph.

Results of the first experiment, shown in Figure 2.4, gave clear support to averaging theory. All four variables were manipulated, yielding six two-variable integration graphs. Each model predicts the shape of all six graphs.

**Figure 2.4.** Judgments of unfairness obey cognitive algebra. These six integration patterns support decision averaging law of IIT, disagree with models proposed by Aristotle and by Adams. (After Anderson & Farkas, 1975.)

**Adams' Model.** Adams' model did poorly. It predicts the two left graphs should be parallel. Instead, both are nonparallel. Adams model also predicts linear fans for the two right panels, $I_A \times O_A$ and $I_B \times O_B$. Instead,
both are parallel. At bottom, Adams' model is qualitatively incorrect; it has wrong comparison structure.

**Aristotle's Model.** Aristotle's model does rather well. It predicts parallelism for the four parallel graphs. It also predicts nonparallelism for the two nonparallel graphs, although linear fans rather than the slanted barrels. It is qualitatively correct, however, for it shows the correct comparison structure.

**Averaging Model.** The averaging model correctly predicts the pattern of all six integration graphs of Figure 2.4. Thus, it reveals the operative social comparisons. Later work has corroborated these results, good support for cognitive algebra of distributive justice.

**Moral Algebra.** This experiment is striking evidence for exact mathematical law of moral cognition. The simplicity of this analysis deserves notice. The experimental design itself is a factorial design, familiar from first-year graduate statistics. The data analysis requires hardly more than visual inspection.

**Social Comparison.** Simple comparison structure in moral cognition is also revealed in these results. This insight into cognitive processing could hardly have been obtained in any other way. Further results about social comparison theory have also been obtained with justice algebra. One is in the next section for multiple dimensions of outcome.

**Unfairness.** Unfairness has obvious importance in moral theory but it has been neglected in traditional concerns with fairness ideals. Fairness theory misses significant aspects of social reality. Unfairness deserves systematic study in its own right.

**MULTIDIMENSIONAL OUTCOME: OUTCOME INTEGRATION? UNFAIRNESS INTEGRATION?**

Outcome usually has multiple dimensions. Job satisfaction, for example, may depend on work interest and working conditions as well as pay. The hypothesis of *outcome integration* states that all such variables are integrated to obtain a net value of job satisfaction. Such one-dimensional mediators have generally been taken for granted although they were not testable without measurement capability.

Unfairness theory, however, suggests the alternative hypothesis of *unfairness integration*. A value of unfairness is calculated for each separate outcome variable; these partial unfairness values are integrated to
obtain a net value of unfairness. Whereas outcome integration requires integration of variables of different quality, this difficulty is avoided with unfairness integration.

Multidimensional outcome was among the many issues studied in the landmark program of research on equity theory by Arthur Farkas (1977, 1991; Farkas & Anderson, 1974, 1979). The two hypotheses imply different patterns in the outcome integration graphs, analogous to those just discussed for multiple input variables. These graphs showed good support for unfairness integration (Farkas, 1991, Figure 3, p. 61). This one experiment deserves follow-up to assess its generality.

Multidimensional outcome is important in everyday life. Outcome integration is implicit in utilitarian theory of “greatest good.” It has also been standard in modern judgment–decision theory. But Farkas’ experiment suggests that outcome integration may be false (see also Input-Outcome Linkage below).

**IMPORTANCE WEIGHTS**

Different variables may have different importance weights in judgments of deserving and fairness. In Equations 3 and 4, for example, Work may be weighted more heavily than Effort.

**Functional Measurement Theory.** Functional measurement theory automatically allows different weights for different input variables in many cases. With Work and Effort in Equations 3 and 4, the importance weight of each variable is implicitly included in its functional value. Hence the integration graphs will show similar patterns regardless of the weights. All predictions for multidimensional input or outcome hold, regardless of weights (Farkas, 1991, Equations 3 and 4).

This capability to finesse the weighting problem allows simple analyses of some complex questions. Some situations, however, require explicit weights, as in the next two subsections.

**Salience Weights.** Unfairness comparisons are expected to be weighted more heavily when they are more salient. Farkas (1977, 1991) extended the basic unfairness model to include salience essentially as follows:

\[ U_A = \omega [1/2 - I_A/(I_A + I_B)] \]  

(6)

If \( I_A > I_B \), the quantity in brackets is negative, that is, unfair to A. This is multiplied by \( \omega \), B’s salience weight in A’s judgment.
In Farkas' experimental scenario, A and B were college students working on summer jobs as construction laborers. The three levels of A's hourly wage were all less than those of B. A and B did equal work, however, so A was always relatively underpaid (thereby avoiding complications from comparing under- and overpayment). Salience was manipulated by whether A and B worked for the same employer (high salience weight) or different employers (low salience weight). Participants judged unfairness to A, $U_A$.

Farkas' model implies that the 3 x 3 integration graph, A's wage \times B's wage, should converge as B's wage increases. Also, the curves for A's wage should be farther apart for higher salience. These predictions were well supported (Farkas, 1977, Figure 10, p. 139).

**Are Underpayment and Overpayment Psychologically Equivalent?**

Some writers have thought that overpayment and underpayment should have equivalent effects. Hence overpayment on one dimension should cancel equal underpayment on another. Such assertions about overpayment inequity were made by Homans (1961) and Walster, Walster, and Berscheid (1978); see *Psychology and the legal system*, Wrightsman, et al. (2002, p. 65). But these assertions were free-floating, lacking experimental evidence.

Farkas studied this issue by using unequal salience weights to represent under- and overpayment in Equation 6. His model showed promise with the half of the participants who considered overpayment unfair (although these may have been reacting to the underpaid person).

Half the participants, however, did not consider the overpayment unfair. This result deserves further study.

Underpayment/overpayment has high social relevance. Underpayment generates displeasure and resentment. Overpayment to some persons may generate negative feelings in others. Here again, standard third-party experiments miss important phenomena of social life. This issue deserves systematic study using conjoint experimental–field investigation (Note 3 and 4).

**INTRAPERSONAL UNFAIRNESS**

Intrapersonal unfairness has also been overlooked in equity theories. Whereas these theories involve comparisons between different persons, feelings of fairness/unfairness may be entirely personal, without comparison to specific other persons. Some adults feel their career or their children did not live up to their expectations. Feeling of unfairness then rests
on comparison of actuality with expectation, without specific comparison to another person’s outcomes (Note 5).

Intrapersonal unfairness is important in everyday life. How can it be studied experimentally? The subtraction rule,

\[ \text{Unfairness} = \text{Outcome} - \text{Deserving}, \]  

(7)

offers a simple beginning. All three terms in this equation, it should be emphasized, are considered personal feelings of the individual.

This model could be studied using simple integration designs for deserving and outcome. Distressed marriages could provide realistic settings using personal design (Chapter 6). “Count your blessings” therapy might be experimentally grounded. This approach might also be useful for associated qualities besides unfairness, such as feelings of resentment or defeat by assistant professors who fail to get tenure.

RELATED ISSUES OF DESERVING

Moral algebra may be a foundation for general theory of distributive justice. If the foregoing results hold up, they will provide an effective base for this major branch of moral theory. Many issues remain unexplored, however, and the cited studies require replication and extension. Some related results are noted in following sections.

UNFAIRNESS PARADOX

Hope for a social system in which feelings of fair treatment are reasonably general may be unrealistic. One obstacle is noted in the following unfairness paradox (Anderson, 1976; Thompson & Loewenstein, 1992).

Two persons who contribute equally to a joint project may both feel unfairly treated with equal outcome. This follows from any of the unfairness models. Each person's own effort will be more salient than that of the other; it will thus get higher weight and/or value in their own mind. Equal division will not seem fully just to either person.

Psychologically, of course, this unfairness paradox is not a genuine paradox. It rests on assumption that the third-party judgments commonly studied in equity theory should somehow hold for first-person judgments. This paradox points up the need to shift focus of equity theory to the first-person framework of so much of life.

A further implication of this paradox is the importance of social mechanisms that may ameliorate such feelings of unfairness. Superior–subordinate relations is one. Other such mechanisms include status,
seniority, and group belonging. Systematic study of such mechanisms could have beneficial social–moral effects.

Biosocial adaptation may be most important; people often adapt and are not troubled by ostensible inequity, as with wives in many marriages. Multidimensional outcome offers opportunities to adapt importance weights of some outcomes, a common adjustment process (Note 6).

INPUT–OUTCOME LINKAGE

The multidimensional nature of input and outcome means they deserve conjoint study. The foregoing experiments were devoted to one or the other but the two may interact.

Figure 2.5. Input–outcome linkage in fair shares judgment. Reward is either money (curves labeled M) or praise (curves labeled P). Left panel shows work performance is rewarded more with money than praise; right panel shows effort is rewarded more with praise than money. (After Farkas, 1991.)

This issue of input–outcome linkage was studied in Farkas' experiment of Figure 2.5. Persons A and B were characterized by performance (how much each had accomplished) and effort (how hard each had tried) on a mutual task. Participants judged fair division of two outcomes—money and praise.

The slopes of the curves in Figure 2.5 show that accomplishment was more important than effort in the division of money (left panel), effort more important in division of praise (right panel). (These slopes provide a ratio scale of importance.)

A general issue of method is illustrated in this experiment. Single measures may yield an inadequate picture of moral cognition (see Profile Measures, Chapter 6).
NEGATIVE INPUT

The problem of negative input caused a small commotion in the 1970s when it was realized that Adams’ equity model fell apart in such cases. A cashier who sneaks €10 from the till has $I_A/O_A = -€10/€10 = -1$; the employer has $I_B/O_B = +€10/-€10 = -1$; equity is satisfied!

Several variant models were published, each claiming to resolve this difficulty. All were disprovable with simple thought experiments (see Anderson, 1976, Note 1, p. 298; Farkas, 1991, Note 1, pp. 88ff). These thought experiments illustrate how mathematical models can help qualitative understanding, here by affirming that negative acts are largely outside equity theory.

Negative performance may of course occur in cooperative groups. Team effort may suffer from error or ineptness of one member. This member may nevertheless share in the team’s outcome. Effective input may include an equality component that derives from team membership. Net deserving of this member may thus be positive.

HARMDOING

Some writers have sought to apply equity theory to harmdoer behavior. As one example, Walster, Walster, and Berscheid (1978) assert that harmdoers denigrate their victims because this denigration reduces their feeling of overpayment inequity.

This fanciful argument arose with an attempt to include deliberate negative input in the equity model. This argument implies that a burglar or bank robber will feel greater guilt with a larger haul! Instead, denigration of victim can ease the harmdoer’s conscience and serve as excuse.

Equity theory refers to distributive justice. This presupposes some cooperative framework, which largely excludes deliberate harm doing. The justice rule that punishment should fit the crime is not distributive justice, which is the concern of equity theory.

NEGATIVE OUTCOME

Some group ventures come to grief. If the group outcome is negative, how can it be equitably divided among the group members?

Adams’ model would require that persons who contributed more bear greater shares of the loss. This hardly seems equitable, especially if they have already lost their larger input contributions. On the other hand,
equal sharing of the loss could be disastrous for persons who had contributed the little they had.

Harris (1983) seems almost alone in trying to deal with this interesting conundrum. His *linear formula*, however, allows negative input which seems dubious as just noted (see also below).

I suggest that this moral dilemma is not sufficiently specified to allow meaningful analysis. Social context is essential. In particular, it seems necessary to know how the group members had planned to share a positive outcome. Equal sharing and proportionate sharing would entail different distribution of the loss. Relative ability of the members to bear the loss could also be relevant.

**SUBTRACTION MODEL**

Although the decision averaging law was well supported in the foregoing experiments, subtraction models have sometimes been observed (Anderson, 1976). In Farkas and Anderson (1974, 1979), a subtraction rule was found when both input dimensions were the same.

This subtraction rule was interpreted to result from task simplification to apply the general-purpose adding-type rule. This interpretation was supported by Singh (1985), who reported a subtraction rule for students but a ratio rule for professional managers in India. The subtraction model reported by Mellers (1982) may have resulted from running participants in groups (see *One Person at a Time*, Chapter 6).

**MULTIPLE COMPARISON PERSONS**

Equity research has been largely limited to two-person groups. Social groups, however, often involve more than two persons. Two hypotheses about unfairness in work groups of three persons, all of whom had equal accomplishment but received unequal wages, were studied by Farkas (1977, 1991, pp. 79f). Participants judged unfairness of A’s wage relative to wages of B and C.

The *group comparison hypothesis* assumes that A is compared to B and C considered together as a group. The *individual comparison hypothesis* assumes that separate unfairness values are calculated for A relative to B and for A relative to C. These partial unfairness values are then integrated to determine an overall unfairness value. This is much like the foregoing hypothesis of unfairness integration and a similar result was expected. The data, however, supported the group comparison hypothesis.
This unexpected simplicity may help with analysis of real groups. The group comparison hypothesis implies that all comparison members of the group would reduce to a single cognitive unit. More generally, individuals may compare themselves to one or two specific persons together with a generalized referent that represents the entire group.

UNFAIRNESS THEORY

Unfairness is a basic social motivation. Feelings of and reactions to unfairness are basic social issues. Equity theory has fixated on ideals of fair division, glancing by the greater social problem. This peripherality is underscored by the concomitant focus on other–other comparisons, neglecting the self–other comparisons so important in everyday life.

Three advantages of studying unfairness may be seen in the experiment of Figure 2.4. It exhibited a cognitive algebra of unfairness, promising for further study of this basic motivation. It distinguished among the three fairness models of Equations 1abc—which could not be distinguished with fairness judgments. And it revealed a fundamental social process, namely, the operative comparison structure.

The foregoing unfairness studies, it should be recognized, were third-person judgments. They lack the emotional content of first-person unfairness of everyday life. First-person unfairness is difficult to study because of difficulty with experimental control.

Three approaches to first-person unfairness deserve consideration. Case studies can be invaluable for initial exploration of phenomena. Personal design could use some actual unfairness situation of a given person and embed it in an integration design with hypothetical but realistic levels of chosen variables (see Personal Design, Chapter 6). Role-play methods, could also be informative. In family or job conflict, for example, each member could role-play other members as well as self.

MEASUREMENT PITFALLS

The equity models involve personal values of input, outcome, and of their determinants such as performance and effort. Nonuse of capability for true measurement of personal values has undercut a lot of research in deserving theory. Some of these pitfalls are noted here.

Objective Measures. Some investigators have relied on objective measures of input and outcome. This is nearly always a mistake as illustrated in the next subsection on ordinal equity. Reliance on objective
measures has this more serious consequence: focus on narrow, artificial situations. Need, ability, status, obligation, appreciation, and many other variables generally lack objective metrics. Such variables are common in deserving but tend to be neglected from neglect of true psychological measures obtainable with functional measurement (Note 7).

**Ordinal Equity.** A rule of ordinal equity was proclaimed by Hook and Cook (1979; Hook, 1983): children make divisions away from equality in the direction of equity but fall short of exact proportionality. In support, they cite a finding that 5-6-year-olds who had completed 15 units to their co-workers 5 units kept an average of 12.7 of 20 rewards. Hook and Cook thought that equity required them to keep 15 of the 20 rewards, in proportion to their actual work. Since the actual responses fell short, they were called ordinal. Hook and Cook went further to argue that true proportionality could not appear before Piaget's stage of formal operations, around 10-12 years of age.

The measurement pitfall in this interpretation is the arbitrary assumption that the objective measure of work was a true measure of the child's value of deserving. As one alternative, children's judgments of deserving may have been an average of actual work and equality that derives from co-worker status (see further Anderson, 1991i, pp. 169f).

Ironically, true proportionality had been shown in 5+–year-old children by Anderson and Butzin (1978; see Figure 5.3). Hook and Cook misinterpreted this experiment as ordinal equity. To do this, they had to assign arbitrary values to the inputs because physical values did not exist. They failed to recognize that the functional measurement analysis had provided true psychological values. Functional measurement showed true proportionality—clear disproof of their ordinal hypothesis.

**Linear Formula.** Harris (1983, 1993) has pursued a linear formula: persons' outcomes should be a linear function of their input contributions. Harris is almost alone in considering the important problem of multi-person groups. However, his linear formula has shortcomings.

One shortcoming is that Harris' linear formula has so many free parameters that it is useless with the two-person groups so common in equity experiments (Farkas & Anderson, 1979, p. 895; Harris, 1983, p. 230; Mellers, 1982, p. 244). In particular, therefore, Harris could not test the equity models proposed by Aristotle and Adams.

The experiment of Figure 2.2 did demonstrate a linear relation between input contribution and outcome. Harris incorrectly asserted that this functional measurement analysis simply assumed Adams' model true by definition. Quite the contrary, functional measurement provided an
exact test of Adams' model. Indeed, functional measurement showed that Adams' model was incorrect.

Another shortcoming is that Harris typically assumes objective values of input and outcome. His theory cannot handle variables such as need or effort that lack objective metrics.

**Equality Rule.** Messick (1993) argued for equality as a general principle of social deserving. He asserted (p. 29) that “It is hard to imagine a more pervasively justifiable principle of making allocation decisions than the principle of equality.”

The ethical principle that reward should be proportional to contribution is ill-recognized by Messick's equality argument. Persons who make greater contributions are generally considered more deserving. So also for people who put in more effort. Messick's equalitarian stance ignores the meritarian principle which is basic in social morality.

Messick's equality principle was tested in each of the experiments described above. It was contrary to the data in every one.

Equality is a great ethical principle. Equal justice under law is a clarion modern ideal. So is equal opportunity. But these ideals should be coordinated with ethical principles of merit and need.

**Subtraction Model.** Functional measurement theory was applied by Mellers (1982), who found a subtraction model and made strong claims that it was universal. But subtraction implies parallel integration graphs, contrary to the many barrel-shape patterns of the decision averaging law in the foregoing studies (see also Subtraction Model above).

In response to a critique, Mellers (1985) sought to force the data of the experiment of Figure 2.4 to be parallel with a monotone transformation and claimed success. But the data of this experiment contained large cross-over interactions. To make these crossovers parallel by monotone transformation is mathematically impossible (Anderson, 1983, 1991e, Figure 8 and Table 2, pp. 90ff; Farkas, 1991, p. 74). Mellers' analysis cannot be correct.

Doubt about the subtraction model arises from comparing inputs of 12 and 11 for person A and B to inputs of 2 and 1. A subtraction model implies that both cases will yield the same judgment of outcome, which seems counterintuitive. This doubt could be avoided by including such examples as part of the instructions. This important problem of instructions is discussed further in Mental Schemas (Chapter 6).

**Unit Problem.** A seeming confusion between equality and proportional equity appears in Bar-Hillel and Yaari (1993). In a representative condi-
tion, participants divided 12 grapefruit between persons Jones and Smith, who desired grapefruit solely for its content of vitamin F. Both needed equal amounts of vitamin F, but whereas Jones got 100 mg from each grapefruit, Smith got only 20 mg.

Over 80% chose the 2:10 distribution as fair, which equalizes vitamin F for Jones and Smith. This was interpreted as showing the proportionality principle of distribution in proportion to need. Instead, it may be said that these participants followed the equality principle: they distributed equal amounts of the focal good, vitamin F. The proportionality rule applies only to the number of grapefruit, which is irrelevant by the statement of the problem.

More effective analysis is possible with the psychological laws. These laws would go further to allow exact analysis of nonobjective variables such as need and merit, variables outside the purview of Bar-Hillel and Yaari.

**Small Groups.** Distributive justice in small groups is an important, neglected issue addressed by Jasso (1983). Her formula for equity includes inequity, or unfairness, one of the few attempts to do so. Of special interest is her attempt to deal with wife–husband groups.

Jasso's theory, however, has problems with measurement. Nonmetric, *quality* goods, affection, for example, are measured by rank within group. Wife–husband groups can only have rank of 1 or 2 (barring equality). This fails to recognize that amount of affection can make a big difference. And quality of affection, a basic aspect of marriage satisfaction, may be rather different for wife and husband, not amenable to ranking. In work groups and teams, quality goods can be critical for individual satisfaction and for group performance. Among these quality goods are job satisfaction and team spirit.

Jasso's concern with small groups focuses on a fundamental domain of social deserving. Small groups deserve systematic study, especially in real-life situations of work groups and family. The averaging law may be useful as with studying marriage satisfaction (see *Family Life and Personal Design*, Chapter 6 in Anderson, 1991c). The laws of information integration may help unify psychological theory with the sociological approach followed by Jasso (see *Group Dynamics*, Chapter 8 in Anderson, 2008; see also Friedkin & Johnsen, 1999).
COMPARISON ALGEBRA

Comparison processes are the heart of deserving theory. The difference between Aristotle and Adams in Equations 1a,b was a difference in comparison processes. To test between them depended on developing effective analysis of comparison processes (Figure 2.4).

Many other comparison issues deserve consideration. Three of these concern multiple dimensions of input, multiple dimensions of outcome, and multiple comparison persons. Although only a single experiment has been done on each of these issues, the results showed promise for general algebra of comparison.

MULTIPLE INPUTS

Deserving may be influenced by multiple variables, as many investigators have shown. A natural assumption is that these variables are integrated into a unitary value that is then used in the equity division. The sole experimental test, however, showed instead that an equity division was made separately for each input variable (Figure 2.3).

Multiple input variables can liberate equity theory from the common zero sum restriction and increase social happiness. Work groups generally include less and more important positions. A common tactic of coaches and other group leaders is to increase satisfaction of those in less valued positions by emphasizing the value of team spirit and also importance weight of their contribution. As one theater director said, “there are no small parts in Shakespeare.”

MULTIPLE OUTCOMES

Multiple outcome variables also deserve systematic study. The hypothesis of outcome integration, that outcomes for each separate variable are integrated into a unitary value, appears not only in traditional equity theory, but more generally in the “greatest good” of utilitarian theory and in much of modern judgment–decision theory.

Under the alternative hypothesis of unfairness integration, a separate unfairness value is calculated for each outcome variable and these are integrated into a unitary unfairness value. This unfairness algebra was supported in the sole experimental test to date (Figure 2.4 above).

These two hypotheses treat overpayment differently. Under outcome integration, over/underpayment are treated symmetrically. Hence overpayment on one variable will act to cancel underpayment on another.
Unfairness integration in contrast, allows that overpayment may have small effect or none at all. An exact algebra of unfairness integration is supported by Farkas’ results cited above.

**MULTIPLE COMPARISON PERSONS**

Multiple comparison persons are common in daily life. The standard two-person equity experiments have limited relevance to larger groups. One limitation is that different comparison persons may have different importance weights, an issue about which other equity theories have little to say. This issue of multiple comparison persons is important in any attempt to apply deserving theory in real life (see also Groups below).

**OVERPAYMENT AND UNDERPAYMENT**

Overpayment and underpayment issues are ubiquitous in deserving theory. These issues also arise in first-person judgments, as shown by the unfairness paradox. These issues are important in social life, but present difficulties for empirical analysis.

Farkas’ work indicates possible extensions of the basic integration models to study these issues, most notably with input-outcome linkage (Figure 2.5). Conjoint experimental-field studies seem desirable to achieve social relevance.

**COMPARING IMPORTANCE**

Comparing importance of two variables is often done but not often correctly done. What seems like a straightforward empirical issue turns out to be theoretically subtle and difficult. Multiple regression, for example, confounds the importance weight of each variable with its psychologically arbitrary unit. Use of correlations as measures of importance is extremely treacherous (e.g., Anderson, 1982, pp. 158-166, 188f, 201, 274, 306, 319-324; see also Empirical Direction).

Correct analysis is possible with the averaging law. With suitable design, importance weight can be measured separately from polarity value (see Measuring Importance, Chapter 6).

**COGNITIVE UNITIZATION**

Complex stimulus fields, which are common in judgments of deserving and fairness, can be exactly measured with functional measurement theo-
ry (see index entries for *Cognitive unitization* in Anderson, 1981a). Such unitization has been denied by some writers, who have despaired of exact laws, not only in moral psychology (e.g., Ellsworth & Mauro, 1998), but throughout the psychological field (see contributors to *Contextualism and understanding in behavioral science*, edited by Rosnow & Georgoudi, 1986).

An effective foothold on complex stimulus fields is available with the psychological laws. Exact analysis is possible by virtue of *Cognitive Unitization*. Valuation of any stimulus field is undoubtedly complex and largely unknowable. However, the value of this field can be exactly measured as a functional unit when an integration law holds (benefit 5 of parallelism theorem, Chapter 1) as illustrated in Figure 6.1.

**GENERAL COMPARISON THEORY**

The foregoing issues are far more general than fairness/unfairness. Comparison processes arise generally in person science. Comparison processes also appear in other fields of psychology, as in language processing and in classical perception. The valuation operation in the Integration Diagram usually involves comparison. Cognitive algebra offers a foothold for general comparison theory.

**GENERAL THEORY OF DESERVING**

Deserving is a fundamental concept that appears in many situations, both personal and societal. The results of this chapter show promise for general theory of deserving based on mathematical law.

**LAWS OF DESERVING**

The concept of an algebraic law of deserving goes back to Aristotle and has been much discussed in modern equity theory. Establishing such a law faced two problems explicated in the Integration Diagram of Figure 1.1—multiple determination and measurement of subjective values. Much work employed makeshift solutions to the measurement problem, which often vitiated the results (see *Measurement Pitfalls* above).

Both problems were solved in Information Integration Theory by using the postulated integration law itself as the base and frame for measurement. This logic is simple, both theoretically and experimentally, as shown with the parallelism theorem. In this functional measurement logic, the laws themselves provide the solution to both problems.
By an inestimable blessing of Nature, this logic has enjoyed empirical success, illustrated in the foregoing experimental studies.

The evidence base is still limited, of course, and many issues remain open. Only a single experiment has been done with multiple inputs, multiple outcomes, and multiple comparison persons. Deserving in marriage, family, and work groups present important social problems, especially first-person judgments. Comments on a few of these deserving problems are given in the following sections.

**SINGLE PERSON DESERVING**

Numerous concepts of deserving appear in everyday judgments of single persons. Equity judgments themselves rely on preliminary single person judgments. Single-person deserving thus requires study in its own right.

Deserving of single persons is part of general person cognition. These judgments are expected to follow the integration theory of person cognition (Anderson, 1981a). In particular, deserving is expected to obey the averaging law. For two stimulus variables, $S_1$ and $S_2$, with values $\psi_1$ and $\psi_2$, weights $\omega_1$ and $\omega_2$, and with prior state neglected:

$$\text{Deserving} = D = \frac{\omega_1 \psi_1 + \omega_2 \psi_2}{\omega_1 + \omega_2}.$$  \hspace{1cm} (8)

Analysis is simple. Parallelism in the $S_1 \times S_2$ integration graph supports an adding-type integration rule. Marginal means of the integration design then estimate true psychological values of the variables.

Integration studies of positive deserving of single persons are rare. However, the averaging law was supported in Lane and Anderson (1976), who found that judgments of gratitude for assistance were an average of intent and amount of assistance (see *Gratitude and Ingratitude*, Chapter 7). Similarly, Anderson and Butzin (1978) found that children aged 4 to 8 years averaged need and deed to determine number of toys that a story child deserved (see Figure 5.3).

Besides its social importance, deserving of single persons is interesting because it has many dimensions, both of input and outcome. A few of these appeared in the foregoing equity studies with performance, effort, and need as inputs and with money and praise as outcomes. With the person cognition task of Chapter 1, the trait adjectives were the input whereas the outcome was the judgment of the person’s likableness or sociability, which may be considered dimensions of personal deserving.
Status, need, merit, respect and disrespect, gratitude and ingratitude are among the many other dimensions that deserve study. Negative deserving of single persons is discussed in Chapter 3 and 4.

SELF-DESERVING

Judgments of self-deserving on job performance, for example, or in family life, are no less important than the third-person judgments commonly studied in equity theory. Realistic experimental tasks, however, are not easy to implement. Standard laboratory tasks can hardly hope to elicit the emotions common in everyday deserving. And such tasks are subject, as various writers have noted, to confounding from impression management, such as fear of appearing selfish.

Personal design may help study judgments of self-deserving. An integration design dealing with job disappointment, for example, or marriage satisfaction, could be embedded in each person's experiential life space. Variables and their levels may be chosen from preliminary mapping of the person's knowledge systems. Personal design showed promise with marriage satisfaction (Anderson, 1981a; Anderson & Armstrong, 1989), but is undeveloped (see Personal Design, Chapter 6).

GROUPS

Social groups are important for deserving theory. Work groups and teams bring problems largely passed by with the abstract two-person groups commonly used in equity theory. Identification with the group can be a major motivation and value, especially for less important members (Levine & Moreland, 1998). Also important are formation and functioning of subgroups (Friedkin & Johnsen, 1999; Graesser, 1991).

Group belonging may be an outcome in more ways than one, as various writers have pointed out. This issue needs consideration in deserving theory. Indeed, this issue emphasizes that outcome in groups is not zero-sum, as is commonly assumed in equity theory (see also Group Dynamics, Chapter 8 in Anderson, 2008).

Negotiation among interested parties has fundamental importance in all social groups, from the family to business and government. Incisive work by Cheryl Graesser (1991) showed that social averaging theory of IIT was notably superior to the social decision schemes of Davis (1973; Stasser, Kerr, & Davis, 1989).
PHENOMENAL QUALITY

Phenomenal quality is central in everyday deserving. Limiting measurement to fairness/unfairness will miss important aspects of people’s phenomenal fields (see Profile Analysis, Chapter 6). Fair treatment may generate feelings of satisfaction or gratitude. Unfair treatment may give rise to feelings of disappointment and resentment. Unfair treatment caused by another person may arouse desire for retribution or revenge.

Algebraic psychology can help with phenomenal analysis. One help is its idiographic capability for measuring subjective variables such as merit and need. Similarly for unfairness, which is important in everyday life (see further Science of Phenomenology, Chapter 7).

FIELD SCIENCE

“Local justice” is an instructive model for field science, studied by Elster and others (e.g., Elster, 1992). This work has concentrated on equitable allocation of scarce resources, such as immigration permits, college admissions, and organ transplants. Such case studies illuminate the complexity of coacting variables, including pressure groups, that trouble search for fairness when different persons have different claims and some must be denied. Aside from their intrinsic importance, such case studies can help make experimental research more relevant.

These studies of local justice also point up the need for measurement theory. Local justice depends on valuation/integration of multiple variables. Valuation, however, is left to common sense measurement that can suffer serious inadequacies, some illustrated under Measurement Pitfalls above (see also Psychological Measurement Theory, Chapter 6).

Joint experimental–field science can be pursued with IIT. Valuation/integration is central to the weighing and balancing of competing claims that is characteristic of local justice. Contributors to Shanteau and Harris (1990) on organ transplants take up such problems.

NEGATIVE DESERVING

Negative deserving is hardly less prominent in society than positive deserving. The same algebraic laws operate, however, as shown for blame in Chapter 3 and for several issues of legal judgment in Chapter 4.
NOTES

Note 1. The slanted barrel shape for fairness judgments, as in Figure 2.2, assumes that $I_A$ and $I_B$ are both varied from low to high. This initial application of IIT to equity was troubled by two other results. One was the subtraction rule discussed later. The other was a distortion of the linear fan pattern predicted for judgments of $O_A$, given $O_A$, $I_A$, and $I_B$: $O_B = O_A I_B / I_A$. Such direct ratio models have generally done poorly, especially in psychophysics, in which they would seem simplest (Anderson, 1974a). In contrast, relative ratio models like the decision averaging law of Equation 1c have done well, not only in the later equity experiments cited in the text, but also as a cognitive generalization of Bayesian statistical theory in judgment–decision.

An interesting result by Hofmans (2012) found that although most persons from three levels in actual organizations followed the decision averaging model for integrating performance input, a minority ignored performance and assigned equal shares. These people seemed to have more agreeable personalities.

Note 2a. One interesting complication was a configural effect in the fairness integration study of Figure 2.3. When persons A and B were equal on W or on E, that variable received lower weight in Equation 4. Inclusion of this configural weight gave an excellent fit to the three-variable integration graphs (see Figure 7.5, p. 229, in Anderson, 1996a). Similar configural effects have been conjectured by writers in several different areas but definite evidence has been scarce.

Note 2b. Quite different results that supported input integration were reported by Quereshi and Massman (1988) for fair division of $5000 raise between two teachers, each characterized by sex, physical appearance, and three sets of teacher-relevant adjectives. Understanding this paper is difficult, however, because no actual data whatever were presented, only the Anova table. Sex had much the largest main effect but whether males were assigned a larger fair share is not reported. Surprisingly, physical appearance ("above average, below average") not only had a substantial main effect but also large interactions with each of the three sets of teacher-relevant adjectives (and also for all six of its three-way interactions).

Note 3. The hypothesis that overpayment and underpayment should have equal and opposite effects leads to ignoral of qualitative variables such as need and merit. Moreover, this hypothesis neglects differences in quality of reaction. The overpaid feel their greater deserving is recognized; the underpaid feel double resentment. Focus on these phenomena would have been more productive (see also Achievement, pp. 365-371, in Anderson, 2008).

Note 4. This resentment of overpayment is dramatically illustrated by public reaction to the multimillion dollar bonuses currently [2009] being paid executives of big financial companies and auto industries whose blundering caused the financial crises that now require huge bailout dollars from the taxpayers.

Note 5. As U. S. President John F. Kennedy said, “Life is unfair,” a bitter truth bitterly realized in his assassination.
Note 6. Importance deweighting seems a common adjustment process in everyday life, especially for dimensions on which one is less well treated. Perhaps Aesop’s fox actually decided he really wanted meat, not grapes, changing their importance weight rather than their polarity value.

Note 7. Feather’s (1999) attempt to apply Heider’s (1958) balance theory to judgments of deserving suffers because balance theory says only that unbalanced triads tend toward balance, nothing about what will change or why. And for balanced triads, Heider’s theory says nothing at all.

Blaming—and avoiding blame—are basic social motivations. These two motivations operate in every area of daily life: family, friendship, work, politics. Experimental analysis of these two classes of motivation offers fruitful opportunities for social attitude theory, developmental psychology, motivation theory, and person science. Opportunities to improve the moral level of society have exceptional importance.

Blame exhibits algebraic law:

$$\text{Blame} = \text{Responsibility} + \text{Consequences}.$$  

Consequences represents the outcome of some action, Responsibility the responsibility of the blamee. This averaging law for blame was first found by Leon (1976, 1977, 1980) and Surber (1977, 1985) with children. This law showed that basic claims of Piaget’s theory were incorrect. More important, this law went further to show that young children have far higher cognitive capabilities than had previously been recognized. In addition, this law demonstrated a simple, powerful method for further analysis.

The basic blame law discovered with children has been replicated in extensive studies with adults. The age generality of this law gives a useful base for developmental comparison.

Responsibility and Consequences are both usually integrals of multiple determinants that require deeper analysis. Many variables deserve study: extenuation, restitution, and personal relationships, as well as associated processes of excuses and counterblaming. Developing general theory of blame thus depends on capabilities with integration of multiple variables. The algebraic laws of blame reviewed in this chapter are a step in this direction.
Blame is ubiquitous in society; it deserves similar place in social theory. Blame, or threat thereof, is prominent in interpersonal relationships, from family interaction to national politics. In social groups, different members will have conflicting goals and/or ways to pursue them. These differences cause negative feelings that surface as blame when goals are blocked. Blaming—and avoiding blame—are basic motivations that help maintain person and society (see *Psychodynamics of Everyday Life*, Chapter 6 in Anderson, 1991b).

Blame underlies both criminal and civil law, of course, which are taken up in the next chapter. Everyday blame is the main concern of this chapter.

Blame follows algebraic law as early as 4\(^\text{th}\) years of age. These laws revealed that moral thought and action differ radically from claims of other major moral theories. The very first experiments showed not only that Piaget’s developmental theory was fundamentally incorrect but demonstrated a more effective theoretical framework (see further *Two Developmental Integration Theories*, Chapter 5).

These blame laws also have solid advantages over popular moral stage theories. They avoid reliance on verbal reasoning, which lacks validity criteria and which may be badly confounded with post hoc rationalization. They also allow study of children from 4 to 12 years of age, a fundamental period in moral development but one to which popular stage theories are admittedly inapplicable (see *Moral Stage Theories*, Chapter 5).

The blame laws, together with the laws of positive deserving (Chapter 2), are a foundation for moral cognition. These laws are part of an empirically grounded moral algebra with considerable invariance across age and across cultures, a foundation for moral science.
This blame algebra is not well known so some detail from early experiments is included to illustrate theory and method. These are simple, illustrated with the parallelism analysis of Figure 3.1 (next page).

**LAWS OF BLAME**

Blame for a harmful action typically involves integration of two determinants: responsibility of an actor and consequences of the action. This integration is represented in the blame schema (Notes 1 and 2):

\[
\text{Blame} = \text{Responsibility} \times \text{Consequences},
\]

where \(*\) represents a symbolic integration operator. Empirically, \(*\) is often a mathematical average as the following experiments show.

*Responsibility* represents the extent to which the actor is held responsible for the consequences. Responsibility is typically, perhaps always, an integral of two kinds of responsibility: causal and social. Causal responsibility may include purposive or careless action as well as failure to take preventive action. Social responsibility includes obligation, social norms of truthfulness and honesty, and behavior in accord with custom or law. The two need not be distinct. Carelessness, for example, may be both causal and social. Responsibility is not in the blamee, of course, but an attribution by the blamer.

*Consequences* may take many forms, including mental distress and even risk from potential consequences that did not actually happen but could have been nullified by normal prudence. Experimentally, consequences has usually been narrowly manipulated as physical damage. It also may involve some attribution by the blamer (see *Unified Causal Attribution*, pp. 293-301, in Anderson, 2008).

**BASIC BLAME LAW**

**Law of Blame.** The basic blame law states that blame is an average of responsibility and consequences:

\[
\text{Blame} = \text{Responsibility (Intent)} + \text{Consequences (Harm)}.
\]

This law was supported by the parallelism of Leon's data in Figure 3.1. His integration graphs were near-parallel across all four age levels, from third grade (8-9 years) to college. This parallelism supported the hypoth-
thesis that blame follows the adding-type integration law: Blame = Intent + Harm.

Piaget’s doctrine of centration (that young children cannot integrate two variables but center on one and judge on that basis alone) was disproven by the separateness of the three Intent curves in Figure 3.1 (see Note 3 in Chapter 5). This failure of centration also holds in Piaget’s main field of naïve physics (e.g. Wilkening, 1988, 2007; Wilkening & Anderson, 1982, 1991). Young children have far higher cognitive capabilities than had previously been recognized (see Two Developmental Integration Theories, Chapter 5).

**Figure 3.1.** Parallellism supports the averaging law: Blame = Intent + Consequences. Graph plots rated naughtiness of a story child who threw a rock with one of three intents (curve parameter) producing one of four levels of harm (horizontal axis). Left panel shows third-, fifth-, and seventh-graders; right panel shows college students. No age trends except perhaps the apparent increase in main effect of Intent. This experiment used Piagetian stories standardized by Crowley (1956). (After Leon, 1976, 1980.)

**Explicit Responsibility and Consequences.** The Piagetian stories used with the experiment of Figure 3.1 are unsatisfactory. Among other reasons, intent is often poorly defined in the Piagetian stories and has to be inferred from insufficient information, as in the Margaret story quoted in Chapter 5. Indeed, Leon’s pilot work showed that children younger than
8 years of age largely failed to understand the intent information in the Piagetian stories.

Accordingly, Leon developed stories in which intent and consequences were both explicitly specified. These were varied in a 3 x 4 integration design and children judged naughtiness of each individual story child, with responses on a graphic rating scale. By virtue of explicit statement of intent and consequences, these stories were usable with first- and second-graders (6– and 7–year-olds, respectively).

Averaging was the modal integration rule with these explicit stories, indicated by parallelism of the integration graphs. Little age trend was found beyond the first grade.

**Alternative Integration Rules.** The explicit stories used by Leon also showed alternative integration rules in his single-child analyses. Most common was the accident-configural rule, used by about a fifth of the children. Their integration graphs showed parallelism except when consequences were accidental, in which case their magnitude had little effect (see also Darby & Schlenker, 1982). This accident-configural rule was more frequent with younger children whose clumsiness gives it appeal. This rule appeared at every age, however, even with a few adults.

Some participants at the younger ages, but a few at all ages, appeared to judge on the basis of intent alone or consequences alone. These are not Piaget's centration rules; young children have shown good integration capabilities in numerous tasks.

The intent-only rule can be rationalized on the ground that what is blamable is the actor's motivation, that is, actor's personal responsibility. The consequences-only rule can be rationalized on the ground that what is blamable is what actually happened. Such one-variable rules have also been reported by Przygotski and Mullet (1993) and by Howe and Loftus (1992). Such rules, however, may be cases of the blame law in which one variable has low weight (Notes 3 and 4).

**Imputations.** Leon also uncovered a process that has general interest: imputations about unspecified information. With stories that presented only responsibility information, some participants imputed a value to the unspecified consequence information and integrated that.

Evidence for imputations came from the intent–consequence integration graphs that included a curve for intent alone. This curve was intermediate between and parallel to the curves for (intent + no harm) and (intent + serious harm). This pattern implies that participants imputed a medium value to unspecified consequences information and added or averaged this imputation with the given information on intent. Without
imputation, the adding rule would require the intent-only and \((\text{intent + no harm})\) curves to lie at the same level. Without imputation, the averaging rule would require the intent-only curve to be steeper than the \((\text{intent + no harm})\) curve (see Anderson, 1991a, p. 74).

Imputations are no surprise in these blame experiments. Most stories included both intent and consequences so participants could readily assume some consequences had occurred even when not specified. Imputations represent information processing capabilities that have general importance; in practice, relevant information is often missing. As yet, however, not a great deal is known about how people deal with missing information (see *Imputations and Schemas*, Anderson, 2008, pp. 335f). Other important work on imputations is given by Ebenbach and Moore (2000) and by Singh (1991, 2011).

Leon's study illustrates how much information can be obtained from a single experiment using Information Integration Theory. Functional measurement methodology revealed high cognitive capabilities of young children repeatedly denied by those who have relied on Piaget's choice methodology. A partial itemization follows.

1. **Moral Law.** The basic blame law is central in moral cognition. This blame law has exact mathematical form already at young ages—an early sign of general moral algebra.

2. **Information Processing.** The basic blame law constitutes a solution to all three operations—valuation, integration, and action—of the Integration Diagram (Figure 1.1 of Chapter 1). One implication is that responsibility and consequences are valuated as independent units; higher damage does not increase responsibility. Another implication is that responsibility and consequences are not just convenience terms from common language; the algebraic law implies they have cognitive reality (see *Cognitive Unitization*, benefit 5 of parallelism theory, Chapter 1).

3. **True Measurement of Feeling of Blame.** Success of the basic blame law supports the method of functional rating as true measurement of psychological feelings of young children. The observable rating of blame is a faithful image of the child's nonobservable feeling; the rationale was given with the parallelism theorem (benefit 2) of Chapter 1.

4. **True Idiographic Measurement of Responsibility and Consequences.** True measurement of responsibility and consequences for each individual becomes possible. This idiographic measurement is simple—benefit 3 of the parallelism theorem.

Idiographic capability is essential for moral theory. The large individual differences in moral values is one reason. Moral cognition of
person A cannot be well understood in terms of moral values of person B or of some group average.

5. Cognitive Development. Young children have far higher cognitive capabilities with all three operations of the Integration Diagram—valuation, integration, action—than had previously been realized. Integration experiments offer an analytic base for developmental theory.

AMELIORATING BLAME

Blame involves negative aspects for blamer as well as blamee. Social procedures have evolved to ameliorate negative effects and maintain working social harmony. To understand these negative effects and make healing more effective is socially important. Two social healing procedures, apology and material recompense, are discussed next.

APOLOGY

Apologies can be effective blame reducers. The extended blame law,

\[
\text{Blame} = \text{Responsibility} + \text{Consequences} - \text{Apology},
\]

was supported for children by Leon (1982). Apology had very substantial effects as early as 4+ years of age. What little developmental trend was observed suggested greater relative effect at younger ages. Empirically, this result infirms claims by Piaget and others for a general objective–subjective trend in development. Conceptually, apology and related variables seem terra incognita to moral stage theories.

How can a simple “I'm sorry” be so effective? Where does this large effect of apology originate? Its appearance at young ages argues that home learning is important. This speculation suggests studying apology across diverse sociocultural backgrounds and with multiple blame scenarios that cover realistic situations of everyday life.

For the blamee, apology may have several benefits. It should reduce both ill-will of blamer and self-blame of blamee by Equation 3. Such reduction of self-blame might also reduce blamee’s feeling of Responsibility, possibly as a halo effect (see Halo Theory, Chapter 1).

The early appearance of large effects of apology also suggests it has a biological base. “I'm sorry” may act as a submission response. This is presumably the case with forced apologies that lack sincerity.
The effectiveness of apology as early as 4+ years of age has special interest as a robust early form of social healing. Blame theory is a wide-open field for study within and between cultures (Note 5).

MATERIAL RECOMPENSE

In his life work on psychology and law, Wilfried Hommers has presented a series of studies of material recompense for harmful consequences. His focus is on legal systems, viewed in psychological perspective.

The moral rule not to do harm has a corollary moral rule to undo harm that is done. This moral rule of undoing harm is well recognized in everyday life. A child who dirties some object may be required to clean it. A person who insults another may be required to apologize. In married couples, recompense in the forms of gifts or soft words is often part of “making up” for distressful acts. So ubiquitous is this moral rule of recompense that at least one philosopher has elevated it to a prima facie duty.

Despite its moral importance, recompense has received little attention from psychologists. One difficulty in studying recompense is that it usually involves other moral variables. Recompense ordinarily involves reference to the harm for which recompense is made, and evaluation of harm may require taking responsibility into account. Various kinds of mitigating circumstances may also be relevant. Hence the study of recompense cannot get very far without capability for handling multiple determination. (Hommers & Anderson, 1991, p. 101.)

Civil law is mainly concerned with material recompense. This concern goes as far back as the Judaic code of the second millennium BCE (“Whom the judges shall condemn, he shall pay double to his neighbor,” Exodus, 22.9). The series of four experiments on material recompense from the cited chapter is summarized here.

Stamp Scenario. A ruined stamp scenario was used so consequences (ruined stamps) and recompense (replacement stamps) would be directly comparable. Meaningful comparisons across age levels were similarly possible. This scenario was personalized to each participant by saying that another person had damaged stamps from his/her personal collection. Three variables (three levels of responsibility; small or large damage; and recompense of none, half, or all the ruined stamps) were used in all four experiments. College students judged deserved punishment.

Extended Blame Law. Inclusion of recompense yields the extended blame schema,

\[ \text{Blame} = \text{Responsibility} \ast_1 \text{Consequences} \ast_2 \text{Recompense}, \quad (4) \]

where \( \ast_1 \) and \( \ast_2 \) are symbolic integration rules.
The first question is whether $*_{1}$ is an average, in accord with the basic blame law. This cannot be taken for granted. The third variable of recompense might disrupt the responsibility–consequence integration found in previous experiments. Also, the recompense information might influence the functional values of responsibility or consequences.

Happily, invariance of Responsibility–Consequence integration was supported in all four experiments; the Responsibility–Consequence integration graphs were uniformly parallel. Of special note, one experiment yielded very similar results for three different orders of presentation of the three variables. This outcome adds to the evidence that integration rules are invariant across associated variables.

**Paradoxical Recompense Effect.** Recompense had much larger effects than the damage for which recompense was made. This paradoxical disproportion was observed in all four experiments. In Experiment 3, complete replacement of the damaged stamps had four times the effect of the damage itself. This comparatively small effect of damage results from its being given lower importance weight in the judgment of punishment. Somewhat similar results have been obtained with apology by several investigators, but this paradox remains unexplained (Note 6).

**Nonadditive Averaging of Recompense.** Recompense is also integrated by averaging, but with greater weight for greater recompense. The symbolic blame schema of Equation 4 followed the algebraic law:

\[
\text{Blame} = \text{Responsibility} + \text{Consequences} - \text{Recompense.} \quad (5)
\]

This nonadditive averaging of recompense was signaled by diagnostic patterns of nonparallelism. In the Responsibility–Recompense integration graphs, the responsibility curves were closer together for higher recompense, signifying higher weight for higher levels of recompense, a positivity effect complementary to the well-known negativity effect. Similar convergence was found for the Consequences–Recompense integration graphs.

**Information Processing.** An interesting implication about information processing follows from the two findings of equal weight averaging of Responsibility and Consequences and unequal weight averaging of Recompense. These findings imply that Recompense is processed as an independent unit, that it has no effect on valuation of Responsibility or Consequences.

It might instead be supposed that the information processing begins by integrating the given Recompense information with the damage to obtain an effective value of Consequences, which is then averaged with
Responsibility. But averaging such effective values would yield nonparallelism in the Responsibility–Consequences integration graph stemming from the nonparallelism in the Responsibility-Recompense graphs. Such insight into the flow of information processing hardly seems possible without analytic capabilities of algebraic laws. This capability may have general usefulness in cognitive theory.

**Concept of Recompense.** Two components of recompense may be distinguished. One is oriented toward undoing the harm, the other toward punishing the harmdoer. **Duplex response**, with separate judgment of material recompense and punishment, may help unravel this distinction (Hommers & Anderson, 1991). Duplex response was used by Hommers (2007), who found that victim’s fault had strong effects on judgment of appropriate material recompense but little effect on judged punishment.

Duplex response has general importance. In this study, however, it suffers because required material recompense may contain a punishment component. This might be remedied, as Hommers has suggested, by specifying recompense from an independent source. The general problem of response confounding with one-dimensional response measures is discussed in *Response Quality and Profile Analysis* in Chapter 6.

**GENERALITY OF THE BLAME LAW**

Generality of the foregoing blame law needs assessment. Promising support was found with married couples and with criminals (Note 7).

**BLAME IN THE FAMILY**

Blame is ubiquitous in family life, a primary tool for socialization, both spouse–spouse and parent–child. The following experiment is among the many in Armstrong’s (1984) PhD thesis on attitudes in marriage (see also Anderson, 1991c, Chapter 6, *Family Life and Personal Design*).

In one of Armstrong’s studies, participants were 20 married couples in student housing on the UCSD campus. Each trial began with a scenario like the following, the same for both spouses.

Nancy and Sue had been best friends for over two years. One day, Jennifer, a new girl in the neighborhood, came over to play. Pretty soon, Jennifer and Sue were playing together by themselves, ignoring Nancy.

Nancy was upset with Jennifer so she thought she would give Jennifer a good scare by riding past Jennifer really fast with her bike.
Nancy’s bike knocked over Jennifer, who sprained her arm. She had to have it in a sling for a month. (From Armstrong, 1984, Childrearing Study 4, p. 152.)

These three stimulus informers give background scenario, intent, and damage. Four background scenarios were used for generality, each the base for a 3 Intent × 4 Damage integration design. Each spouse first made a private judgment of “deserved discipline” for Nancy, Armstrong’s term for avoiding spouse differences in type of discipline.

Next, each spouse received different additional information, mildly negative for one, positive extenuating for the other. They exchanged this information in mutual discussion, telling how it had changed their own view. Each then privately revised their initial judgment to take account of their own added information and that from their spouse. Three results are noted here.

Figure 3.2. Independent judgments of blame by husbands and wives. Initial judgments based on information about intent (curve parameter) and damage (horizontal axis). Revised judgments based on additional information presented by spouse. Lo, Med, Med+, and Hi represent graded levels of damage. (After Anderson & Armstrong, 1989.)

**Basic Blame Law.** The basic blame law, Blame = Intent + Damage, is well supported by the near-parallelism of Figure 3.2. Initial judgments are shown in the left panels. The lowest left-hand point in each panel, which deviates from the parallelism, represents a careless action with no
damage. This may reflect Leon's accident-configural rule that was discussed earlier.

**Spouse Influence.** Effect of spouses’ added information is shown by the lower mean elevation of the right-hand graphs. Lower blame results because the added information was mainly extenuating. Hence the near-parallelism supports the extended blame law,

\[
\text{Blame} = \text{Intent} + \text{Damage} - \text{Extenuation.} \tag{6}
\]

Would similar results be obtained if each spouse constructed their own added information which they communicated to their partner? Yes, as shown in a devoted follow-up experiment by Armstrong (1984).

**PSYCHOSOCIOLOGY OF DEVIANCE**

Deviance has long been a major concern in sociology, especially with life styles and behavior that conflict with norms of social conduct. Sociological studies, however, have two limitations. First, heavy reliance is placed on statistics of groups with neglect of individual differences. Second, although specific deviant actions depend on integration of multiple variables, sociological methodology is weak at analyzing such integration (see *Field Science*, Section 15.5, and *Interpretation With Observational Data*, Section 16.2, in *Empirical Direction*).

**Functional Sociology.** To overcome these two limitations, Yuval Wolf (2001) and his colleagues advocate a functional sociology. They study how individuals in social groups valuate and integrate information and translate this into action. This functional framework focuses on goal-oriented functions of individuals, especially from diverse classes of deviants, including juvenile delinquents and aggressive personalities.

Three advantages come with this functional approach. It recognizes that offender and victim have different perspectives on the same aggressive action. It recognizes and can, in some cases, quantify multiple determinants of specific acts of aggression. Most important, it allows shifting “the definition of aggression from armchair dictates . . . to perceptions of those who experience and practice aggression on a daily basis as perpetrators of harm, victims, or observers” (Wolf, 2001, p. 30).

**Anomie Theory.** In one application of this functional approach, Hoffman, Wolf, and Addad (1997) used Information Integration Theory to assess sociological anomie theory (Merton, 1967). Anomie theory makes two main predictions: deviants justify their behavior more when they
have greater need for important social goals of status and material well-being, and also when they have lesser means to obtain these goals.

These predictions were tested by using offenders' need for money and difficulty of obtaining it legally as variables in an integration design. Participants were from six different social groups: juvenile delinquents, prison inmates convicted of property crimes, prison inmates convicted of white collar crimes, high school students, and male and female college students. They were asked “To what extent it is justified, in your opinion that your friend [or an institutionally dissimilar adolescent] should commit [a specified crime] to obtain the needed money” (p. 184).

Both predictions from anomie theory were supported: the offense was seen as more justified when the offender's need was greater and when it was more difficult to obtain the needed money legally. Surprisingly, all groups showed similar integration graphs. However, the definition of the response (whether the offense should be committed) meant that all responses were near the low end of the scale, which limited discriminative power. One alternative would ask for a blame judgment for actually having committed the response.

The usefulness of Information Integration Theory in sociology is indicated in this experiment. In themselves, the predictions of anomie theory seem rather obvious but the integration-theoretical approach can provide quantitative analysis with analytic power about specific psychosociological variables for comparing different social groups. No less important, integration theory can study the individual spectrum within a group (see also Anderson, 1991b, pp. 269f, 1991c, pp. 224ff).

**BLAME JUDGMENT BY CRIMINALS**

Blame is basic in judgments of antisocial acts. Much work has been done in relation to the legal system (see next chapter). But surprisingly little has been done to elucidate how such judgments are made by accused persons and criminals, both first-time and habitual criminals.

**Blame Judgments By Ex-Prisoners.** Ex-prisoners followed the same blame law as persons who had never been incarcerated in this innovative study by Przygotski and Mullet (1993) in France. Ex-prisoners were from a halfway house, having recently been released after serving prison terms of 1 to 15 years. Nonprisoners were matched in age and level of education (none had a secondary school diploma).

An Intent × Damage design was used, similar to that of Leon in Figure 3.1. Three different scenarios, all suitable for ex-prisoners, were used
to assess generality. Judgments were ratings on a scale with end anchors of “No punishment” and “Very severe punishment.”

Individual analyses supported the basic blame law,

\[
\text{Judged Punishment} = \text{Intent} + \text{Damage},
\]

as the modal pattern. Also fairly common was this same law except that Damage had negligible effect with zero Intent, as with Leon’s accident-configural rule. In addition, a substantial number of persons showed statsig main effects only for Intent or only for Damage. These results are similar to those in America cited above, except for a higher frequency of apparent one-variable rules in adults. Ex-prisoners and nonincarcerated exhibited similar integration rules (see Note 3).

Ex-prisoners showed lower levels of deserved punishment than the comparison group, a difference attributed to lesser influence of Intent. Such results, however, are troubled by the dual character of criminal moral systems. One level is that of society, the other their own everyday life. Their responses are some uncertain mixture of these two levels.

Moral systems of criminals have great interest but their dual character makes them difficult to study. One possibility would be to have criminals and ex-criminals role-play judgments of other criminals of several different types (see also Response Quality, Chapter 6).

Self-Defense. Self-defense can justify physical violence. Judgments of blame for scenarios that specified Intent, Consequences, and Dangerousness of an intruder shot by a homeowner were obtained by Hermand, Mullet, Tomera, and Touzart (2001). Prisoners (n = 20), police officers (n = 19) and men in the street (n = 40) were participants.

Results supported the Intent + Consequences law. Main effect of Dangerousness was found for only one police officer, but for about a third of the other two groups which were roughly equal. Related work by Howe is discussed in the next chapter on legal psychology.

LOCUS OF CONTROL

Locus of control, whether people tend to attribute events to their own actions (internals) or to outside influence (externals) is a substantial aspect of personality studied by a number of investigators (e.g., Rotter, 1966; Phares, 1979; Lefcourt, 1991), who suggest that external attributions serve as excuses, ego defense against failure, actual or possible.

Wang and Anderson (1992) used three realistic scenarios of a bad performance of another person, each with a list of plausible excuses. Par-
Participants were UCSD students, 39 internals (I-E scores between 0 and 7) and 30 externals (I-E scores between 16 and 23). First, they rated (0-10) how much they themselves agreed each excuse by that person. After this, they were instructed to imagine they were that person and rate each excuse for each scenario.

Externals made higher other-excuse ratings than internals for each scenario. Overall means across three scenarios were 4.74 and 3.74, respectively. The same pattern appeared with self-excuses although with higher overall means of 5.17 and 4.13, respectively. Both differences are statsig and support the hypothesis of ego defense. Curiously, both differences are nearly equal.

In a second experiment, 32 externals and 24 internals received 10 scenarios based on realistic situations from student life. In each scenario, they and another (anonymous) student were both partly responsible for a negative outcome. For each scenario, they divided 100% of the blame into three parts: self, other, and no one.

As expected, externals assigned less blame than internals to themselves than to the other for all 10 scenarios. Self-blame means were 43% for externals, 53% for internals, F(1, 54) = 12.27. Externals also assigned more blame to the other than internals, 45% versus 38%, F(1, 54) = 5.62. These results support the hypothesis of ego defense.

The slight difference of 3% in “no one” response was unexpected. The externals could have used this response to avoid blaming anyone. Perhaps they have a need to personalize blame.

This blame division task illustrates a general approach to studying personality characteristics as they function in social interaction. Of the numerous locus of control scales reviewed by Lefcourt (1991), even the marriage scale items do not involve much interpersonal interaction. Yet interpersonal interaction is a basic personality domain.

Integration studies to extend blame division to the foregoing moral laws offer promise. Perhaps the basic blame law would hold for both self and others. Locus of control would presumably manifest itself in different values of apology and the contextual variables.

Credit division is a second direction for further work. The hypothesis of ego defense may need supplementation by a hypothesis of ego enhancement. Credit division parallels the fair share divisions of Chapter 2. Perhaps similar integration laws apply.
RESPONSIBILITY AND CONSEQUENCES AS INTEGRALS

Responsibility and Consequences in the blame schema are generally integrals over complex fields of stimulus informers. The basic blame law treats each as unitary at the level of judgment. This is justified by the Cognitive Unitization property of the parallelism theorem (see below). Each of these integration processes, however, deserves detailed analysis.

Attribution of Responsibility. In the blame schema, Responsibility is generally an attribution about the actor (see Attribution, pp. 157-168, Anderson, 1996a). This attribution process will often involve integration of two forms of responsibility, social and material. Typical social responsibility would involve obligation, as with keeping promises or acting with normal prudence. Typical material responsibility would be the role of the person’s behavior in causing harm, actual or potential (Anderson, 2008, pp. 203f).

How these two components are integrated is unknown. A natural design would vary both kinds of responsibility, expecting the integration graph to reveal the integration process. Such graphs should also shed light on the valuation processes that construct functional values of responsibility from given stimulus informers (benefit 3 of the parallelism theorem).

Social responsibility is itself an integral; it has multiple determinants specific to each situation and context. Conflict of obligation illustrates this issue. A woman may have partially conflicting obligations to her children, husband, job, and self, a prime issue for moral theory.

One experimental approach would involve division of some good, such as attention, money, responsibility, or blame, as with Locus of Control above. Such division may follow the decision averaging law for fairness of Chapter 2. This approach may be useful in family theory, with opportunities for longitudinal analysis.

A responsibility schema parallel to Equation 1, as yet untested, holds for praise or credit in place of blame:

\[
\text{Credit} = \text{Responsibility} + \text{Consequences}.
\]

Consequences as Integral. Rationally, consequences should add, and this rule was supported by Hermand, Mullet, and Prieur (1992). The generality of this result is unknown; averaging laws have been found in most cases in which adding was expected.

Foreseeing consequences has obvious importance. Several consequences may be possible so judgment of their relative likelihood is also
important. Such Expectancy × Value judgments may be amenable to the linear fan analysis of functional measurement.

**Cognitive Unitization.** The Unitization property of the algebraic laws gives leverage on deeper analysis of moral cognition. Responsibility integration has multiple levels. One is the social–material level just noted. The social component in turn is usually itself an integral, as with conflicting obligations. Each obligation in turn may itself be an integral of multiple determinants. Obligation to a friend, for example, may develop over years of interaction, most of which has been integrated into knowledge systems and is unknowable in detail.

Even this simple analysis yields three levels of valuation/integration. At any level, however, values can be treated as units when an algebraic laws holds (benefit 5 of the parallelism theorem). Analysis of deeper levels of processing may thus become feasible.

As one example, levels of responsibility could be specified by a two-variable, Social × Causal integration subdesign. Functional values of responsibility from a Responsibility × Consequences design would then be a true response measure for the Social × Causal subdesign. This integration graph would be a faithful mirror of underlying process even if it did not follow any algebraic rule. Moreover, it illustrates an approach to measuring the nonconscious (see *Science of Phenomenology*, Chapter 7).

**BLAME AS PERSON SCIENCE**

Blaming is a central personality function; so is avoiding blame. Both should thus be studied within a framework of person science. Important particular issues have been discussed by many investigators but these exhibit little interaction or generality. A few suggestions toward a more unified approach are given here.

**FUNCTIONS OF BLAME**

Why is blame so ubiquitous? When something goes wrong, “who’s to blame” often seems an automatic reflex. Functional theory begins by looking for what blaming does for the blamer.

Blame has multiple functions. Most obvious are utilitarian functions of influencing others’ behavior. Blame is thus a common motivation in family life. Complaining can help develop adjustments needed for working marriages; failures to adjust may intensify blaming. Parents use blame to teach acceptable behavior to their children.
Blame may also stem from more primitive biosocial motivations. Blaming another may embody anger, some frustration-aggression dynamic, or some dominance reaction. Need to preserve self-esteem may lead to laying blame elsewhere (see Excuses below).

Blame may be blended with other motivations. Some may be positive, as when a parent corrects a child. Some may be negative, as when a husband feels that his wife doesn’t know the value of money. Blended motivation is a general problem that deserves systematic study.

Blaming continues outside the family in school, playgrounds, friendships, and ubiquitous factions from university departments to local, state, and national politics. Blame may be used to bolster policies of one faction by attributing some undesirable state of affairs to policies of an opposing faction—the first law of politics. In short, blame is an invaluable mechanism for maintaining society—with many faults that deserve systematic efforts at amelioration.

Blaming depends heavily on social context: spouse, child, parent, coworker, subordinate, superior, competitor, friend, acquaintance, stranger, foreigner, enemy, and so on. Each context imposes its own goal constraints on how blame is expressed, constraints that depend further on specific interpersonal relations. General blame theory must incorporate these goals, several of which may operate jointly. The basic blame law offers one foothold for further analysis, already illustrated with apology.

Legal systems, including regulatory agencies and courts of law, express blame at societal levels. Child protective agencies may rescue children from their biological parents. In criminal law, prison terms may function as retribution for past crime, preventive of present crime, and deterrent of future crime. In civil law, blame may be expressed as required restitution, one instance of the moral rule to undo harm done.

QUALITIES OF BLAME

Blame is so common that its meaning is generally taken for granted. Different experiments use different words—naughtiness, badness, blame, deserved discipline, and punishment. Diverse scenarios have been used, including children’s misdeeds, adult’s failures of obligation, and criminal acts. These diverse judgments seem to lie on a general right–wrong axis. Quantitative support for this view is given by the blame law which has done well in diverse experiments.

But blame has other qualities besides right–wrong. Blamers’ motivations (e.g., anger) and goals (e.g., instruction, derogation) may blend into expression of blame. Blaming a child differs from blaming a spouse. It
may thus be desirable to use profile measures that measure multiple qualities of blame (see *Response Quality*, Chapter 6).

The inductive philosophy of IIT seeks meanings of blame as beginning in everyday usage. In contrast, Shaver and Drowns (1976, p. 701; Shaver, 1985) follow a prescriptive approach that rests on an a priori definition of blame. Three differences between these inductive and prescriptive approaches deserve mention. First, a person may be blamed even though, contrary to Shaver and Drowns, no justification or excuse is offered by the blamee; most foregoing experiments were of this kind. Of course, justification or excuse may function in the basic blame law either as an added term or as a determinant of Responsibility. Second, intention is not necessary for blame; ignorance or inattention may be a determinant of Responsibility. Third, judgment of blameworthiness does not require a harmful act; a person may be blamed for inattention or carelessness even though no harm resulted (Note 8).

**EXCUSES**

Blame or threat of blame often evokes reflex denial—“It's not my fault.” Excuses are often subsequent rationalizations or justifications. Even a clearly false excuse may help the blamee preserve self-esteem; silence would seem admission.

Excuses have been discussed by many writers, with heavy emphasis on self-esteem motivation. Most discussions go little further than typologies of common excuses, however, enhanced by catchy phrases such as Goffman's (1971) “self-splitting,” in which blame is placed on a temporary, disavowed part of the self (“I had a bad day” or “I wasn't myself”). Self-splitting may act in part as apology and in part to reduce loss of self-esteem (Notes 9-11).

The most common kinds of excuses aim to reduce Responsibility in the blame schema. One way is by reducing causal responsibility. This is often easy because any action or event is an outcome of a chain or lattice of multiple causes. When something goes wrong, it is seldom difficult to blame some material obstacle in this causal lattice, which usually has a measure of truth (Note 12).

Social responsibility may be even easier to reduce by downplaying own responsibility and/or imputing fault to others: “It’s not my fault,” “It's her fault,” “He started it; I was just defending myself,” or even “Now look what you made me do.” Such excuses have the dual goal of reducing blame in the minds of both blamer and blamee. Responsibility integration can thus study excuses as a basic function of personality (see

**PERSON SCIENCE**

*Function* is a guiding theme of Information Integration Theory, a basic shift from traditional *trait* theory of personality. This theme is explicit in the valuation and integration operations of Integration Diagram, manifest in the general deserving theory of this and the previous chapter. Integration designs can study joint action of the multiple variables that operate in everyday life, as with diverse determinants of blame. This approach can extend trait theory to provide quantitative analysis previously lacking in Person × Situation formulations (Note 13).

Integration designs thus provide an essential extension of the questionnaire method on which traditional trait theory rests. Integration theory can thus help unify static trait concepts with dynamic situational personality functioning (see further *Integration Data vs. Questionnaires*, Chapter 6).

Person science requires single-person approaches to personality, one of which is available with IIT. Single-person design and personal design (Chapter 6) provide methods for idiographic theory (*Person Science and Personality*, Chapter 7).

**SOCIETAL BETTERMENT**

The behavior influence function of blame has mixed efficacy in children's learning of social behavior, in marital adjustment, and in legal systems that keep antisocial behavior under some measure of control. The manifest shortcomings of this function should not conceal its roles in developing and maintaining society.

Social formulas to increase effectiveness of blame in interpersonal interaction have been discussed by various writers (e.g., *Nobody's perfect: How to give criticism and get results*, Weisinger & Lobsenz, 1981; *Getting to yes*, Fisher & Ury, 1991; *Getting to 50:50*, Strober & Meers, 2009; see also Benjamin Franklin, 1793/1982, pp. 16f, 84f; Note 14). These exemplify the GOLDEN RULE:

*More Praise: Less Blame.*
NOTES

Note 1. Blame = Responsibility + Consequences. “Responsibility” is used instead of “Culpa” in previous work (e.g., Psychodynamics of Everyday Life: Blaming and Avoiding Blame, Chapter 6, Anderson, 1991b). Although Responsibility can be ambiguous, it is easier to compare with work by others.

Note 2. Weiner (1995) summarizes a wide range of previous work, including much of his own, on judgments of responsibility, with primary emphasis on blame. He comments that most of these results are little more than common knowledge (p. 260), as with more blame for lack of effort than for lack of ability.

Weiner’s main concern, however, is to present a theoretical unification of such empirical results. This effort is roadblocked by lack of capability for integration of multiple determinants. Unable to deal with integration, Weiner’s theory (Figure 1.8, p. 12; Table 9.1, pp. 260, 268) consists of a sequence of yes-no judgments that end up in one of two states: responsibility and no responsibility. Thus, Weiner’s theory cannot deal with quantity measures, as with the three quantities in the blame law, Blame = Responsibility + Consequences. As one example, the functional value of Responsibility may be an integral of causal and social responsibility as discussed below.

This inadequacy of Weiner’s theory is illustrated in Figure 2.2 (p. 33) of his book. Hypothetical students were described by three variables: Ability (Hi, Lo), Effort (Hi, Lo) and Test Performance (5 levels from Excellent to Clear Failure). Participants acted as teacher and graded each student on a -5 to +5 scale. The curves of Weiner’s Figure 2.2 show near-parallelism, evidence for an adding-type integration of the three variables, which Weiner failed to recognize.

Note 3. One-Variable Rules. Most experiments have not reported one-variable rules, perhaps from lack of single-person analysis. On the other hand, experiments that have reported such rules have had small amounts of single-person data with consequent low power to detect real effects of a less important variable.

True one-variable rules may be important. More extensive study is desirable, which might efficiently begin with short group screening tests to detect likely one-variable persons. Scenarios to cover several social situations are desirable for generality. Most one-variable rules have been found with blame. Leon (personal communication) reported that those he questioned about these one-variable rules were emphatic in their appropriateness (see Centration in Chapter 5).

Note 4. Report of Nonreplication. That mothers and sons exhibit similar rules of blame integration was reported by Leon (1984). This result was not replicated in the careful PhD thesis by Arlene Young (1990) (see similarly Note 2, p. 211 in Anderson, 1996a; Note 1, p. 220, in Anderson, 2008). More useful indexes of family similarity may be obtained with integration indexes like the Relation Range Index given in Chapter 6.

Note 5. “A fault confessed is half redressed,” proverb cited in Merry Wives of Windsor (Act I, Scene 1, l. 96, H. J. Oliver, ed.).

Note 6. That Recompense has greater effect than the damage might reflect an additional influence on Responsibility. This, however, seems inconsistent with the evidence that
these two variables are processed independently cited in the second following subsection, *Information Processing*.

**Note 7.** Singh (1978) reported that the basic blame law was also supported for male engineering students in India, who judged complaint cases against hypothetical employees. A substantial apparent negativity effect may be seen in his Figure 1, with greater weight for more negative behavior.

**Note 8.** *The Attribution of Blame* by Shaver (1985) discusses many basic concepts such as intention, causality, responsibility, blame, and excuses, and references discussions by philosophers, legal scholars, and psychologists. To motivational factors, however, Shaver gives only incidental consideration. Instead, he focuses on attribution of blame by a “rational perceiver,” which undercuts his discussion for psychological theory. Indeed, his final theory for assignment of blame resorts to a diagrammatic model based on an official diagram of case flow through the criminal justice system (pp. 156ff). In contrast, IIT considers that motivational factors lie at the heart of blame theory; see *Psychodynamics of Everyday Life: Blaming and Avoiding Blame*, Chapter 6 in Anderson, 1991b.

**Note 9.** Snyder, Higgins, and Stucky (1983) give a wide-ranging discussion of excuses with extensive references to other writers. They also attempt to present a unifying theory but this suffers certain limitations. One is reliance on Kelley's (1972) theory to handle causal attribution. Kelley's theory is irrelevant to excuses because, in particular, it has no place for affect (see *Unified Causal Attribution*, pp. 293-301 in Anderson, 2008).

A second limitation is definition of excuses in terms of self-esteem (p. 45), neglecting the role of punishment. A third limitation is the claim (p. 57) that “excuses invariably are biased interpretations of events.” Persons who fail to foresee some obstacle are certainly not biased in attributing a bad outcome to this obstacle. Whether they should be considered culpable for insufficient foresight may or may not be warranted. Nevertheless, their book contains many interesting observations, a helpful guide to previous work.

**Note 10.** Self-splitting excuses are not infrequent in literature. One example is Hamlet's (Act V, Scene 2) apology to Laertes for assaulting him in Ophelia's grave:

> Was't Hamlet wronged Laertes? Never Hamlet.

. . .

Who does it then? His madness.

His madness is poor Hamlet's enemy.

Sir, in this audience,

Let my disclaiming from a purposed evil

Free me so far in your most generous thoughts,

That I have shot my arrow o'er the house

And hurt my brother.

**Note 11.** Self-attribution of madness as apology appeared long before in Homer’s *Iliad*, which centers on the anger of Achilles, foremost warrior in the coalition of independent Greek states, at Agamemnon, the leader of the expedition against Troy, himself angered by Achilles’ strong, insolent support for returning to Chryses, priest of Apollo, his daughter whom Agamemnon had taken as his own as spoil from a previous battle and threateningly denied to return her despite the high ransom offered by Chryses. Chryses departed in fear but prayed to Apollo who accordingly sent a plague to the Greeks that
finally compelled Agamemnon to return Chryses’ daughter. But in his anger, he high-handedly took from Achilles the woman Achilles received as spoil from a previous siege. This was great dishonor to Achilles in a time when honor was a primary virtue, especially of warriors. Savagely angered, Achilles withdrew from the war, together with his Myrmidon troops. The tide of war then turned entirely against the Greeks and Agamemnon was forced in a public meeting to try to appease Achilles. In the Lattimore translation (Book 9, ll. 115-120):

> Then in turn the lord of men, Agamemnon spoke to him: 'Aged sir, this was no lie when you spoke of my madness. I was mad, I myself will not deny it. Worth many fighters is that man whom Zeus in his heart loves as now he has honored this man and beaten down the Achaian people. But since I was mad, in the persuasion of my heart’s evil, I am willing to make all good and give back gifts in abundance.'

Agamemnon goes on to list gifts of unbelievable munificence, including ten talents’ weight of gold, twelve race horses, “seven women of Lesbos, the work of whose hands is blameless,” and much, much more. But Achilles’ anger is not appeased; he refuses the gifts. He stays out of the battle until his bosom friend, Patroclus, is killed. Then he enters the fighting, slaughtering Trojans without mercy except for 12 young men whom he reserves to sacrifice alive over Patroclus’ funeral pyre.

I detected in Homer little criticism of Achilles’ withdrawal from the fighting although it “hurled in their multitudes to the house of Hades strong souls of heroes, but gave their bodies to the delicate feasting of dogs . . .” (Book1, ll. 3-5). Homer was a bible in ancient Greece; their moral culture still retains appeal as in Germany and Japan in World Wars I and II (e.g., E. Jünger, Storm of steel, memoirs of a German field officer in WWI, M. Hoffman, trans., 2004).

**Note 12.** The blame law, \( \text{Blame} = \text{Responsibility} + \text{Consequences} \), may help clarify the much discussed finding that people feel reluctant to change the path of a train so that it will kill one person rather than let the train continue its ongoing course which would kill several people. Although the Consequences are greater if fate is allowed to take its course, the Responsibility seems greater with the personal action to kill one person.

**Note 13.** The potential of studying blame functions in personality is suggested by the extreme range of forgiveness reported by Girard and Mullet (1997) from “always forgivers” to “never forgivers” (Algebra of Forgiveness, Chapter 7).

**Note 14.** In the deserts of the heart,

> Let the flowing fountain start,
> In the prison of his days,
> Teach the free man how to praise.

(W. H. Auden.)
Chapter 4 Preface

LEGAL JUDGMENT AS INFORMATION INTEGRATION

Legal judgments and decisions require valuation and integration of stimulus information. Such information processing is a province of psychological science and many psychologists have taken up legal issues to seek social usefulness.

Some issues in legal psychology obey the same mathematical laws of information integration established in other areas of human psychology. This is not surprising; the same cognitive processes operate in all these areas. Person cognition and social attitudes, in particular, are basic in legal psychology. So also is judgment–decision theory.

Some writers disagree. They argue that legal information, such as testimony of witnesses and arguments of prosecution and defense attorneys, is too complicated and too subject to contextual effects to be amenable to simple mathematical analysis. Their argument is nullified by the successes of the mathematical laws—Cognitive Unitization of these laws allows exact analysis of some complex context effects that is not otherwise possible.

Cooperative use of field observation and laboratory experiments is essential if legal psychology is to be socially useful. Laboratory experiments can establish validity of cognitive processes, as with the averaging law and generally with functional measurement analysis of multiple coacting variables. Social applications, however, require understanding knowledge systems that operate in social reality. The landmark experimental–field studies of Ebbesen and Konečný and well-designed work by Kaplan and by Hommers provide models for future investigators. This direction of inquiry can help develop a more moral and more humane society.

ALGEBRAIC LAWS OF LEGAL JUDGMENT (3)
AVERAGING THEORY (4)
JUROR COGNITION (11)
OTHER LEGAL VARIABLES (16)
FIELD STUDIES OF THE COURTS (21)
NOTES (25)
Chapter 4

LEGAL JUDGMENT

AS INFORMATION INTEGRATION

Copyright © Norman Henry Anderson
May 19, 2013
Comments are most welcome.
nanderson@ucsd.edu

Legal judgment—decision, as is universally recognized, rests squarely on integration of multiple items of evidence. Testimony of successive witnesses in a jury trial is a classic example. One approach to this integration problem is shown in the Integration Diagram on the next page, repeated here from Chapter 1. Three basic processing stages are shown: valuation, integration, and action.

Valuation is first and most important. Each juror must process testimony of witness A (here denoted $S_A$) to construct its value, $\psi_A$—in relation to operative GOALS. In criminal trials, the final goal would be judgment of guilty—not guilty. Supplementary goals may also be important, as in judging reliability of individual witnesses.

Integration is the second operation in the diagram. The values constructed for the separate witnesses must be integrated to obtain a unitary judgment, denoted $\rho$. Finally, this implicit $\rho$ must be externalized by the action operation, which constructs the observable response, $R$.

The Integration Diagram of Figure 4.1 applies generally, not just to witness testimony. Similar processing is required for the arguments of the prosecution and defense attorneys. Similar processing is also required during juror deliberation, discussed in a later experiment. Bail recommendations by prosecution and defense attorneys and fines and sentences by the judge also require valuation—integration—action.

That fines, sentences, and other blame/punishment should be proportionate to (negative) deserving is generally accepted. Present legal systems, however, rest on crude, makeshift analyses of such proportionality. The laws of information integration are analytic tools for deserving theory that can help develop a more just society.
**ALGEBRAIC LAWS OF LEGAL JUDGMENT**

An effective base for studying the three processing operations of the Integration Diagram was found with the algebraic laws of information integration. This base was illustrated in Chapter 2 with positive deserving and in Chapter 3 with the negative deserving of blame, which underlies much legal judgment. This chapter applies these laws to legal issues.

The effectiveness of the integration laws was indicated with the parallelism theorem given in Chapter 1. Observed parallelism in an integration graph supports an adding-type law by benefit 1 of the theorem. By benefit 2, the overt response, R, is a true measure of the underlying feeling, ρ. Finally, the functional values of the stimulus informers constructed by the valuation operation are available from the integration graph (benefit 3).

**Figure 4.1.** Information integration diagram. Chain of three operators, V – I – A, leads from observable stimulus field \{S\} to observable response, R.

*Valuation operator, V,* transmutes stimuli S into subjective representations, ψ.

*Integration operator, I,* transforms subjective field \{ψ\} into internal response, ρ.

*Action operator, A,* transforms internal response, ρ, into observable response, R.


Jurors are seen as goal-directed information processors in the Integration Diagram. All three operations—valuation, integration, action—involves purposive construction processes. This constructionist character of the Integration Diagram contrasts with passivist views of juror
cognition. As Wrightsman, Greene, Nietzel, and Fortune (2002, p. 438) point out:

“They [the courts] expect something different. They envision a juror who does not form hunches or fill in the blanks but instead passively processes all incoming information without immediate interpretation until finally instructed by the judge to decide.

A similar passivist view was an “article of faith of the classical attitude theorists” in social psychology (Crano, 1977, p. 94). In this classical view, attitudinal judgments are based directly on whatever of the original stimulus materials remain in memory at the time of judgment.

Clear evidence against this “article of faith” was discovered by Anderson and Hubert (1963)—a dissociation between memory and attitudinal judgment: what was best remembered had least effect on the attitudinal judgment based on that very material (Functional Theory of Memory, Figure 8.2, Chapter 8).

The need to view jurors as active information processors has been recognized by many writers. Such concepts as schemas (Medin & Ross, 1992), themes (Lingle & Ostrom, 1981), and stories (Pennington & Hastie, 1981) are similar in spirit to the present conception of knowledge systems. These concepts recognized important complexities of cognition and pointed to important problems. But they were little help with analysis. Indeed, the main specific claim of schema theory was found false with work on Information Integration Theory (Anderson, 1991a, p. 82). The psychological integration laws have provided tools to analyze dynamic information processing.

**AVERAGING THEORY**

Substantial support for averaging theory has been found in experiments on legal judgment. This evidence agrees with the extensive work on the averaging law in person cognition and social attitudes, both of which pervade legal cognition. Some pertinent studies are reviewed here.

**INFORMATION LEARNING**

To a juror, jury service is a learning situation. Each successive witness or other evidence constitutes an information learning “trial.” Jurors valuate each successive piece of evidence and integrate this value into their cumulating judgment of guilty–not guilty. The graph of these provisional judgments as a function of trials is an information learning curve.
Averaging Model for Information Learning. The following experiment explored the applicability of an averaging model for juror learning:

\[ \rho_n = \omega_n \psi_n + (1 - \omega_n) \rho_{n-1}. \]  

(1)

Here \( \rho_n \) and \( \rho_{n-1} \) are the cumulative juror judgments on trials \( n \) and \( n - 1 \), \( \psi_n \) is the functional value of the evidence given on trial \( n \) as constructed by that juror, and \( \omega_n \) is its importance weight. This equation represents a serial curve of information learning (Anderson, 1959).

This averaging model may be rewritten in the following form as a proportional change:

\[ \rho_n - \rho_{n-1} = \omega_n(\psi_n - \rho_{n-1}). \]  

(2)

In words, the amount of change on the left side of this equation is proportional to the possible change, \( (\psi_n - \rho_{n-1}) \), on the right side. The proportional change parameter, \( \omega_n \), represents the importance weight constructed for the stimulus informer on the given trial.

Bigamy Trial of Thomas Hoag. The bigamy trial of Thomas Hoag in 1802, a legal classic, seemed ideal to study juror information learning because the prosecution and defense witnesses disagreed totally in total confidence. All six witnesses for the prosecution were totally certain that the defendant in the courtroom was Thomas Hoag, who had bigamously married Catherine Secor in Rockland, New York. Secor herself was called to the stand as a witness for the prosecution, declaring:

Catherine Conklin (formerly Catherine Secor) testified, that she became acquainted with prisoner in the beginning of September, 1800, when he came to Rockland; he then passed by the name of Thomas Hoag; that witness saw him constantly; that prisoner, shortly after their acquaintance, paid his addresses to her and finally, on the 25th of December, married her; that he lived with her till the latter end of March, 1801, when he left her; that she did not see him again until two years after; that on the morning of his leaving her, he appeared desirous of communicating something to her of importance, but was dissuaded from it by a person who was with him and who passed for his brother; that Hoag, until his departure, was a kind, attentive and affectionate husband; that she was as well convinced as she could possibly be of anything in this world, that the prisoner at the bar was the person who married her by the name of Thomas Hoag; that she then thought him and still thinks him the handsomest man she ever saw.

And all six defense witnesses were equally certain that the defendant was Joseph Parker, a long-term resident of New York, who had never before been in Rockland (see Batteries of Stimulus Materials, Chapter 6).
Participants in the experiment were Yale undergraduates, who read summarized testimony of each successive witness and made provisional judgment of guilt–innocence. They were instructed to keep an open mind and not reach a definite judgment about guilt–innocence until they had received all the evidence. This instruction was reinforced by the sharp contradiction between prosecution and defense witnesses that occurred already on trial 3.

**Juror Learning Curve.** Juror learning curves were obtained by plotting provisional judgments as a trial-wise function of successive witnesses. Witness testimony was given in different orders to different participants. These learning curves were consistent with the learning model of Equation 1 (see Figure 4.3 below). These learning curves agree with evidence from actual juries cited by Wrightsman, et al. (p. 427): “jurors often form very definite opinions before the close of the trial.”

*Basal–surface structure* was a serendipitous discovery of this jury trial experiment. Participants’ attitudes had a labile surface component superposed on an enduring basal component. Discussion of basal–surface structure is deferred to detailed analysis of Figure 4.3 below.

**Information Units: Two Criticisms of Information Learning Theory.**

A unique foundation for studying information units is provided by the Cognitive Unitization of the integration laws. The difficulty of this issue is illustrated in Catherine Conklin’s testimony quoted above, which must be valuated by each juror. Is it meaningful to consider this complex stimulus field as a unit?

Information units can be established with integration laws. Conklin’s testimony could be included in a prosecution witness × defense witness integration design. Parallelism in the integration graph would imply that jurors valued her testimony and that of the other witnesses as cognitive units (Cognitive Unitization, benefit 5 of parallelism theorem).

Pennington and Hastie (1981) criticized mathematical models of juror decision-making on the argument that they fail to provide a psychological account of the information unit. They point to an important problem, but they provide no method even for determining what the units are, much less giving a psychological account of them. IIT had made good progress on both problems; an integration law can establish psychological reality of units—and measure their functional values.

Ellsworth and Mauro (1998, p. 697) second Pennington and Hastie. They assert that integration models are “much too elemental” and must fail because the meaning of each small element of information obviously varies with the context.
Their criticism does not apply to IIT. Quite the contrary. IIT is a contextual theory; it *insists* that values depend on content. Their criticism is invalidated by the success of the averaging model in many demanding experiments, some cited below. Their criticism fails to recognize that the integration laws have identified and validated functional units. Cognitive Unitization rests on empirical laws (*Analytic Context Theory*, Chapter 7).

Other approaches do lack capabilities for determining units. Introspective reports are subject to serious invalidity as shown by meaning invariance in person cognition (see *Meaning Invariance*, Chapter 1). Measures of evidence recall have uncertain value as shown by the cited dissociation of attitude memory and verbal recall (see Figure 8.2).

The importance of cognitive unitization can hardly be overstated. It gives a solid base for deeper analysis of processing of “each small element of information”—a basic problem in every field of psychology.

**Necessity of Integration Models in Legal Psychology.** The necessity, and utility, of integration models is nicely illustrated in the cited experiment. A jury trial is a dynamic learning process: multiple informers in temporal sequence must be valuated and integrated into the cumulating judgment.

The Integration Diagram of Figure 4.1 applies only to a single “trial” in this learning situation. This same diagram, however, may be applied to each successive trial by including the previous judgment, \( \rho_{n-1} \), as one element to be integrated with the present evidence, \( \psi_n \). Such dynamic learning is incorporated in Equation 1.

**BASIC BLAME LAW**

The basic blame law of the previous chapter was supported in the three following investigations. Each illustrates one way in which laboratory experiments can contribute to legal theory.

**Judges and Students Both Follow the Basic Blame Law.** Circuit court judges and college students showed similar blame schemas in Howe (1991) and Howe and Loftus (1992). The latter study used a scenario based on a fight between two angry men in a parking lot by a tavern in which one man suddenly pulled out a small revolver and shot the other. Four degrees of intent (deliberate, reckless, negligent, accidental) and two degrees of harm (serious injury, death) were used in this integration design. Participants made a graphic rating of blameworthiness.

Overall data for both judges and students followed the basic blame law, \( \text{Blame} = \text{Intent} + \text{Harm} \). This rule was supported by parallelism in
the integration graphs. Individual analyses were interpreted to imply that almost half of both groups ignored harm and followed an intent-only rule. However, these single-person analyses had low power with only 9 df for error. Moreover, the two levels of harm were both quite serious and showed small difference across all participants.

The blame schema was extended to include the third variable of justification for the harmful act by Howe (1991). Two scenarios were used: a passerby coming to the aid of a woman being assaulted in a parking lot; and a man coming home to surprise a burglar. Justification was manipulated as two levels of threat by the harmdoer to the protagonist. The basic blame schema, Blame = Intent + Harm, was supported in both groups, judges and students (Note 1).

But whereas students integrated justification in parallel with intent and harm, judges exhibited configural valuation; they assigned far less blame for low harm under high justification. The overall justification effect, moreover, was about four times larger for judges than students. These results show how integration graphs can help study configural processes that do not follow a simple integration law.

This replication of the basic blame law for judges as well as students supports its generality. At the same time, the group difference in effects of justification indicates the need—and capability—to take account of judges' knowledge systems and values, especially concerning variables familiar from professional experience.

Howe's individual analyses are a model for future work. Group data, whether psychological or sociological, are useful for some questions. But development of legal psychology depends heavily on capability to work within individual knowledge systems.

**Averaging Versus Adding.** The mock juror study of Moore and Gump (1995) included the opposite effects test that distinguishes averaging from adding. They used robbery cases on file with the District Attorney's office to construct three strengths of evidence that implicated the defendant as the midnight robber of a convenience store, together with three levels of the store clerk's eye-witness confidence in identifying the defendant as the robber. A fourth level of no information about confidence was also included to obtain a 3 × 4 integration design. Two separate experiments were done, the second being an exact replication of the first to assess reliability. Both yielded very similar results.

Judgments of probability of guilt from Experiment 1 are shown in Figure 4.2 as a function of evidence strength (horizontal axis) and eye-witness confidence (curve parameter). The near-parallelism of the three
solid lines implies that these two variables are integrated by an adding-type rule—either adding or averaging.

![Graph showing judgments of probability of guilt as a function of evidence strength (horizontal axis) and eyewitness confidence (curve parameter). Averaging law diagnosed by parallelism of the three solid curves and crossover of the dashed curve for no information about confidence. (After Moore & Gump, 1995.)](image)

**Figure 4.2.** Judgments of probability of guilt as a function of evidence strength (horizontal axis) and eyewitness confidence (curve parameter). Averaging law diagnosed by parallelism of the three solid curves and crossover of the dashed curve for no information about confidence. (After Moore & Gump, 1995.)

The dashed line gives the opposite effects test that can distinguish between adding and averaging. Adding requires that the dashed line (no information about eye-witness confidence) parallel the solid lines. This line is clearly nonparallel, contrary to adding.

Averaging theory accounts for this nonparallelism. To see this, note that the dashed curve crosses over the two lower solid curves. Thus, low and medium eyewitness confidence increase guilt when added to low or medium evidence strength but decrease guilt when added to high evidence strength.
Averaging has practical importance. If you have strong information, you may weaken your case if you add less strong information. If you have weak information, more may be better.

**Age Limits for Competence.** Understanding of right–wrong, considered prerequisite for competence to stand trial, is presumed present by age 7 in American common law and German civil law. This assumption developed from observation of children of different ages involved in various misdeeds. Hommers' (1992) integration study of this 7–year-age standard is a fine illustration of one way experimental analysis can contribute to legal practice (see also Hommers, 1997, on 14–year age standard for criminal law).

An arson scenario was used inasmuch as suits for large damages can result from fires set by children. One main variable was intent (inadvertent, malicious) of the scenario child in setting the fire. The other main variable was apology (yes, no) of the child. Participants across four age levels rated the scenario child on a graphic, good–bad scale. Effects of both main variables are considered to demonstrate adequate understanding of right–wrong in German civil law.

Hommers' experimental results supported the 7–year-age limit, that German children have adequate understanding of right–wrong at least by age 7 years. Apology had large effects already for the 5-6–year-olds. Intent (inadvertent, malicious) had slight effects at 6 years but moderately substantial effects at older ages.

Of special interest, IQ, which had been strongly advanced as a criterion for understanding of right–wrong, had near-zero diagnosticity. This underscores need for experimental analysis of legal standards.

**Legal Relevance.** Hommers' study illustrates how experimental analysis can contribute to legal systems in society. His judgment task could be developed into a diagnostic test for individual children with uniform meaning across different jurisdictions, avoiding idiosyncratic subjectivity of clinical assessment (see also Simpler Designs in Chapter 6).

Extensive replication is of course needed to influence the legal system. Other misdeeds besides arson need study, especially those more common among young children. Reliable individual assessment requires development of more than a single scenario. Childrens’ ratings of goodness and badness of deeds and misdeeds, perhaps with the child role-playing parent, may help with scenario development.

Howe's work showed that judges and students both followed the basic blame law. Notable differences were found, however, with the variable of justification. Howe’s studies show how integration graphs can
help understand cognition of judges and other professionals in the legal system. Indeed, his work shows that integration graphs may be essential.

**JUROR COGNITION**

Jurors and juries have been the most popular issues in legal psychology. The following sections are mainly limited to contributions of investigators who have applied Information Integration Theory.

**JUROR PERSONALITY**

Juror personality was studied by Martin Kaplan within his functional analysis of personality in terms of information integration. His systematic program of work was well rewarded (see review of his early work in Anderson, 1981a, pp. 257-271). A brief survey is given here.

**General Personality.** People have prior dispositions to view others as more or less likable. Kaplan's thesis was that this disposition could be represented as the initial impression (prior belief) of IIT. Prior belief was thus considered an internal item of information, to be averaged with information derived from external sources, such as behavior of the person or comments from acquaintances. Participants were selected as Positive or Negative disposition on Kaplan's Trait Adjective Checklist.

Kaplan's theory makes two predictions. First, disposition effects should decrease as more external information is included. This prediction is contrary to the attractive hypothesis that prior disposition acts to influence values of stimulus informers (see below). Second, disposition effects should be less when the external information has greater reliability. Both predictions were exactly verified.

In another experiment, participants judged likableness of persons described by personality adjectives of four values from high to low. Kaplan's theory predicts that the two personality groups will exhibit parallel curves in the integration graph, which they did (see Anderson, 1981a, Figure 4.9, p. 260). Similar results were obtained in an experiment with sociableness instead of likableness.

Of special interest, the state variable of temporary mood was shown to have similar effects. Abele and Petzold (1994) also reported that mood was integrated into the overall judgment but not into the values of the individual informers.

**Information Integration Theory vs. Reinforcement–Affect Theory.** Information Integration Theory was compared with the reinforcement–
affect learning theory of interpersonal attraction of Byrne (1969) and Clore and Byrne (1974). In this comparison, Kaplan and Major (1973) used the Byrne–Clore paradigm of judging attractiveness of hypothetical persons described by 3 or 6 of their attitudes on social issues. Each description had 1/3 or 2/3 attitudes similar to those of the participant.

Kaplan’s data disagreed with Byrne-Clore theory but supported averaging theory (see Anderson, 1981a, Figure 4.13, p. 266). These data thus negated the attempt by Byrne and Clore to set interpersonal attraction within their framework of classical conditioning (see detailed comparisons in Kaplan & Anderson, 1973a,b).

Clore and Byrne (1974; see also Byrne, et al., 1973a,b) strenuously defended their theory. They asserted that “reinforcement–affect” was qualitatively different from “information” (their Figure 1). Later, however, Clore (e.g., 1992) silently adopted Kaplan’s view that mood is information (see Mood Is Information, Chapter 7).

**Juror Personality.** Juror judgment was studied by Kaplan within his general approach to personality already outlined. Personality traits would thus function as predispositions or knowledge systems—goal-relevant internal information.

Jurors differ in predisposition along a leniency–severity dimension toward defendants as a class. The traditional tack has been to relate this specific trait to more general traits, such as authoritarian personality, following the trait-typological framework of personality theory.

The functional approach to personality pursued by Kaplan is very different. Kaplan focuses on how traits function in juror judgment (e.g., Kaplan, 1975a,b; Kaplan & Miller, 1978; Kaplan & Schersching, 1980). This functional approach was successfully applied in a number of studies of juror predisposition in much the same way as predispositions toward likableness noted in the second previous subsection.

Of special interest, Kaplan's formulation applies not only to general personality dispositions, but also to temporary mood states created experimentally and treated as information (Kaplan & Miller, 1978). The main concern of this program of work, however, was juror deliberation, discussed next.

**JURY DELIBERATION**

Juror deliberation is part of reaching a joint verdict. Kaplan extended his studies of juror personality to this issue. Two theoretical predictions were tested.
1. Deliberation should reduce effect of personality disposition.
2. Deliberation should make jurors’ opinions more extreme.

Both predictions were well satisfied, most impressively in a realistic mock jury study conducted in the Lewis School of Law, in which law students acted as judge, prosecuting and defense attorneys, and court personnel (Kaplan & Miller, 1978).

Deliberation should reduce disposition effects because the interchange of opinion exposes each juror to the opinions of the others. Averaging theory implies that integration of others’ opinions will reduce the effect of each juror’s prior disposition.

The polarization prediction, that deliberation makes the mean opinion more extreme, may seem counterintuitive. However, it is a direct implication of averaging theory. The theoretical rationale is straightforward. Each juror begins the deliberation with an opinion that represents an average of his/her prior disposition, assumed to be nonextreme, and trial evidence, assumed to be more extreme. In the deliberation, other jurors make half-forgotten evidence more salient, increasing its salience weight. Since this evidence is more extreme, averaging it in makes the juror’s opinion more extreme (Kaplan & Miller, 1979).

Juror polarization is a special case of the general phenomenon of polarizing effects of group discussion, even in absence of pressure to reach agreement. Group polarization seemed mysterious when first recognized; many explanations, such as conformity pressures, were advanced. The foregoing integration-theoretical analysis, with experimental support, was given by Kaplan (1977; Myers & Kaplan, 1976). Further discussion is given in Group Dynamics, Chapter 8 in Anderson (2008).

JUROR “BIAS”

“Bias” is a favorite term not only in legal psychology, but throughout social–personality. As usually used, however, “bias” represents serious misconception of human cognition (e.g., Anderson, 1974b, p. 75, Note 3; 2008, pp. 157-160; see also “Bias” in Chapter 7).

Individual differences are inherent in personality and hence also in juror judgment. Valuation of evidence, the primary process in juror judgment, depends on each juror’s personal knowledge systems. Knowledge systems embody previous experience and naturally differ for different persons. Evidence value is not in the evidence per se; it must be constructed separately by each separate person. Different jurors will construct different judgments from the same evidence.
“Bias” is typically used pejoratively, as though it represents error or fault. Rightly, of course, bias properly refers to deviation from some correct standard of accuracy. But human judgment often does not admit correct standards, especially with social attitudes and moral judgment. To treat personality in terms of “bias” often rests on implicit premise that everyone should have the same values as the investigator.

The need to allow for individual differences is recognized in the jury system. It is designed to minimize extreme views, for example, of jurors adamantly opposed to the death penalty. Prosecution and defense attorneys have opportunity to disqualify jurors with strong prior opinions that could influence their verdict. And the traditional jury of 12 members helps moderate extreme individuals.

Two “Bias” Modes: A Theoretical Pitfall. One theoretical pitfall with “bias” arises because prior opinion may operate in two different modes. In one mode, prior opinion may be integrated directly into the verdict, as with an implicit belief that an accused person probably has reason to be accused. In the other mode, prior opinion may influence valuation of single items of evidence (see “Bias” in Chapter 7).

The distinction between these two “bias” modes is important, practically as well as theoretically. If prior opinion is integrated in parallel with other evidence, its effective weight will decrease as more information is added. This mode is often taken for granted. Bayesian decision theorists, in particular, make much of the claim that the effect of subjective prior belief will be washed out as more evidence accrues. This claim, however, rests on the dubious, implicit assumption that evidence value is not affected by prior knowledge.

But value is not in the evidence itself; value must be constructed by each individual. Increasing the amount of evidence may actually cause divergence of their opinions, exactly contrary to Bayesian theory. This seems not unlikely with, for example, liberals versus conservatives, as in the current squabbling over health care and the federal deficit.

The distinction between these two “bias” modes can be understood with averaging theory. Indeed, both modes can be quantified with the averaging law as shown next.

Measurement Theory for Juror “Bias.” An ingenious application of the averaging law was developed to measure juror prior opinion by Ostrom, Werner, and Saks (1978). Legal instruction to presume innocence corresponds to a prior belief of \( \psi_0 = 0 \) in the averaging law. This instruction may be hard to follow; the mere fact of being accused raises some presumption of guilt. Perhaps, Ostrom, et al. say, it would be more
appropriate for jurors to set the importance weight, $\omega_0$, of their prior opinion equal to 0.

Their results indicated that $\psi_0$ was near zero and that $\omega_0$ was greater than zero. This pair of results demonstrates the first mode of prior opinion: the presumption of innocence was itself integrated into the juror's judgment.

Evidence for the second mode was also obtained: prior opinion influenced valuation of specific items of evidence. Prior opinion was assessed with questions such as “Most people brought to trial are guilty as charged.” Participants were divided into pro and anti defendant groups by a median split on this questionnaire score.

Functional measurement analysis showed that the anti group placed higher guilt ratings on less incriminating evidence and higher weight on each item of evidence. Both effects lead to higher probability of guilt judgments. Both groups had about the same $\psi_0$, however, and both placed nearly equal value on the more incriminating evidence (although this might be a ceiling effect; their Figure 4). Similar results were obtained with two independent replications with college students and with a heterogeneous sample of adults with recent jury experience.

Supportive results were claimed by Kassin and Wrightsman (1983), who showed that a similar pro–anti questionnaire had substantial correlation with guilty verdicts. But such correlation analysis is ambiguous about the locus of this effect; prior opinion might operate in either of the two cited modes (see Halo Pit below). Ostrom, et al. (1978) had shown how to resolve this ambiguity. They also showed that averaging theory can yield more informative results.

Generality of their results was a concern of Ostrom, Werner, and Saks (1978), as shown by their three independent replications. Further assessment of generality is certainly desirable with other kinds of issues that come to trial. Judges' opinions might be studied similarly (Note 2).

“Inevitability of Juror Bias.” This quoted assertion from Wrightsman, et al. (2002, p. 432) follows from IIT. “Bias” is inevitable because the functional weight/value of any item of evidence must be constructed separately by each individual, using knowledge systems of that individual. Different individuals, having different knowledge systems, will inevitably construct different weight/value for the same stimulus information. The averaging law can analyze this process, as shown by Ostrom, et al. in the previous subsection.

Calling this “bias,” however, can be conceptually misleading. One reason, already noted, is that “bias” assumes some correct standard of
accuracy. No less important is that many “bias” frameworks fall into the
deadly halo pit discussed next (see further “Bias,” Chapter 7).

Halo Pit. An attractive way to assess influence of specific informer
stimuli on an overall judgment is to ask for direct judgment of influence
after the overall judgment has been formed. Unfortunately, this simple
method suffers a halo artifact uncovered in early work on person cogni-
tion (see *Foundations of Person Cognition*, Chapter 3 in Anderson,
2008). The overall judgment acts as a halo on subsequent judgment of
the specific informer—which is thus invalid (*Halo Theory*, Chapter 1).

This halo pit is important enough to deserve a specific legal exam-
ple. The main claim of Goodman-Delahun, Green, and Hsiao (1998)
was that jurors’ prior opinions influence their valuation of specific items
of evidence. They used a realistic mock juror situation that began with a
questionnaire about attitudes toward the death penalty and then presented
a videotape of an actual store robbery in which a clerk was killed,
together with videotapes of the closing arguments of the prosecution and
defense attorneys. Each mock juror then made an individual judgment of
guilty–not guilty and of sentence.

After this, the main data were obtained—judgments about the indi-
vidual items of evidence that had been presented. The main result was a
correlation between juror prior opinion and judgments about incrimina-
ting value of evidence. Mock jurors less favorable to death sentences
made lower judgments about incriminating value of items of evidence.
This result was taken at face value to mean that prior attitude had influ-

But this correlation contains a likely halo artifact. Since evidence
value was judged *after* overall judgment of guilt/innocence, this overall
judgment will influence subsequent judgments about the items of evi-
dence. The authors’ claim may well be true, but this experiment cannot
separate out the halo artifact. Averaging theory can, as illustrated by
Ostrom, Werner, and Saks (1978) in the second previous section.

**OTHER LEGAL VARIABLES**

Much concern has been expressed about variables that influence legal
judgment. Some aspects of this issue are considered in the following
subsections.

Primacy–Recency and Basal–Surface Structure of Attitudes.
The primacy–recency issue has long been of interest in psychology of
law as well as in general theory of judgment–decision. Is it better to pre-
sent your case first, hoping to crystallize opinions in your favor? Or second, hoping not only to undo the first arguments but also to leave your arguments fresher in the recipient's minds?

The foregoing jury experiment on information learning (Anderson, 1959) was designed to provide evidence on primacy–recency. This could be measured at three points, after 4, 8, or 12 witnesses.

The two curves in the top panel of Figure 4.3 represent the same 4 witnesses over trials 1–4: closed circles for prosecution–defense order, open circles for the opposite, defense–prosecution order. The crossover at trial 4 shows recency; the same information has greater effect when presented second. This recency, however, represents surface attitude: it disappears over the next two trials (see figure legend).

A very different picture appears with the recency crossover at trial 8 in the middle panel of Figure 4.3. This recency remains substantial until the end of the bigamy trial as shown by the continued separation of the two curves. This enduring effect represents basal attitude, a sharp contrast with the rapid decay of surface component in the top panel.

Important additional information on basal–surface structure appears in the bottom panel of Figure 4.3. After 12 witnesses, substantial recency was again observed. But this immediately reversed to primacy on the next trial, on which all participants received the same prosecution evidence. This recency at trial 12 was thus a labile surface component that masked a basal primacy that remained until the end of the trial.

Figure 4.3. Basal–surface memory structure. Judgments of guilt–innocence in Thomas Hoag bigamy trial. In top panel, two prosecution and two defense witnesses are given in prosecution–defense P–D order to half the subjects and in the opposite D–P order to the other half. Crossover at witness 4 shows that more recent witnesses have greater effect but this recency lasts only 2 trials. The P–D subjects are now split into two subgroups: half get next four witnesses in the P–D order, half in opposite D–P order; the same split is made for D–P subjects. Curves in the top panel are averaged over these two subgroups, however, so they show no systematic effect of witnesses. Instead, the middle panel shows judgments of these bifurcated subgroups over the next four witnesses. These two curves are much like those already seen, for they represent similar sequences of witnesses. At witness 8, these two curves cross over, showing recency. Over the next four witnesses, each subgroup is again bifurcated into P–D and D–P subgroups in the same manner. Curves in the middle panel are averaged over these subgroups, as before, and so show no systematic effect of witnesses. Instead, judgments of these subgroups are shown in the bottom panel. Although the judgment at witness 12 shows recency, the curves uncross at the very next witness to reveal hidden primacy. This primacy was statsig and appeared uniformly for all four pairs of subgroups with different sequences of information. The last four trials were the same for everyone: testimony from two prosecution witnesses followed by a denouement in the form of two pieces of courtroom demonstration that ended the trial. (After Anderson, 1959.)
No general rule of primacy–recency should be expected, as this mixed pattern of results showed. In practice, recency has been far more common. Primacy is obtained in a few situations but the frequent belief in potency of first impressions is a myth (Note 3).

_Basal–surface_ structure was the most important outcome of this experiment. Attitudes may have two components: an enduring _basal_ component and a labile _surface_ component (see Basal–Surface Theory, pp. 94-97 in Anderson, 2008; Note 4 below).

This 1959 study may be the first definite demonstration of basal and surface components of attitude. Rapid decay of initial impact of some communication has been demonstrated, but that could merely be normal decay, not a distinct component.

Basal–surface theory has been little studied, although it seems fundamental throughout attitude theory. Some support, however, may be seen in Pyszczynski and Wrightsman (1981), who used a 2×2, weak×strong design for opening statements by prosecution and defense attorneys (given in the legally prescribed prosecution–defense order). Following this, all four conditions received the same sequence of 11 items of evidence. Probability of guilt was judged after each of the 13 trials.

Their Figure 1 shows the juror learning curves for each of the four conditions. The pattern was striking: weak prosecution followed by strong defense opening statements on trials 1 and 2 yielded a persistent attitude that changed little over the following 11 items of evidence. The other three conditions all yielded much higher guilty judgments and were essentially the same from trial 5 on. These data suggest that the strong defense opening statement created a strong basal component.

_Basal–Surface Theory_. Basal–surface structure has fundamental importance for general theory of attitudes. Much attitude change reported in the literature may be merely surface component that quickly vanishes.

This basal–surface problem has been ignored in attitude research. Even the obvious question whether ending with an uninformative, neutral message will wash out surface component seems unanswered.

The evidence for basal attitude in the experiment of Figure 4.3 was a serendipitous consequence of the primacy–recency structure of this trialwise design in which basal component formed mainly over trials 7-10. Systematic analysis is now possible based on later developments with the averaging law (see e.g., Anderson, 2008, Figure 4.4, p. 95; see further Functional Theory of Learning, Figure 8.3, Chapter 8).

_Legally Inadmissible Evidence_. Functional memory theory explains the findings that instructions to jurors to disregard inadmissible evidence
that may intrude in the testimony (prior criminal record, for example) are relatively ineffective. As goal-oriented information processors, jurors valuate such evidence as it is given and integrate it into their developing, case-specific knowledge systems.

The judge's instruction to disregard such evidence comes too late; this evidence has already been valuated and integrated. The judge's instruction reflects the legal conception of jurors as passive information processors indicated in the earlier quotation. But having been valuated/integrated into the juror's case-specific knowledge system, the original stimulus information may no longer have separate existence. Legal psychology requires a dynamic, functional conception of memory (see *Functional Memory Theory*, Chapter 8).

Legally inadmissible evidence may have diagnostic value. Prior record is evidence about the defendant that bears on the present charge; persons convicted of one burglary are more likely to commit another than persons who have not. With sex crimes, this relevance of prior record has been recognized as admissible in federal courts.

**Nondiagnostic Variables.** A second class of extralegal variables includes those that presumably lack diagnostic value but may still influence legal judgment. Order of presentation of evidence is one, as with primacy/recency above.

Personal attractiveness has been claimed to be another. This was taken for granted by Zebrowitz and McDonald (1991) as the explanation for their finding that more attractive plaintiffs in small claims court were more likely to win their cases. But personal attractiveness may well be diagnostic in these field data. Plaintiffs who give more attention to personal appearance may give more attention to preparing their case. And they may have better cases. Valid interpretation of such correlational data presents empirico-statistical difficulties that can be very treacherous (see *Illusion of “Statistical Control,”* Chapter 6).

Even experimental studies of nondiagnostic variables may not be worth much. The much-studied issue of stereotypes illustrates the problem. Aiming to demonstrate some stereotype, investigators usually simplify by omitting other variables. But other variables are nearly always important in everyday life. The strength of the stereotype must be established, which usually requires comparison with effects of other variables. The common tactic of omitting other variables can reveal weak stereotypes with little social relevance (Anderson, 1981a, p. 248; see *Nonarbitrary Metrics With Information Integration Theory*, Chapter 6).
This need for an integrationist approach to stereotype theory is underscored by the work of Konečni and Ebbesen discussed below. Not one popular stereotype, such as race, had a discernible effect on length of sentence imposed by judges in actual cases.

**Halo Bias Explains Double Discounting.** Halo process may bias cases of comparative negligence, in which jurors make two judgments. One judgment is of relative responsibilities of plaintiff and defendant, the other of the full amount of plaintiff's losses. The former judgment is used by the judge to reduce the full amount of plaintiff's losses in proportion to plaintiff's responsibility.

The evidence indicates “double discounting.” Mock jurors discount plaintiff's losses in proportion to plaintiff's responsibility, contrary to what the law prescribes. The subsequent discount by the judge shortchanges the plaintiff (see references in Wrightsman, et al., 2002).

Halo theory explains double discounting. This follows the basic blame law, \( \text{Blame} = \text{Responsibility} + \text{Consequences} \). Judgments of blame for plaintiff are higher for higher plaintiff responsibility. This blame judgment then exerts a halo effect on the juror’s subsequent judgment of plaintiff's loss (see Halo Pit above). This halo effect may properly be called bias because there is a correct standard.

**Another Halo Bias.** A similar halo bias arose in social psychology with findings that judgments of responsibility for a harmful act are greater for greater harm. The cognitive analysis follows the basic blame law. Jurors form an overall judgment of blame and this exerts a halo effect on their judgments of relative responsibility.

The alternative hypothesis of defensive attribution (Shaver, 1975; Fiske & Taylor, 1991) disagrees with the basic blame law; this law shows meaning invariance for Responsibility. This illustrates the conceptual power of the integration laws (see Psychodynamics of Everyday Life, Chapter 6, pp. 260ff, in Anderson, 1991b).

**FIELD STUDIES OF THE COURTS**

**CONJOINT EXPERIMENT AND OBSERVATION**

Experimental analysis can help improve the legal system. This hope has been pursued by many investigators, as in the foregoing studies of juror information learning and juror cognition. Such studies can help understand cognitive processes of judges, prosecution and defense attorneys, police, and others in the legal system, criminals especially. Necessarily, however, the continuing evolution of laws and regulations relies mainly
on observational data and so does their implementation. Conjoint experimental–observational studies are needed. These are rare but two truly impressive programs of research are noted here.

SETTING JUST BAIL

What is just bail for a person charged with a crime? Bail is intended to help ensure that the accused person will appear to stand trial without having to spend the interim in detention. Posting bail is a hardship for the accused, especially for those who must use a bail bond agent at a cost of 10% of the bail. Setting bail addresses a conflict between the individual's right to liberty and the community's right to freedom from crimes or threats thereof.

Setting just bail involves information integration. Several variables may be valued and integrated: seriousness of crime; community ties (job, family); prior criminal record; and possibly character information from the arresting officer or other persons.

Pioneering work by Ebbesen and Konečni (1975) applied experimental analysis conjointly with field observation. They used a factorial integration design in single person experiments with Superior Court judges, together with regression analysis of actual bail settings in court sessions. The two levels of local ties in the integration experiment represented 93% of the actual robbery cases in the court sessions; levels of the other three variables were also chosen to be representative (Note 5).

Four issues raised by the work of Ebbesen and Konečni are discussed under the following four headings.

**Question 1.** What do judges consider just bail?

The experimental study found that judges considered community ties (e.g., job, family) by far the most important variable, as measured by the main effects in the integration design. This seems entirely reasonable; community ties has obvious claim as assurance that the accused will appear to stand trial. Prior record and recommendation of the district attorney also had reliable effects, although not the recommendation of the defense attorney.

An adding-type model for information integration was indicated by the near-complete absence of any interaction term in the Anova. Lack of statistical interaction supports the use of simpler designs that may be needed in field studies (Notes 5 and 6).

**Question 2.** Do judges' actual bail settings in court agree with their private judgments?
Evidence on this question was obtained by having observers unobtrusively code ongoing court cases on the same four variables used in the experiment. Multiple regression was applied to these data.

*Community ties had virtually no effect in these field data.* Community ties, by far the most important in judges' private judgments, had little or no effect in their actual bail settings. Instead, judges relied heavily on the recommendation of the district attorney.

Ebbesen and Koneční realized that a real effect of community ties in judges' bail settings could be masked by an effect in the district attorney's recommendation. However, regression analysis showed no effect of community ties in recommendations of the district attorneys. Judge’s courtroom bail settings evidently differ sharply from their ideals of justice that they expressed in the integration experiment.

This work illustrates one way in which experimental analysis can help improve society. Replication of this work in other jurisdictions and with a similar study of district attorneys is certainly desirable. Their recommendations seem most important in practice, as Ebbesen and Koneční found, and in principle because the district attorney has detailed knowledge of each case.

*Question 3. What is just bail?*

The foregoing results raise serious doubt about justice of the bail system. Judges have some reason to rely so heavily on the recommendation of the district attorney, who has professional and personal interest in the details of the case, especially that the accused will appear for trial. But this interest will tend to produce unjustly high bail settings.

Experimental analysis of just bail could be straightforward. On a stratified sample of cases, reduce the set bail by, say, 20% for a random half of the cases. If this yields too low bail, an unacceptable fraction of this group will fail to reappear. Otherwise, prevailing levels of bail are unjustly high. Such experimental analysis must of course be done within the legal system, with cooperation of all concerned. This is one way that experimental analysis can help improve the legal system.

*Question 4. How practicable are field experiments?*

The lack of follow-up of the conjoint experimental–observational approach of Ebbesen and Koneční raises the question whether it is generally practicable. Both authors argue strongly that it is highly desirable and that its labor-intensive character is more than justified by its social importance (personal communications, 2008).
SENTENCING DECISIONS

The foregoing work on bail setting was extended by Konečni and Ebbesen (1982, 1986) in major research on sentencing. Sentencing is popularly considered a complex cognitive process in which the judge takes account of multiple determinants specific to each case and integrates them into a just decision. This view seemed strongly supported when judges were tested with integration experiments. Two studies of this kind, one with focused interviews of judges in their chambers, the other with judges' responses to a sociological questionnaire, both found substantial effects of pertinent case variables.

Here again, judges' ideals as represented in the experimental study differed sharply from their courtroom behavior. This was revealed by archival analysis of about 1200 court files. In the courtroom, judges rely mainly on the recommendation of the probation officer, who presents a detailed report of 8-15 pages to the judge on each case. Most sentencing hearings themselves took only about 5 minutes.

Konečni and Ebbesen point out that simple regression models could do as well, probably better, than the present system—at much less cost to taxpayers. They also point out that much else of the present legal system depends on opinions of the legal establishment that have unconcerned relation to scientific analysis.

Their argument agrees with similar studies of “expert” opinion in other areas. Simple mathematical models predict better than experts in many different fields (e.g., Swets, Dawes, & Monahan, 2000). Konečni and Ebbesen express doubt that the legal establishment will welcome their proposal, a doubt reinforced by persistent neglect of psychological science in clinical psychology (Grove & Meehl, 1996).

The enormous effort represented in the foregoing and related studies by Konečni and Ebbesen showed that a few primary predictors gave very good accounts of sentencing decisions. This supports their argument for providing each judge with a printout of relevant variables in each case. And perhaps also the judgment of their personal regression equation, including the weights obtained from their personal experiments.

A related contribution was the irrelevance of numerous factors such as race, gender, religion, and military record, that have been implicated by other investigators in laboratory experiments that ignore the field situation. Their work is a remarkable contribution to a legal system grounded in true field science—a new direction in legal science.

The arduous labors of these two pioneers is a twofold model for applications of psychological science to legal issues. They demonstrate
the usefulness, necessity, of conjoint experimental–field analysis. They also show how to attack problems of high social relevance that may be amenable to reform.

Psychological research has given much attention to jury trials, yet only a small proportion of legal cases come to trial. Much of this research, moreover, rests on mock simulations that have only nominal relevance to either law or psychology. And that are unlikely to have any effect on the actual jury system.

Many legal issues offer more promise than jury trials for social practice as well as for psychological science. Among these are causes and correlates of crime (Wilson & Herrnstein, 1985), economics of the justice system (Phillips & Votey, 1981), police behavior (Skogan & Frydell, 2004), the exclusionary rule for evidence (Totten, Kossoridge, & Ebbesen, 1999), and diverse others dealing with child support, domestic violence, anger management, and parole/probation. Research on legal psychology could usefully begin with a survey of problems, their relative importance, and prospects for worthwhile results.

NOTES

Note 1. A useful result is that Howe (1991) and Howe and Loftus (1992) both found similar integration rules using within design, in which each participant judged all stimulus combinations, and between design, in which each participant judged only a single combination. This supports the similar result of Konečni and Ebbesen (1982). Within design is much more efficient (Chapter 6).

Note 2. This finding of Ostrom, et al. (1978) that prior opinion influences valuation of specific items of evidence disagrees with cited results of Kaplan and of Abele and Petzold. This issue of functions of prior opinion has general importance.

Note 3. Myth of Primacy. Some writers treat primacy as a general phenomenon (e.g., Flanagan, 1991, p. 284; Nisbett & Ross, 1980). Indeed, the anchoring and adjustment heuristic of Kahneman and Tversky rested entirely on the assumption that primacy is general. In fact, recency is far more common (see Heuristics, Anderson, 1996a, p. 347).

This myth of first impressions was strongly proclaimed by Wrightsman, Greene, Nietzel, and Fortune (2002, pp. 413ff). Their claim disagrees with the jury experiment cited in the text (Anderson, 1959) and with nearly all work in judgment-decision theory. Scrutiny of Wells, Micke, and Wrightsman (1985), which they cite in support, shows little support. The critical comparison between the prosecution–defense and defense–prosecution orders failed of statistical significance despite an N of 201.

In everyday life, of course, first impressions may be potent simply because they rest on more information.

First impressions could have special significance if they influenced valuation of later information. This could be studied using the averaging law to measure weight/value but this has not yet been done.
Note 4. This jury trial experiment is perhaps the first definite evidence for dual learning components: an enduring basal component and a labile surface component. Much published data on attitude change may be merely surface component that evaporates as the subject departs the experimental room.

Note 5. Field investigations are often concerned with main effects of certain variables, as just illustrated with effect of community ties in bail setting; the exact nature of the integration process often has secondary interest. Hence complete factorial designs, commonly used to diagnose integration processes in laboratory experiments, may not be needed. Smaller designs may be more useful (see Simpler Designs, Chapter 6).

Note 6. The lack of statistical interaction in the experimental study of bail setting by Ebbesen and Konečni also indicates that the dollar bail setting was a true measure of the judge’s opinion (benefit 2 of parallelism theorem). This is a notable extension of functional measurement with ratings to a behavioral measure with ecological significance.

Two companion studies by Konečni and Ebbesen (1982) deserve comment. Both found that rank orders of importance of sentencing variables, such as severity of crime and prior record, differed across judges, defense attorneys, and college students.

Such differences should be no surprise. Judges, defense attorneys, and college students have very different knowledge systems. Hence they place different values on the same stimulus information. Konečni and Ebbesen are certainly correct in concluding that much current laboratory research lacks outcome validity.

Process validity, however, is important for theory of legal cognition (see Two Kinds of Validity: Process and Outcome, Chapter 6). Their work suggests that the same integration models are used by judges and college students, also found by Howe (1991). These models allow true idiographic measurement of values, especially of judges’ ideals, which could help improve the justice of our justice system.
Chapter 5 MORAL DEVELOPMENT Preface

Children are proficient integrators of stimulus information. They have followed the three psychological laws of information integration in several areas of psychology, especially in moral cognition (e.g., Anderson, 1980, 1983, 1991c, 1996a, Chapters 6 and 8).

These integration laws provide effective theory for studying cognitive processes through their development. These laws not only mirror the processes of integration but, of no less importance, they can also provide true measurement of the values that are integrated for each individual child. These nomothetic–idiographic laws provide unique power for developmental analysis.

These integration laws disagree sharply with stage theories of development. Stage theories are attractive because development exhibits temporal evolution and stage frameworks promise to uncover regularity and order in this evolution.

But stage theories cannot handle integration and they have no place for value. Thus, they are inadequate empirically and misguided conceptually. A different conceptual approach is needed.

One alternative approach rests on the laws of information integration. These laws revealed that young children have high cognitive capabilities that were obscured or denied in previous approaches. These laws can help unify developmental psychology with person science, social attitudes, judgment–decision, and learning (Chapter 8). These laws of information integration open a new conceptual direction for studying development across the life span.

LAWS OF INFORMATION INTEGRATION (2)

TWO DEVELOPMENTAL INTEGRATION THEORIES (4)

COMPARING THE TWO INTEGRATION THEORIES (7)

MORAL STAGE THEORIES (16)

MORAL DEVELOPMENT: LOOKING FORWARD (22)

NOTES (23)
Information integration is important in studying moral development. The prominent role of information integration in adult morality was documented in previous chapters. These moral systems begin early in life as children learn about good–bad and right–wrong. Understanding developmental beginnings is important for understanding—and improving—moral functioning in later life.

Information integration tasks can be simple, suitable for very young children, yet meaningful at older ages. Such tasks can embody basic moral concepts such as good–bad, unfairness–fairness, apology, getting even, truthfulness, and other pro/antisociality. Age comparisons can then offer direct portrayal of development.

A second advantage is that response measures can also be simple. Graphic rating of “how much,” as with deserved amount of reward or punishment, has been the standby. This functional rating method requires minimal verbal facility. It is usable down to at least 4 years of age. It is easily understood across cultures. And it can provide true measurement.

Not least important, functional rating avoids the well-criticized confounding with verbal facility that undercuts the reliance on verbal reports in some research programs. Indeed, the method of functional rating can provide a validity criteria for verbal reports.

**LAWS OF INFORMATION INTEGRATION**

The laws of information integration provide an effective foundation for studying moral development. Contrary to earlier beliefs, young children are proficient information integrators. Indeed, they follow the same integration laws found at older ages. This age-invariance is a useful tool for studying development of moral values and structure of moral knowledge systems.
INTEGRATION DIAGRAM

The conceptual theme of Information Integration Theory (IIT) is shown in the Integration Diagram of Figure 5.1, repeated here from Chapter 1.

![Integration Diagram](image)

**Figure 5.1.** Information integration diagram. Chain of three operators, V – I – A, leads from observable stimulus field, \{S\}, to observable response, R. 

*Valuation operator, V, transmutes stimuli, S, into subjective representations, \(\psi\).* 

*Integration operator, I, transforms subjective field, \(\{\psi\}\), into internal response, \(\rho\).* 

*Action operator, A, transforms internal response, \(\rho\), into observable response, R.* 


Objective stimuli, S, impinge on the person and are valuated to construct their psychological values, \(\psi\). These \(\psi\) values are then integrated into a subjective response, \(\rho\), which is externalized to become the observable response, R.

*Purposiveness* is indicated by the threefold appearance of GOAL in the Integration Diagram. Valuation especially is goal-oriented; the same stimulus S may be transmuted into different \(\psi\)'s for different goals.

MULTIPLE DETERMINATION

Multiple determination is a key problem for all attempts to develop psychological theory. Some workers seek to slide by this problem with the common tactic of showing that some variable does or does not have an
effect. Judgment of intent or responsibility of a harmdoer, for example, may be studied for developmental trend of this important attribution process. This one-variable tactic is severely limited, however, because most thought and action depend on integration of multiple variables, even in young children. Developmental analysis depends on capability to analyze integration processes.

Standard factorial analysis of variance has often been used in attempts to study multiple determination. This can be useful but serious pitfalls have been widely ignored. One pitfall is that statistical interactions may be meaningless unless the response measure is a linear (equal interval) scale (see Understanding “Interactions,” Chapter 6). Another pitfall is that the common practice of treating main effects of variables as measures of their importance is usually invalid (see Concept-Instance Confounding, Chapter 6).

An effective foothold on multiple determination was provided by findings that the integration operation, I in the Integration Diagram, exhibits simple algebraic laws for much thought and action. These laws can also be used to measure true subjective values for individual persons. Furthermore, the treacherous problem of comparing importance of different variables can be resolved in some cases.

These integration laws are found at all ages down to at least 4 years. The age invariance of this basic cognitive process facilitates cross-age comparison. Empirical illustrations with fairness and with blame are discussed below.

**TWO DEVELOPMENTAL INTEGRATION THEORIES**

Besides IIT, one other theory has taken information integration as an experimental base for child development, namely, that of Jean Piaget. Piaget’s *integration choice methodology* was introduced in his pioneering experiments on moral development (Piaget, 1932/1965), with a subsequent shift to naïve physics—the base for his genetic epistemology.

This discussion considers only moral development, comparing IIT with Piaget's integration choice methodology which had extensive influence on later investigators. Functional measurement methodology, however, leads to very different understanding of development (see also Bogartz, 1994; Cuneo, 1982; Surber, 1982, 1985).

PIAGET'S INTEGRATION CHOICE METHODOLOGY

Piaget's integration choice methodology presents two objects, A and B, A > B on one dimension, A < B on a second dimension. People choose which is larger overall. A fully appropriate choice depends on integration of the two dimensions for each object and choice of the larger integral.

Piaget's choice methodology has been used extensively throughout the developmental field. This methodology and these results underlie much current belief, not only about children's cognition, but also about choice of research issues and experimental procedure. Unfortunately, this choice methodology suffers confoundings that invalidate many applications, nonmoral as well as moral (see How not to study child development, pp. 230ff in Empirical Direction).

PIAGET'S STUDIES OF BLAME: CENTRATION HYPOTHESIS

Piaget introduced his integration choice methodology with his work on blame. The two following stories were intended to vary both intention and harm as determinants of blame. Children are to choose who is naughtier, Marie or Margaret.

There was a little girl who was called Marie. She wanted to give her mother a nice surprise, and cut out a piece of sewing for her. But she didn't know how to use the scissors properly and cut a big hole in her dress.

A little girl called Margaret went and took her mother's scissors one day when her mother was out. She played with them for a bit. Then as she didn't know how to use them properly she made a little hole in her dress. (p. 122)

Piaget then questioned them about their reasons for their choice, a desirable practice but with a deadly confound (Leon, 1980).

Piaget's major claim was that younger children cannot integrate. Instead, they center on a single variable, either intent or harm, and judge on that alone. They understand that intent and harm are both relevant; given only one, they make sensible judgments. But, claimed Piaget, they cannot combine the two into a unified judgment. Centration became a
basic premise throughout Piaget's studies of naïve physics. Centration is still believed by some workers despite massive contrary evidence.

Piaget’s evidence for centration came from verbal justifications for the choice. Children who chose Marie as naughtier naturally justified their choice by appeal to physical damage (the “big hole in her dress”). Such verbal response may seem direct insight into children's thinking.

But this verbal justification is undercut by the all-or-none character of the choice task itself. Having chosen the story with the greater harm, the child's justification will naturally appeal to that harm. Marie’s intent (“nice surprise”) argues against the choice. Intent will hardly be mentioned, therefore, even though it may have been integrated (Leon, 1980).

Piaget, however, considered centration a major discovery. He relied on it systematically in his voluminous studies of naïve physics, in which he continued to employ his integration choice methodology.

But when functional measurement methodology was applied, centration was quickly seen to be an artifact of Piaget’s choice methodology. Integration graphs provide simple, critical tests of centration. Integration graphs are theoretically neutral. Had centration occurred, this would have been transparently clear in the graphical pattern. Instead, this pattern showed integration—as in Figure 5.2 below (see also Anderson & Cuneo, 1978; Leon, 1980; Schlottmann, 2000; Shanteau, Pringle, & Andrews, 2007; Singh, 2011; Surber, 1977, 1982, 1985, 1988, 2007; Wilkening, 1979, 1982, 1988, 2007; Wilkening & Anderson, 1982, 1991; Notes 2a,b,c).

FUNCTIONAL MEASUREMENT METHODOLOGY

The functional measurement methodology of IIT was applied to blame theory in the landmark thesis of Manuel Leon (1976, 1977, 1980) and in impressive work by Colleen Surber (1977, 1982, 1985). Children even younger than those studied by Piaget integrate very nicely in diverse tasks. Piaget’s centration hypothesis predicts that only one variable will show an effect in an integration task. This prediction was clearly disproved in the cited integration experiments, some of which were discussed in Chapter 3 (e.g., Figure 3.1).

Advantages of functional measurement methodology are illustrated by these studies. Foremost is capability to uncover the underlying law of information integration. No less important, the metric response allows simple quantification of developmental trends, an effective tool for developmental analysis.
This functional measurement methodology is far more informative than Piaget’s choice methodology. And simpler to boot. Applications to some developmental issues are given next.

**COMPARING THE TWO INTEGRATION THEORIES**

**PREFERENCE INTEGRATION**

The following experiment seems the first to establish an integration model in children. At that time, Piaget’s claim that young children cannot integrate but center and judge on the basis of one stimulus alone was widely accepted (e.g., Flavell, 1967, p. 157; Siegler, 1976). Piaget’s integration choice methodology, however, gives only crude information about age trends and has little capability with single child analysis. Application of IIT was expected to help in both respects.

![Figure 5.2. Parallelism in left panel supports adding-type model; crossover in right panel eliminates adding model and supports averaging model. Children judge liking for one or two toys in factorial integration design. (After Butzin & Anderson, 1973.)](image)

**Experimental Procedure.** On each trial, children rated how much they would like to play with one or two toys shown to them. These toys had been preselected to be Lo, Med, or Hi in attractiveness and were presented in a 3 x 3, row x column integration design. The six single toys were rated similarly. These 9 + 6 trials were presented twice to each child with
careful randomization. 30 children were recruited from the surrounding community and paid $1 for being tested in their own homes.

**Two Results: Integration and Proportional Motive Thinking.** The parallelism in the left panel of Figure 5.2 implies an adding-type integration model, either adding or averaging (benefit 1 of parallelism theorem in Chapter 1). The crossover of the dashed single-toy curve in the right panel of Figure 5.2 shows opposite effects: adding the Med row toy averages up the Lo column toy, averages down the Hi column toy.

Little sign of developmental trend was found. The younger and older children (mean ages of 6–2 and 9–7 years) showed similar integration graphs (Figure 1 of Butzin & Anderson, 1973).

Two claims of Piagetian theory are disproved by Figure 5.2. First, children did not center. A glance at the integration graphs shows that both toys influenced the preference (Note 3).

Piaget also claimed that children younger than 10–12 years of age cannot use proportional metric thinking; the parallelism of Figure 5.2 shows quite the opposite (benefits 2 and 3 of the parallelism theorem). Proportional metric thinking holds true for preoperational children even younger than 4 years of age (Cuneo, 1982). IIT thus provides a powerful metric methodology for developmental analysis (Note 4).

**DESERVING AND FAIRNESS**

Deserving and fairness, both important in social–moral practice and theory, obeyed exact algebraic laws in extensive experiments on information integration with adults (Chapter 2). Understanding how these concepts develop and function can help build a better society. The experiment summarized here found the same integration laws with children even younger than 5 years.

Participant children in 4 age groups, from 4+ to 8+ years, played Santa Claus in two tasks. In the equity task, they made fair division of 20 symbolic toys between two story children based on deed (how much they had cleaned up the campground or helped their mother) and need (how many toys they already had). In the deserving task, they assigned a fair share of the 20 symbolic toys to a single child based on both deed and need of that child. These judgments were made by sliding a chosen fraction of the 20 symbolic toys along a rod, a graphic rating scale (Anderson & Butzin, 1978).
The children’s fair divisions are shown in Figure 5.3. The wealth of information obtainable from a single integration experiment may be illustrated with the following list of nine implications.

1. **Equity Schema.** Fair shares division between two story children followed the decision averaging law of Chapter 2. Deed–deed division in the left panel of Figure 5.3 shows the slanted barrel pattern predicted by this law. This same pattern is predicted for the need–need division in the center panel although this barrel shape fell short of being statsig. No reliable trends across the four ages were found; even the 4+-year-olds divided very nicely—they understood fairness (Note 5).

2. **Deserving Schema.** Deserving of single story children followed an adding-type rule. This rule is observable in the parallelism of the need-deed integration for a single child in the right panel of Figure 5.3.

![Figure 5.3](image)

*Figure 5.3.* Mean number of toys given to child as a function of information about performance and need: Experiment 2. Left and center panels show equity division between two children as a function of performance and need, respectively; right panel shows deservingness reward for single child as a function of its performance and need. (After Anderson & Butzin, 1978, Experiment 2.)

3. **Social Comparison: Need Versus Deed.** Piaget’s claim of a developmental trend of importance from objective factors at younger ages to
subjective factors at older ages has been widely accepted. The present data, however, showed nearly equal effects of subjective need and objective deed and little age trend. Of course, this like nearly all other reports of objective–subjective trend, is inconclusive owing to concept–instance confounding (Chapter 6).

4. Multidimensional Input. In Experiment 3, each of two story children was characterized by both need and deed, each at low or high levels. Participant children were told to make fair division of 20 toys between them. These judgments exhibited parallelism in the Need × Deed integration graph at every age, in accord with integration theory.

5. Integrational Capacity. Capacity to integrate multiple stimulus informers is important everywhere in life. Integrational capacity was studied with individual analyses in Experiment 3, which was feasible because two replications were given each child. All four main effects were statsig for every 8–year-old, with a steady decline at younger ages. But 2 of 10 4–year-olds had four statsig main effects and another 2 had three. Further study of this cognitive capability might avoid the complication of fairness division and instead study judged deserving of single story children (Note 6).

6. Social Comparison: Input Integration vs. Fairness Integration. Equity theorists have taken input integration for granted—that multiple input dimensions (need and deed in the experiment of Figure 5.3) are integrated to form a unitary value of input. This unitary value is then used in the equity division. Fairness integration is an alternative hypothesis: people make an implicit fairness division for each dimension of input and then integrate these partial fairness values.

A definite test between these two hypotheses was possible following the logic of Equations 3 and 4 of Chapter 2. Fairness integration did better than input integration, just as with adults. This evidence on flow of information processing in young children illustrates potential of this integration-theoretical approach.

7. Proportional Thinking: Measurement of Internal Response, \( \rho \). The response measure in these experiments was a true linear scale (benefit 2 of parallelism theorem). Even at 4+ years of age, the observable response was a faithful measure of the children’s unobservable feeling, \( R \) and \( \rho \), respectively, in the Integration Diagram. This finding contrasts sharply with Piaget’s claim that such proportional thinking does not occur until his stage of formal operations, at 10-12 years of age. This capa-
bility of functional measurement is a notable advantage for developmental analysis.

8. True Personal Measurement of Internal Stimulus Values, ψ. True measures of psychological values of each stimulus informer may also be obtained. This is simple—benefit 3 of the parallelism theorem.

Most graphs present group means. However, parallelism analysis may be applied in exactly the same way to single persons, child or adult. This idiographic capability can be useful for longitudinal study.

9. Internal World. The method of functional rating provides a faithful image of the internal world as early as age 4 years. Functional rating may also be used when no algebraic law applies, a powerful new method for analysis (see Response Generality, Chapter 6).

RECOMPENSE

Recompense for harmful acts is important for social healing. This issue, discussed in Chapter 3, has also been investigated for developmental trends using integration tasks.

Paradoxically Large Effect of Recompense. Recompense for damage may have much larger effect than the damage itself. This paradoxical result, found with adults (Chapter 3), has also been found with children. Indeed, this disproportion may be larger at younger ages.

In the study of Figure 5.4, preschoolers (left panel) and 9–year-olds (right panel) were instructed to role-play a victim some of whose stamp collection had been ruined by another child who made specified recompense—full, half, or none of replacement stamps as listed by each curve. They judged amount of deserved spanking on a graphic rating scale.

Effect of recompense is shown by the vertical spread between the three curves in Figure 5.4; effect of damage is shown by the slope of each separate curve. Recompense has far larger effects than the damage for which it is made. This paradoxical effect is larger at the younger age. Similar results were obtained in all three experiments in this article (Note 7). Similar results, although less extreme, were also obtained in four experiments with adults by Hommers and Anderson (1991).

Age Invariance. Similar results were shown by children as young as 4+ years of age in several experiments on material recompense by Hommers (see references in Hommers, 1997, and Hommers & Anderson, 1991). The extended blame law of Chapter 3, Blame = Responsibility + Consequences – Recompense, was supported at every age.
The main developmental trend was an apparently larger paradoxical effect of recompense at younger ages. This result deserves further study, especially with populations other than the middle class children common to so many developmental studies.

These results on material recompense indicate early development of adult moral concepts, much as was seen with apology. This line of inquiry is outside the horizon of popular stage theories of moral development (Hommers, 2010; see Moral Stage Theories below).

![Graph showing punishment assigned by preschoolers and 9-year-olds as a function of damage and recompense](image)

**Figure 5.4.** Punishment assigned by preschoolers (left panel) and 9-year-olds (right panel) as a function of damage (horizontal axis) and recompense (curve parameter). (After Hommers & Anderson, 1985, Experiment 3. Note 7 below.)

**Extended Blame Law.** Considerable work with children and adults has supported the basic blame law:

\[
\text{Blame} = \text{Intent} + \text{Harm}.
\]

These experiments, reported in Chapter 3, found that apology had effects similar to recompense. Taken together, these experiments indicate that apology and recompense both operate as subtractive averaging in the extended blame law:

\[
\text{Blame} = \text{Intent} + \text{Harm} - \text{Recompense (Apology)}.
\]

Similar algebra would be expected with extenuation and provocation.
COGNITIVE ALGEBRA IN INDIA

Cross-cultural generality of Information Integration Theory was demonstrated in impressive studies in India by Ramadhar Singh (see 1991, 2010, 2011) in several different substantive areas. Three studies with young school children, among the first on developmental integration theory, are summarized here. All conversations were in Hindi.

**Happiness With Praise-Blame.** In this experiment, the child strung 7 beads on a shoelace as fast as possible. Regardless of their actual performance, they were told their performance on each trial was “Very Good” or “Very Bad” and given 1 or 5 balloons. There were 16 boys between 5 and 6 years of age who received two trials in each cell of this $2 \times 2$ between person design (Singh, Sidana, & Saluja, 1978a). Happiness was rated on a 9-point scale after each trial.

Children integrated the two stimulus informers according to an adding-type rule. This was shown by parallelism in the integration graph. Both main effects were statsig whereas the interaction was not, which supports the graphical parallelism (Note 8).

**Happiness With Playgroups.** Play means a lot to children. Playgroup desirability typically depends on valuation/integration of multiple variables. How causal analysis could replace the widely used correlations was shown by Singh, Sidana, & Saluja (1978b).

Playgroups in the first experiment were represented by 3 clay dolls, individually characterized as good or bad, together with the number of toys the group had to play with. Children between 6 and 7 years of age were urged to consider each group as real and judge how much they would like to play with this group.

An adding-type rule is indicated by the near-parallelism of the four curves of Figure 5.5. A neat qualitative test in a second experiment confirmed adding and supported averaging; adding two mildly good (bad) children to a group of two very good (bad) children lowered (raised) the judged goodness of the group (see similarly Anderson & Alexander, 1971; Oden & Anderson 1971).

The authors point up need for extension to real groups. An attractive alternative would be to work toward a general-purpose battery of TV cartoon groups. Such cartoons could also be useful in moral education.

**Happiness With Parents.** Parental treatment is central in children’s lives. Some parents act as positive informers; others seem always finding
fault. Singh, Sidana, and Srivastava (1978) varied goodness of mother and father in 5 steps from very good to very bad. Children between 6 and 7 years of age judged happiness of hypothetical children for all 25 mother–father combinations. Happiness was hypothesized to be an average of goodness of mother and goodness of father.

A qualitative test like that of the previous subsection supported averaging and ruled out adding. However, their integration graph, although roughly parallel, was constricted in the middle and diverged toward both ends. This does not seem to be unequal weighting; greater weighting of more extreme levels has been found, as with the negativity and positivity effects, but such weighting would tend to produce convergence rather than the divergence. Perhaps the divergence resulted from lack of end anchors to prevent end bias.

Overall, these three early experiments from India provided timely support for the usefulness of IIT in developmental analysis. They were also promising evidence for cross-cultural generality of basic processes of information integration. Moreover, they were promising early evidence for cross-cultural generality of basic moral concepts.
ATTRIBUTION PROCESSES

Attribution is an inference, often about cause of some action, but also about some characteristic of an actor. In Blame = Intent + Harm, for example, valuation of Intent by the blamer generally involves some inference about the blamee. This attribution may be extended beyond the act in question to blamee’s general personality, such as thoughtlessness.

Experimental Analysis. A more complex class of attributions appeared in the experiment of Figure 5.6 based on Clifford Butzin’s (1978) PhD thesis. Participant children were told how much money an actor child had been promised for helping his mother (curve parameter) and how much help the actor child had actually given (listed on horizontal). They judged goodness of the actor child.

![Figure 5.6](image)

**Figure 5.6.** Development of causal attribution schema. Children of three age groups judge goodness of story child as a function of how much he helped his mother (horizontal axis) and how much money his mother had promised him for helping (curve parameter). (After Butzin, 1978; see Butzin & Dozier, 1986.)

The three successive panels of Figure 5.6 show a notable developmental trend. Judged goodness of the actor child is a direct function of the promised money for 5–year-olds, null function for 7–year olds, and inverse function for 9–year-olds.

The data patterns for all three ages may be interpreted in terms of valuation of Money in the generalized attribution schema

\[
\text{Goodness} = \text{Work} \times \text{Money}
\]

The 9–year-olds exhibit adult cognition for they valuate Money negatively: the more the promised Money, the less the actor’s Goodness. This valuation process involves attribution about actor’s motivations.
The 5–year-olds, in sharp contrast, valuate Money positively relative to the operative goal: the more the promised Money, the greater the actor’s Goodness. This rationale seems simple: those who do better get more reward; so getting more signifies being better.

A longitudinal extension was studied by Dozier and Butzin (1988), who presented two tasks that required inverse compensation in the fall and again in the spring. The social task used just the money variable of Figure 5.6. The physical task had comparable structure but with a simple physical standard of correctness. The social task was never solved before the physical task (see also Anderson & Wilkening, 1991, p. 30).

These results, as Dozier and Butzin emphasize, imply that development of concepts or abilities cannot be studied with just one or two tasks. A battery tasks is essential.

**Attribution Theory.** Attribution processes pervade thought and action. They have been much studied in social psychology and also in judgment–decision. Much of this work, however, suffers from reliance on makeshift measurement. Functional measurement has resolved some of these problems and should be similarly useful for studying attributions in the moral realm (see Anderson, 1991a, pp. 58-73, 1996a, pp. 157-168, 2008, pp. 293-301; Anderson & Wilkening, 1991, pp. 24-30).

**MORAL STAGE THEORIES**

The dominant conceptual framework in psychological approaches to morality has been the stage theory of Kohlberg (Colby, Kohlberg, Gibbs, & Lieberman, 1983; Modgil & Modgil, 1986; Rest, 1983). Moral development is postulated to be a sequence of distinct cognitive stages that begin with morality of obedience to authority and culminate in the principled morality of rational, equalitarian cooperation. Each successive stage develops by qualitative reorganization of the present stage to form a structured whole that governs all moral cognition. A person’s stage is diagnosed by complex coding of verbal justifications of yes-no choices in standard moral dilemmas, most famously whether Heinz should steal the drug that might save the life of his wife (Note 9).

Kohlberg’s theory suffers two problems: *narrowness* and *invalidity*. Stage theory has no relevance to much of morality as detailed in the next several sections. Even within its own domain, stage theory rests on face validity that has failed strong experimental tests cited below.
MORAL DEVELOPMENT

The stage theories do not apply below about 12 years of age. Younger persons have little appreciation of the standard dilemmas and lack verbal facility to justify any choice. Although stage theories claim to be developmental theories, they are blind to moral development across preteen years, illustrated with fairness and blame in Chapters 2, 3, and 5. Preteen influences of family, schools, and peers are completely neglected in stage theory.

MORAL NARROWNESS

Stage theory is narrow. It is limited to justice and ignores the moral domain of beneficence (see e.g., Eisenberg, 1995, p. 401; Frankena, 1953; Gilligan, 1982). Moreover, basic moral concepts such as recompense, although part of justice, are not recognized in stage theory (see below).

MORAL VALUES

Moral values are central in moral thought and action. But moral values lie outside stage theory. This exclusion stems from Kohlberg’s principled elimination of content from stage analysis. Moral theory without moral values is impossible.

INTEGRATION

Kohlberg recognizes the importance of integration. He treats justice as “balancing or weighing of conflicting claims” (Colby, et al., p. 7)—this is integration. But nothing is said about how this is done. Indeed, Kohlberg’s theory is inherently unable to study integration—it ignores values, which are what are integrated.

SOCIAL COGNITION

Social cognition is foreign to moral stage theory. The moral and social–cognitive domains are considered fundamentally distinct (Colby, et al., p. 6). To many developmental and social psychologists, however, moral cognition is social cognition.

Moral attitudes underlie most moral thought and action. But moral attitudes embody value and so lie outside stage theory.
VALIDITY

Do the verbal protocols of stage theory give valid evidence about the moral cognition that underlies the dilemma choice? Or are these verbalizations inextricably confounded with post hoc rationalization, as various writers have suggested? Stage theories merely assume validity; they give slight evidence about underlying cognitive processes.

Invalidity of verbal reports had been revealed in the initial studies of IIT. In the standard personality adjective task, people give plausible, detailed reports about interactions between adjective meanings as they judge the person on likableness. If valid, these reports would predict specific deviations from parallelism in their integration graphs. The many findings of meaning invariance (benefit 4 of the parallelism theorem; Note 6 of Chapter 1) showed that these verbal reports were invalid. Treacherousness of verbal reports also seems to have vitiates Damon’s (1977) work on fair sharing (Note 10).

REST’S STAGE THEORY

Rest (1983; Narváez & Rest, 1995) sought to simplify Kohlberg’s stage theory and make it more flexible. Rest’s Defining Issues Test is much simpler than the coding complexities of Kohlberg’s verbal protocols. But most of the foregoing criticisms also undercut Rest’s theory. The 12-year age limit still applies and moral considerations are still considered qualitatively different from social considerations.

Rest recognizes the importance of integration. Indeed, he claims that the major contribution of stage theory has been to provide “a framework for prioritizing and integrating considerations to formulate what one’s rights and duties are in a particular situation” (1983, p. 563). Neither then nor later, however, does Rest give the slightest indication about how such integration is accomplished. Rest’s theory, like Kohlberg’s, is roadblocked by this central problem of moral cognition.

ITT COMPARED WITH STAGE THEORY

Stage theory has no place for valuation, no means to handle integration. But valuation and integration are both basic in moral cognition. An effective alternative is available with the integration laws; they handle valuation as well as integration. Of special importance, these laws operate during preteen years, a basic period of moral development, but a period that is systematically ignored in the stage theories. These same laws,
moreover, operate throughout life, a base to study moral development from infancy to old age.

STAGE THEORY FAILS STRONG EXPERIMENTAL TESTS

Strong tests of stage theory were obtained with ingenious designs by Martin Kaplan and by Wilfried Hommers. Both showed how integration theory could yield penetrating tests of basic stage assumptions.

Kaplan’s Test of Stage Theory. Kaplan (1989) showed how to separate moral reasoning from moral value, the latter of which is excluded from stage theory. This reasoning–value distinction may be represented by the weight–value distinction of the averaging law. Participants classified as preconventional, conventional, or postconventional with Rest’s Defining Issues Test were presented dilemmas that represented three stages (preconventional, conventional, and postconventional), each with varied probability in an integration design. They judged how strongly the protagonist should choose the normative, more moral action.

Results disagreed sharply with stage theory. Persons at all three stages showed parallel curves as a function of probability of occurrence of each preconventional consideration. This contradicts stage theory, which predicts nonparallelism (Anderson, 1991c, pp. l73ff).

To see this prediction, note that preconventional persons should place high importance weight on any given preconventional consideration; hence their response should change substantially as its probability increases. Postconventional persons, in contrast, should place low weight on this preconventional consideration; hence their response should change little as its probability increases. These two response curves should thus be quite nonparallel—contrary to the data. Similar parallelism held for persons at all three stages and for all three stage dilemmas.

Hommers’ Tests of Stage Theory. Hommers’ (1997) thought paradigm used the Heinz dilemma but stated that Heinz had already stolen the drug that might save his wife’s life. Participants were told of Heinz’ thoughts during his theft; different thoughts represented different stages. Thoughts about risk of punishment, for example, represented Kohlberg’s stage 1; thoughts about danger to social structure from law breaking represented Kohlberg’s stage 4. Each was presented at low and high levels in an integration design. Participants judged badness of Heinz’ theft, taking account of his thoughts.

Stage theory makes a clear prediction. Participants should place high importance weight on a thought from their own moral stage; that stage
variable will have a large effect on their judgment. And they should place low importance weight on a thought from a different moral stage; that stage variable will have a small effect on their judgments.

Correlations between main effects of any two stages will thus be negative—if Kohlberg’s theory is correct. Instead, these stage correlations were positive (see similarly Hommers, 2012).

Furthermore, factor analysis will reveal each stage as a separate factor if Kohlberg’s theory is correct. Instead, there was only a single factor. The stages were not distinct—they were homogeneous.

Neat validational support came from Hommers’ inclusion of recompense information representing Heinz’ thoughts about making anonymous payments to the druggist to repay his theft. This was revealed as a separate factor, distinct from the Kohlberg factor, as it should since recompense is one of many variables that have no place in stage theory.

Very similar results were obtained with German and Korean children 8 to 12 years of age (Hommers & Lee, 2010). The three Kohlbergian stages were again positively correlated. Again they yielded a single factor. Again recompense was a distinct factor.

Hommers’ analysis illustrates a powerful method for testing the stage theories. Stage theorists who question his conclusions can apply his method and that of Kaplan themselves.

**Lesson From History.** Has the immense amount of work on stage theory accomplished anything at all? This work was grounded on two premises: (1) that moral development proceeds upward by qualitatively distinct stages; and (2) that these stages could be revealed from verbal rationales for choices in moral dilemmas. Both premises failed the strong tests by Kaplan (1989) and by Hommers (1997) cited above.

At bottom, the choice/verbal rationale method, on which stage theory was grounded, is severely inadequate and misleading. Much moral cognition is not verbalizable. And much verbalization is invalid. Such invalidity had already been seen in the foregoing tests of Piaget’s theory. Much earnest, dedicated effort has been wasted. Stage theory illustrates the importance of choice of research problem (see *Achievement*, pp. 365-373 in Anderson, 2008).

One approach to unifying IIT and stage theory would present an act together with a list of reasons for and against that act. Participants would rate meaningfulness of each reason as well as personal value/weight. Such metric judgments represent rationalized moral cognitions with minimal demands on verbal expressiveness. This approach can be extended to study the verbal rationales (Hommers, 2011).
The list of reasons could include those based on the stage principles. A broader view is needed, however, in which the acts and reasons represent everyday moral issues including beneficence, self-interest, and recompense that seem outside the scope of stage theories. Integration designs of reasons would allow deeper analysis.

**Respect Phenomena.** Respect phenomena should be the first principle of moral science. The stage theories failed because they sought to force an a priori framework on the phenomena. This a priori framework led to ignorality of moral development that occurs before 12 years of age. It led to ignorality of basic moral phenomena, such as apology, recompense, and beneficence. The problem of integration was sloughed off. Above all, moral values were officially out of bounds.

Integration theory gives first place to phenomena. Had the stage theories been correct, the cited integration experiments would have provided strong support. Instead, a very different theoretical outlook has emerged—mathematical laws with demonstrated social–moral validity (Note 11).

Respect for phenomena also underlies the position of Krebs and Denton (2005), who argue for replacing stage theory with a pragmatic approach based on morality of everyday life. Just such a pragmatic approach underlies the inductive framework of Information Integration Theory. Morality of everyday life was the focus of the early studies of deserving and of blame by Butzin, Hommers, Leon, Singh, and Surber that were cited in the text (see Chapters 2 and 3). Besides demonstrating mathematical laws of moral judgment, IIT has gone further to help unify the moral realm with the rest of psychological science (see Chapters 7 and 8).

The stage principles have attractive face relevance to social morality. They deserve to be unified with social cognition and moral development (Anderson, 1996a, pp. 207f). Such unification was the goal of Kaplan and of Hommers. Although their results disagreed with stage theory, they were definite. Stage theories need liberation to become cognizant of moral–cognitive phenomena, moral values especially (Note 12).

Developmental broadening of knowledge systems about social–moral–legal systems is an important class of moral phenomena. Young children need to develop understanding of context variables as illustrated by their perplexity when first confronted with white lies. This broadening of social–moral knowledge systems continues during elementary school, secondary school, and adult life. Mapping this broadening is an
important goal for developmental psychology. Amplifying this broadening should be a main goal of social–moral education (Note 13).

**MORAL DEVELOPMENT: LOOKING FORWARD**

The influence of childhood experience on moral thought and action has been studied by many developmentalists and much has been learned. Their work has also raised many issues that deserve further study. Two major classes of issues—cognitive theory and societal betterment—are discussed briefly here.

The main theme in these comments is the value and the need for a framework, both conceptual and empirical, based on facts and laws of information integration. Previous approaches lacked effective capabilities to study integration of moral variables. Seeking progress, they adopted other methods, sometimes useful, sometimes blind alleys. One useful direction is available with Information Integration Theory.

**COGNITIVE THEORY**

How do moral attitudes develop? How do moral attitudes and values function? What is the structure of moral knowledge systems? What is the developmental course of capabilities with judgment–decision processes involved in moral thought and action? Does functional theory require a paradigm shift in developmental learning theory?

These questions argue for a unified approach to moral development. Person cognition, attitudes, judgment–decision, and learning/memory are all important in moral thought and action. These areas have had little interaction with one another, even less with morality (Chapter 8).

Theoretical unification is available with the psychological integration laws; they have done well in these and other areas. These laws show nomothetic generality of integration processes across diverse areas; they allow personal, idiographic values which are necessary for psychological theory. These laws have substantial age-invariance which is useful for developmental analysis.

Substantive unification may be found in person cognition. Most studies of moral issues in this and previous chapters involve person cognition. Thus, praise and blame are typically moral judgments about another person. Much unfairness is a moral judgment about self and other persons.

Person cognition functions in many other social areas, attitudes most prominently. The integration laws revived functional theory of attitudes
together with a basic conceptual shift to person-centered theory (see *Functional Theory of Attitudes*, Chapter 8). Person cognition is the heart of family life, a basic moral domain.

**IMPROVING PERSONS AND SOCIETY**

Family life is basic for improving persons and society. The family is a major source of moral attitudes about self, self-respect, and respect for others, about keeping one’s word, about obligation, duty, honesty, deceit, and so on. Also, of course, family life is a source of happiness/unhappiness throughout life.

Much improvement is desirable, as all will agree. But social inertia is high, hard to overcome. One obstacle is that many parents have low socio–moral levels. Even parents with good intentions generally lack training to instill morality in their children. Their children thus suffer a haphazard beginning. Many families, moreover, live in crowded neighborhoods without playgrounds or similar forms of recreation. Street corner learning will hardly improve children’s moral level.

Schools are a second base for improving the moral level of society. Courses in history and civics have basic relevance, but moral considerations should be infused into every school subject. Further discussion of this basic societal problem is given in *Education* in Chapter 7.

**NOTES**

*Note 1.* Homage to Piaget. Piaget was the first developmental psychologist to focus squarely on stimulus integration. He recognized that this required measurement capability, to which he gave detailed attention in his treatment of conservation. This meritorious concern was undone by severe logical confusion as he tried to force the data into his theoretical preconceptions (Note 2, p. 37, in Anderson & Wilkening, 1991).

Nevertheless, Piaget is one of the great psychologists. He went directly to the children with many clever tasks of naive physics. This focus on the phenomena led to fascinating empirical findings, nonconservation most famously (but see next three notes), that earned him a high place in psychology.

*Note 2a.* Apparent nonconservation of quantity by children up to 5-6 years of age may be dramatically demonstrated by presenting two identical glasses filled equally with liquid. When asked which glass has more or are both the same, children say both the same.

Now, while the child watches, the liquid from one glass is poured into a wider glass so the liquid level is lower. Now the child says the wider glass has less liquid. This may be solidified by pouring the liquid from the wider glass into a narrower glass in which case the child says the narrower glass has more liquid. At this age, it would seem, children lack the idea that quantity is conserved.
But Piaget’s collateral conclusion that young children cannot integrate (height and diameter of a glass) is incorrect. This mistake became clear as soon as integration methodology was applied in place of Piaget’s choice methodology. This work also led to a new theory of how conservation develops (Anderson, 1996a, pp. 200-257, 257-261).

**Note 2b.** Piaget’s demonstration of nonconservation in young children may be peculiar to liquids in glasses. Although Anderson and Cuneo (1978) replicated Piaget’s Height-only rule for liquids in glasses by 5-6-year-olds, these same children integrated both height and width in judging rectangular cookies—following a Height + Width rule. This inconsistency between non-integration for liquids in glasses and integration for area of rectangles was initially thought to be some shortcoming in our experimental procedure. But seven follow-up experiments indicated that Piaget’s result was peculiar to contents of glasses.

This Height-only rule for liquids in glasses was interpreted to result from drinking from glasses and cups in everyday life. For children especially, liquid height is a cue to avoid dribbling on yourself.

This interpretation was supported by judgments of amount of wax in wax cylinders. Inside glasses, these cylinders were judged by a Height-only rule. But outside glasses they were judged by an additive, Height + Width rule (Anderson, 1996a, pp. 251-257).

**Note 2c.** A general-purpose adding-type rule was also implicated by these studies of conservation (Anderson & Cuneo, 1978). This rule first appeared in finding that young children judge area of rectangles by a Height + Width rule. This adding-type rule has also appeared in other tasks. It is considered to have an innate base.

Good evidence for this general purpose adding-type rule was given in Cuneo’s 1982 PhD thesis on judgments of numerosity in linear arrays of similar objects varied in length and density. Judgments followed a Length + Density rule except when the total number was small; in this case, subitizing yielded an apparent Length × Density rule. Her results also supported linearity of the method of functional rating (Anderson, 1996a, p. 97).

**Note 3.** Parallel integration graphs for a group can result if some participants center on one variable, others on the other. This possibility may be ruled out with single person analysis, as in Leon (1980). Alternatively, centration implies that a High and Low combination will yield a bimodal distribution (Anderson & Cuneo, 1978).

**Note 4.** Siegler (e.g., 1978, 1998) attempted to improve Piaget’s method by including a group of choices that would identify children’s knowledge without requiring verbalization. Unfortunately, Siegler’s method systematically misrepresents children’s knowledge (Wilkening & Anderson, 1982, 1991, pp. 64-71, 75-77). As Wilkening (2007) observes, how this myth that young children cannot integrate persists in the face of all the evidence is hard to understand.

**Note 5.** The weak barreling of the two left graphs of Figure 5.3 suggests that some children may have followed a subtraction rule. Single child experiments with not too few replications would be needed to study this question since the amount of nonparallelism is theoretically small. Use of practice trials incongenial to the subtraction rule may be desirable (see Subtraction Model in Chapter 2).

**Note 6.** Integrational capacity. Excellent integrational capacity of Indian school children from 4 to 10 years was found by Singh and Singh (1994). Virtually every child showed
statsig effects for all 4 variables, even at 4+ years of age. This high integrational capacity may have resulted because Singh and Singh required the child to reproduce the given information in the given order before they predicted exam performance.

Integrational capacity may be unlimited in principle in tasks that allow each successive stimulus informer to be integrated into a single cumulative response. Each successive trial requires only memory of the previous integrated response to be integrated with the present informer. The previous integrated response implicitly includes effects of all previous trials even with no separate memory of previous informers (e.g., Figure 8.2).

An important issue in integrational capacity concerns written or spoken material. These require the participant to identify stimulus informers to be valuated/integrated. This issue appeared with the witness testimony in the Hoag bigamy trial, as with the testimony of Catherine Secor quoted in Chapter 4, and in studies of president attitudes, as with the two biographical paragraphs on Theodore Roosevelt listed under Batteries of Stimulus Materials in Chapter 6. This problem was finessed with Cognitive Unitization. More detailed analysis is desirable by constructing stimulus materials using integration designs.

It may be repeated that the mother–son similarity of integration rules reported by Leon (1984) was not supported in the careful PhD thesis of Arlene Young (1990; see similarly p. 211 in Anderson, 1996a, pp. 220, 226ff, and 240 in Anderson, 2008).

However, developmental similarity of attitudes among family members may be amenable to analysis with the relative range index of Chapter 6. Wife–husband similarity was measured with this index by Armstrong (1984) (see pp. 214-218 in Family Life and Personal Design, Chapter 6 of Anderson, 1991c).

Note 7. The small effect of damage for the preschoolers in Figure 5.4 is puzzling. Experimental procedure was careful, with an experienced female experimenter. The children were instructed about stamp collecting using an introductory guide from the U. S. post office. Even with the 9–year-olds, damage had little effect with full recompense. The stamp scenario was developed to allow direct comparison of recompense and damage. However, replication with more familiar kinds of damage and with some other response than spanking are certainly desirable.

Note 8. A fascinating early study of praise–blame reinforcement with children by Thompson and Hunnicut (1944) is discussed in Empirical Direction, pp. 146f.

Note 9. Stage conceptions of development can be extremely attractive. They promise simple order underneath surface complexity. But each such promise imposes a framework on investigation that may yield wasted work if the promise fails. Two failures of Piagetian theory were noted above (see Figure 5.2).

Both of Piaget’s claims have also been repeatedly disproved with naïve physics, the prime concern of Piaget’s theory and an area in which several workers have applied IIT. Here it suffices to note that young children show the same integration laws in both areas (e.g., Anderson, 1980, 1983; Cuneo, 1982; Schlottmann, 2000; Surber, 1985b; Wilkening, 1982; Wilkening & Anderson, 1982, 1991).

Note 10. The treacherousness of verbal justification of moral choice may be illustrated with the impressively careful work on fair sharing by Damon (1977), who used Piaget’s integration choice methodology and relied on children’s verbalization. Damon’s claims disagree totally with the integration experiments of Figure 5.3.
Damon’s level 1-A, predominant at age 5, specifies equal shares for all. This is “so overwhelmingly consistent that 1-A reasoning often takes on a quality of inflexibility and absolutism . . . and no mitigating circumstances or reasons are allowed or recognized” (pp. 81f). In absolute contrast, the 4– and 5–year-olds represented in Figure 5.3 not only shared unequally but followed an algebraic law.

The “new notion of need” (p. 84) does not enter until age 8, at Damon’s level 2. In absolute contrast, 4– and 5–year-olds in the cited integration experiments were not only sensitive to need but integrated this with deed (see further Moral–Social Development, Chapter 5, pp. 166f, in Anderson, 1991c).

This issue was also pursued by Moore, Hembree, and Enright (1983) in their ingenious analysis of stage theory. They point out (p. 199) that the experiment of Figure 5.3 above provides “evidence that an understanding of the reward allocation principles that are designated as the highest stage in Damon’s theory may occur quite early.”

Damon’s work was done very carefully, yet it yielded seriously incorrect conclusions about children’s moral sense. The main outcome was demonstration of the flaws in Piaget’s integration choice methodology noted above.

An about-face appears in Damon’s (1988) later views on equality and need. Although Damon presents no evidence for his about-face, his later views are quite consistent with those in Figure 5.3 and of Moore, et al. (1983) just cited.

**Note 11.** *Behavior-Analytic Approach.* Respect for phenomena is shown by Peláez–Nogueras and Gewirtz (1995) and Gewirtz and Peláez–Nogueras (1992), who take a “behavior-analytic” approach to moral development, with emphasis on observable action and denial of unobservables. But this behaviorist emphasis is blind to the first two operations, *valuation* and *integration*, of the Integration Diagram, for these are unobservable. The psychological laws can make unobservables part of psychological science.

This need for unobservables may be illustrated with Herrnstein’s behavioral matching law, that the relative rate of observed response equals its relative rate of observed reinforcement. To take account of different reinforcement qualities, such as food preferences, however, requires allowance for unobservable psychological values. Some writers argued that such a psychological matching law was tautological, that values could always be found to make it hold—and that such tautology affirmed the necessity of behaviorist theory. This argument is incorrect (see *The Matching Law* in Chapter 6).

Functional measurement analysis can liberate behaviorism to study the internal world (see *The Two Worlds: Internal and External* in Chapter 7).

**Note 12.** Stage theories have also been criticized by Haidt (e.g., 2001), but his intuitionist argument disagrees with much previous work on Information Integration Theory. Haidt argued that people cannot give satisfactory verbal accounts of how they make a moral judgment—and hence that these judgments are “intuitive.” Such lack of satisfactory verbal accounts had already been shown in repeated disproofs of the change-of-meaning hypothesis in person cognition (Anderson, 1981a; see also Note 6 in Chapter 1).

But this work also revealed that these judgments were governed by mathematical laws, not “intuition.” These same mathematical laws are prominent in moral cognition as shown in this and previous chapters (see further *Intuition* in Chapter 7).

**Note 13.** The reasoning protocols studied in stage theory are important aspects of cognition. Suggestions for unification are in Anderson (1991i, pp. 171ff; 1996a, pp. 207f).
Chapter 6 Preface: METHODS, MODELS, AND MEASUREMENT

Dreams of mathematical laws in psychology have persisted for well over a century in the fields of perception and psychophysics. In modern times, mathematical models have been prominent in judgment–decision and in learning. Mathematical models have also been proposed in several areas of social psychology, including integration models for attitudes (Chapter 7) and equity models in deserving theory (Chapter 2).

These dreams of mathematical law could not be actualized, however, without true psychological measurement (see Parallelism Theorem in Chapter 1). Establishing true psychological measurement depended on several issues of method. Foremost was the issue of linear response scale (Premise 2 of the parallelism theorem). Fortunately, this was achieved with simple precautions (see Methods of Information Integration Theory below). These simple methods revealed empirical integration laws in almost every area of human psychology.

These empirical laws, established by many investigators in many countries, are the foundation of psychological measurement theory.

Certain popular pitfalls invalidate not a few published articles. Among these are comparing relative importance of different variables, meaningfulness of “statistical interaction,” and illusion of “statistical control.” How to foresee and avoid such pitfalls is discussed under Faulty Methods and Measurement Pitfalls.

Methodological issues that arise in planning and interpreting experiments are also discussed, especially extrastatistical inference. These comments are modest contributions to important issues that deserve systematic study in every substantive field of psychology.
Empirical data, grounded in empirical conditions and given meaning within one’s conceptual framework, are the ground of science. The psychological laws of information integration, applied to moral cognition in this book, rest on such ground. This chapter summarizes a number of issues of method in this theoretical development.

Some issues are technical, as with the “illusion of statistical control” and with understanding how (and how not) to test an algebraic model. Some are largely empirical, as with pilot work and writing instructions. Most are empirical—conceptual blends: assessing generality of results, pitfalls of confounding, and the treacherous problem of comparing importance of different variables. Most basic are integration laws that make possible true psychological measurement.

EXPERIMENTAL METHOD

Clean data are invaluable in science (Note 0). The time spent in gathering data in typical experiments is only a fraction of the total time to decide what issue to study, read relevant literature, formulate one’s questions or hypotheses, develop experimental procedure and design through successive pilot stages, analyze and interpret the data, relate your work to the literature, and write a report for publication. The worth of all this work rests on the worth of your data—and the worth of your experimental design.

Problems of experimental method have been discussed elsewhere (Anderson, 1974a,b,c, 1981a, 1982, 1996a, 2001, 2002, 2008). Some important issues are noted in this chapter. These discussions owe much to previous workers in many areas. They are presented as contributions to continuing development of scientific method that need consideration from other perspectives, especially with respect to the many practical problems of social—moral betterment of person and society.
EXTRASTATISTICAL INFERENCE

Extrastatistical inference, and statistical inference, are twin pillars of science. Techniques of statistical inference can help control variables, avoid certain confounds, increase reliability of results, and assess reliability, as with confidence intervals. Statistical inference is essential to provide reasonable confidence that one has a real result—within the specific empirical situation (see Random Assignment below).

Statistical inference is severely limited. Except with random sampling from some population, which is rare, statistical inference applies only to the specific samples at hand: task, stimulus materials, and participants. But nearly all samples are handy samples; random assignment allows statistical inference only to the handy sample.

Extrastatistical inference is essential to generalize beyond one’s specific situation. All who write articles for publication hope and believe their results will have some generality beyond their handy sample of participants and specific experimental conditions. This belief rests squarely on extrastatistical inference based on empirical understanding.

Extrastatistical inference has paramount importance. This fact is largely neglected in standard statistics texts; they give the impression that significance tests are be-all and end-all. Extrastatistical inference is hard to discuss, of course, since much depends on empirical, situation-specific understanding. Further discussion of extrastatistical inference is given in Empirical Direction in Design and Analysis (Anderson, 2001), hereafter referred to as Empirical Direction.

INSTRUCTIONS

Experiments with humans usually rely on instructions to define the task, especially the meaning of the response. Workers in the field of tests and measurements have amply documented how easily people can misunderstand instructions. Pilot work should aim to detect misunderstandings and eliminate them. One help is to have participants summarize their understanding of the task in their own words (see also next section). This may be supplemented by directed, post-experimental questioning, especially in the pilot work, about how they answered specific questions. Two examples are cited in Anderson (2008, pp. 395f).

Instructions are especially important in moral psychology. In studies of forgiveness, as one example, different investigators define forgiveness in different ways. Comparing results of different investigators is thus uncertain. Few present evidence on what their participants had in mind.
when they made their judgments. One writer calls this a “pernicious”
problem, a fitting adjective (see *Algebra of Forgiveness*, Chapter 7).
This problem of psychological meaning of to-be-published data requires
special attention in the planning and pilot stages of investigation.

PILOT WORK

Pilot work is important for clean data. Pilot work should pretest the ex-
perimental procedure to uncover shortcomings and seek improvements.
Sensitive post-task interviewing should seek to understand the exper-
imental task from each participant’s view. Too often, investigators as-
sume that common words, such as forgiveness and gratitude (Chapter 7)
have common meaning.

MENTAL SCHEMAS

Mental schemas underlie each operation in the Integration Diagram. They
deserve careful attention in the instruction period. The valuation
operation is most important, of course, for it determines the meaning of
the data. Also, a mental schema for integration must be constructed by
each participant to embody their understanding of the task (see *Integration Processes*, pp. 64-69, Anderson, 1996a).

One example comes from judgments of each of performance, moti-
vation, and ability, given levels of the other two. Empirically,

\[
\begin{align*}
\text{Performance} &= \text{Motivation} \times \text{Ability};
\text{Motivation} &= \text{Performance} - \text{Ability};
\text{Ability} &= \text{Performance} - \text{Motivation}.
\end{align*}
\]

The pilot work had revealed that some participants followed a sum-
mative schema for the last two judgments, in line with the natural corre-
lation between ability and motivation, failing to realize the inverse con-
straint imposed by given Performance. This was resolved by including in
the instructions *choices* between cases with equal Performance but
unequal Ability or Motivation.

CLEAN DATA: ONE PERSON AT A TIME

Testing people in groups is an invitation to unclean data. Their attention
is poorly controlled; misunderstandings or carelessness are almost inevi-
table. Some prominent mistaken claims have resulted from group experiments (e.g., Anderson, 1996b). Group data can be useful for pilot work but have limited place in serious science.

It may be feasible to run two participants at a time, which would cut running time by 50%. Three at a time, if warrantable, would yield an additional savings of only 17%.

Group settings are natural in some situations, of course, as in studies of classroom education or in group discussion of moral issues. In such cases, however, each group may correspond to only a single unit (df) in the statistical analysis (see Section 15.1 in Empirical Direction).

The Internet offers cheap data but quality control is lacking and response rate is low (Van Acker, Theuns, Hofmans, & Mairesse, 2007). It is hard to put much faith in such data except as pilot work. Buttressing such data with controlled experiments could provide faith.

GENERALITY

Generality of results is always a concern. Any one investigation is narrowly limited to specific conditions (see Extrastatistical Inference above). We presume our results will have some generality. We seek to validate this presumption through our experimental procedure.

Random Assignment. Handy samples of participants are usual in experimental analysis. Randomness, the essential requirement for statistical inference, may be obtained with Fisher’s invention of randomly assigning participants to experimental conditions. The blundering of early studies of the Head Start program, criticized by Campbell and Boruch (1975), began with failure to use random assignment.

Random assignment allows statistical inference only to the handy sample—a statsig result gives confidence that it was not an accident of which participants were assigned to experimental conditions. To go beyond our handy sample, as we desire, rests entirely on extrastatistical inference as discussed above.

Random assignment is not possible with variables such as level of education or socioeconomic status. Some investigators attempt to match groups on some relevant variable, often falling into the “black pit of the regression artifact” (Empirical Direction, p. 582).

Some investigators apply “statistical control” to deal with observational data. These statistical procedures are prone to deadly artifacts (see Illusion of “Statistical Control” below). Some uncontrolled variables, however, may be usefully incorporated in the design as a stratified varia-
ble with random assignment within each stratum, and included in the statistical analysis. Of course, this still allows only correlational conclusions for the stratified variable (Empirical Direction, Section 14.2.4).

**Stimulus Samples.** Running an experiment with a single set of stimulus materials is thin ice design. Results may not generalize to other stimulus materials. It is often advisable, therefore, to use more than a single set of stimulus materials to assess this aspect of generality (Empirical Direction, Section 15.2).

Stimulus generality has special importance in moral cognition. Verdi’s study of conflict of obligation in Chapter 7 used three kinds of obligation to assess generality of the adding-type law. Other examples include my 1962 integration study of person cognition, which used six sets of personality trait adjectives, Armstrong’s studies of wife–husband interaction (Figure 3.2), and blame judgments of criminals by Przygotski and Mullet (1993; see Chapter 4).

**Multiple Variables.** Multiple variables are the norm in everyday life. The importance of multiple variables was emphasized by Aronson, Wilson, and Brewer (1998, p. 135), who conclude their handbook chapter, *Experimentation in Social Psychology*, by calling for a new synthesis:

> assessing the relative importance of several variables, which all influence an aspect of multiply-determined behavior, rather than on testing to see if a particular variable has a ‘significant’ impact.

Just such synthesis of multiple variables had been the concern of workers on Information Integration Theory over the previous 30-odd years. Their work had shown that “multiply-determined behavior” obeys mathematical laws in most areas of psychology, from social–personality to learning/memory. In particular, “relative importance,” usually assessed with invalid methods, had been given the conceptual clarification that it needs (see Measurement Pitfalls and Measuring Importance below) together with valid methods to measure importance.

**TWO KINDS OF VALIDITY: PROCESS AND OUTCOME**

Outcome validity and process validity are both important but often incompatible in any one investigation. *Outcome validity* is mainly concerned with observable outcomes; *process validity* is mainly concerned with underlying process.

An experiment to test whether showing audience children a film of actor children’s group discussion of bullying transferred to playground
behavior of the audience children would be mainly concerned with outcome validity. Success may be ample reward even though it may say little about operative cognitive processes, which could be important for improving the discussion procedure.

In legal psychology, to take a second example, many workers have assumed that customary laboratory experiments could produce results relevant to real jury deliberation. Much of this work has little social relevance. To seek social outcome relevance, psychologists need to work within the legal system, emphasized by Ebbesen and Konečni in their experimental–field studies of bail setting and sentencing (see Chapter 4; see similarly Gerbasi, Zuckerman, & Reis, 1977, on mock juries).

Process validity is concerned with underlying cognitive processes. The blame law of Chapter 3 is one example as are the associated studies of apology and extenuation. These integration processes are basic cognitive capabilities with substantial generality in everyday judgment.

Unfortunately, outcome validity and process validity often require rather different experimental design. Aiming for both may compromise both. Social attitude research gives instructive examples (e.g., Anderson, 2008). Further discussion is given in Validity, pages 8-16 in Empirical Direction.

PREDICTION AND UNDERSTANDING

Algebraic models may be used for two purposes—prediction and understanding. Prediction and understanding are both important but often involve quite different design and analysis. Methods useful for one purpose can be a mistake for the other.

Prediction. Prediction usually concerns applied situations in which there is an accuracy criterion of success, as with college admissions and job suitability. The most common prediction model is multiple linear regression which has done remarkably well in many situations using rough and ready values of predictor variables. Indeed, such approaches typically outperform expert judgment at much less cost (e.g., Grove & Meehl, 1996; Swets, Dawes, & Monahan, 2000).

But for understanding cognitive processes that underlie behavior, such prediction models are generally poor and misleading. Although high correlations are generally quite satisfactory for prediction, they may seriously misrepresent underlying process. Among the examples discussed under Weak Inference, Section 4.1 in Anderson (1982), additive
models gave correlations of .99 for multiplicative data and .98 for data with an anti-additive crossover.

Weak inference with linear models (Anderson & Shanteau 1977, p. 1133) analyzed published articles from three popular areas in research on judgment–decision:

In each of these examples from decision theory, high correlations provided initially compelling support for the model in question. This led to further, often intensive, research on the psychological processes that were presumed to underlie these models. . . . these correlations did more to obscure than to reveal underlying process. As a consequence, much labor came to nothing.

To my knowledge, no one has disputed this analysis. Yet weak inference remains common. Prediction has high importance but understanding requires a different framework, both conceptual and methodological.

Understanding. A model of behavior conveys understanding when it reveals cognitive processes that underlie that behavior. For an algebraic model, this generally requires measurement of the psychological values of the variables that were functional in the behavior.

The parallelism theorem of Chapter 1 provided a base for such functional measurement. Observed parallelism supports the validity of the response measure by virtue of benefit 2. True measures of the stimulus variables are similarly given by benefit 3.

Matters were by no means so simple. The opposite effects phenomenon, for example, raised doubt that any algebraic model could account for the data. Twelve such theoretical issues had to be resolved, some of which are discussed in Chapter 1. Fortunately, these and other difficulties were nicely resolved with the averaging model, which has done well in most areas of human psychology, as in the initial empirical chapters.

Overall, these studies by many dedicated investigators have revealed a general cognitive algebra. This cognitive algebra can help with further elucidation of cognitive process.

OBSERVATION AND EXPERIMENT

Observation and experiment are the two basic sources of data. Observation is arguably more basic as the primary source of meaning of what is measured. Meaning of some concepts may seem sufficiently clear from everyday communication, as with heaviness or warmth, perhaps even with fairness or blame. Many concepts, however, may have multiple qualities or dimensions that deserve separate analysis, as with gratitude, forgiveness, or attitudes toward women. Other concepts such as personal well-being and marriage satisfaction present greater difficulties of defini-
tion (see also *Response Quality* and *Profile Measures* at the end of this chapter).

Workers in tests and measurements have contributed invaluable knowledge about wording of questions and problems of reliability and validity. For constructing tests, factor analysis offers one means to deal with complex concepts that can be very useful for prediction.

The Achilles heel of observational data, of course, is causal analysis. The clinical psychologist Meehl (1990, pp. 229f) concluded that the usual tests of correlational predictions in clinical psychology are subject to ten obfuscating factors such that the “usual research review is well-nigh uninterpretable”—“*a bunch of nothing*” (see *Empirical Direction*, Section 11.4.3). Similar cautions hold for the bulk of current research on health psychology, positive psychology, and other important issues of everyday life. “Statistical control” of nonexperimental data is typically an illusion (see below).

Experimental analysis—with randomized assignment—is usually necessary for causal conclusions in field situations. Among these are comparing effects of different programs of moral education in the schools and someday in the family as well. Observational studies and nonrandomized experiments can make vital contributions—if they understand and lead toward experimental analysis (see *Field Science*, Section 15.5 in *Empirical Direction*).

**EXPERIMENTAL–FIELD SCIENCE**

Experimental analysis embedded in field situations has high importance for both goals of moral science: cognitive theory and social betterment. Both goals face the problem, noted by workers in many areas, that laboratory experiments can hardly hope to reproduce the variables operative in real life.

This limitation is prominent with social–moral cognition. In equity theory, for example, standard experiments mainly used abstract situations and asked for ideal judgments of fair shares (Chapter 2). In real life, of course, different persons have different values of relevant variables that are ignored in such ideal judgments. As one consequence, the important motivation of unfairness was neglected (*Unfairness Paradox* in Chapter 2).

A stellar illustration of experimental–field analysis is the work by Ebbesen and Konečni (1975) on bail setting in the courts. Judges’ ideals, assessed experimentally in their chambers using IIT, took sensible account of case variables. But these ideal judgments had virtually zero
relation to their judgments from the bench. The justice system was thus shown to be systematically unjust.

The limitation of laboratory experiments reappears with problems of contextual variables specific to each social situation. In educational psychology, as Cronbach and Snow (1977) emphasized, classroom context includes specific teachers and socioeconomic status of students that may have major influence. Results from one school may have little generality (see Field Science, Section 15.5 in Empirical Direction).

Many issues require experiments randomized across a population of social groups: families, schools, playgrounds, churches, factories, ethnic subgroups, or other social units. Randomized experiments are now common in medical science and are gaining popularity in clinical psychology (Kazdin, 2011). Our educational system deserves nothing less, not only for moral education but no less for standard school subjects (see Adaptive Transfer under Education, Chapter 7).

The psychological laws provide one useful foothold on field experiments. They have unique capability with analysis of multiple determinants. They have substantial nomothetic generality together with idio-graphic capability with personal values. Context effects can, moreover, be treated as exact units in some cases by virtue of Cognitive Unitization, as with Armstrong’s wife–husband study of blame (Figure 3.2). Experimental studies of cognitive theory can thus aid social betterment.

**EXPERIMENTAL DESIGN**

Experimental design is fundamental in psychological science. Good design can increase reliability, validity, and generality. One class of designs, dealing with persons as design units, is considered here.

**BETWEEN PERSON DESIGN**

Between person design uses different persons for each experimental treatment. Such design may be necessary when any treatment produces carryover effects that would confound effects of a following treatment. Comparing school programs on moral education or programs on family counseling are examples. Such studies need to be situated in actual social settings to allow a realistic mélange of context variables.

But between person design suffers two difficulties. First, the statistical error term includes individual differences which are generally large, negatively impacting power. Second, it averages out individual differences that may be important.
Studies with natural groups face the additional problem that the scores within each group may be correlated through dependence on common context. In a classroom program on moral impact of courses on U. S. history, for example, all persons in a given class would usually reflect influence of a single instructor and a single set of curricular materials as well as interaction among class members. One class is thus just one df in the statistical analysis. A single group could provide useful pilot experience, but multiple groups would be needed for social outcome validity (Natural Groups, Section 15.1 in Empirical Direction).

REPEATED MEASUREMENTS DESIGN

In repeated measurements design, multiple treatments are given each person. This design type was standard in experiments on deserving and blame in Chapters 2 and 3. The main effect of individual differences is factored out, yielding an error term usually several times smaller than between person design (e.g., Figure 6.1). Smaller error yields shorter confidence intervals and greater power.

Individual analysis is also possible because each individual has been in multiple conditions. Individual error terms are obtainable by presenting some or all conditions two or more times or even by pooling higher order interactions. Perhaps individual analysis should be standard with repeated measurements design (see also Cluster Analysis below).

Repeated measurements design can suffer from order and carryover effects. Response to later treatments may be influenced by practice, for example, or by carryover from previous treatments. To reduce such order and carryover effects, it is usually desirable to adapt persons to the task in the initial instruction stage. Latin square design (see below) can help balance order effects and assess their magnitude (see index entries for Order effects in Empirical Direction).

SINGLE PERSON DESIGN

In single person design, each person is tested with multiple treatments and a complete analysis is made for each person (Anderson, 2002). Single person design is an ideal for process theory because the locus of process is in each individual person. In particular, the functional values of the stimulus informers are those of that person, not some agglomerate of unknown different values of different other persons.

Single person design may be undesirable in outcome studies, at least in initial stages. With moral education, for example, developing proce-
dures that will be effective with most children would be well worthwhile. Preliminary information on individual differences might still be obtained by, for example, stratifying participants on some pertinent variable.

PERSONAL DESIGN

Personal design embeds the experiment within each person’s life space. Personal design was used in a study of divorced wives’ marriage satisfaction. In an initial session, each wife recollected satisfactory and unsatisfactory incidents from her marriage. These incidents were used as stimulus levels in an Affection × Appreciation design. The response was a judgment of satisfaction with a week of married life characterized by a pair of incidents. This personal design helped extend the averaging law into this basic area of social life (Anderson, 1990, 2008).

Personal design could be useful in marriage and family counseling. A personal integration graph could help participants come to grips with their own needs and problems. Personal design could also help liberate current trait conceptions of personality from dependence on group data to study individual persons in their personal life space (Person Science and Personality in Chapter 7).

INDIVIDUAL DIFFERENCES

Individual differences can pose difficult problems in every field of psychology. The common hope for general nomothetic law often runs aground on individual differences.

The laws of information integration, however, unify nomothetic and idiographic using within person design. These laws employ individual values of stimulus informers, yet the laws themselves have substantial generality across individuals. Three other issues of individual differences in experimental design and analysis are noted briefly here.

Stratification. Participants may be stratified on some pretest, with strata included as a factor in the design. Error variance can be decreased; individual differences associated with strata are fractionated out of the error yielding shorter confidence intervals.

More important is whether the strata differ in reactions to the experimental variables. One would expect, for example, that conservatives and liberals would differ in valuation of such variables as deserving and need of applicants for family assistance. Similarly, initial moral profiles of children could help improve design of programs on moral education.
**Individual Design and Analysis.** Individual analysis comes naturally when using repeated measurements design. This approach was used to good advantage in Leon’s studies of the blame law discussed in Chapter 3 (see also Repeated Measurements Design above).

Individual analysis is explicitly planned with single person design, especially personal design. Individual analysis is valuable for process validity because cognitive processes operate separately in each individual. Cognitive algebra represents generality in the integration process while allowing for large individual differences in valuation.

**Cluster Analysis.** Cluster analysis sorts individuals into clusters that are similar in some way. A striking example is the substantial minorities of Always Forgivers and Never Forgivers found in France by Girard and Mullet (1997) discussed under Algebra of Forgiveness in Chapter 7. An impressive application to functional theory of pain is given by Oliveira, de Sa’ Teixeira, Oliveira, Breda, and da Fonseca (2007); see also averaging law for phenomenal causality (Schlottmann & Anderson, 1993).

An important extension of cluster analysis was made in innovative work by Hofmans and Mullet (2013). Individuals may differ in more than one way, not only in their psychological values, but also in their integration rules. With integration data, four kinds of similarity are possible, each illustrated with published data.

Clustering on values is a simple case. All persons are assumed to obey an adding-type model and to use a linear response scale. For each person, the stimulus values measured by marginal means will also be a linear scale. These are not comparable across persons, however, because zero and unit will differ across persons.

To make persons comparable, subtract the lowest value from each value and divide by the highest value, separately for each person. This yields a zero-one scale that is comparable across persons. Single values are not comparable across persons, of course, but closeness in values is. Hence cluster analysis may be applied to cluster persons with similar value spectra. This method of finding clusters does not require an integration design; it may be applied to responses to a single variable.

Cluster analysis can help sort out individual differences. Cluster meaning must, of course, be determined by understanding the data.

**SIMPLER DESIGNS**

Integration designs study joint influence of multiple variables. This is important for social cognition, in which multiple variables are typically
operative. Studying one or two at a time may be misleading. But multiple variables can lead to large, cumbersome integration designs that present all possible combinations of each of several variables.

Simpler designs are often possible and will often be more effective than complete integration designs. Simpler designs may be essential with doctors, judges, politicians, and other professionals, who may balk at inroads on their time. Studies with children, families, or people in the street may also benefit from simpler designs.

Field experiments must often use smaller designs than laboratory experiments, often with a need to include larger numbers of variables. The field experiment of bail setting by Ebbesen and Konečni (1975) used a four-variable design with 36 conditions, and still did not include the fifth variable of severity of crime. To get judges’ cooperation, they felt it necessary to ask each to judge only 8 conditions. To allow Anova, they adopted the ingenious device of assigning these 8 conditions at random, subject to obtaining 4 judges per condition. This allows a reasonable statistical analysis.

More effective designs have been developed by statisticians. Thus, the foregoing 5 variables could be studied in a $2^5$ design with 32 conditions but using a 1/4 fractional replication that requires only 8 conditions. This would measure all 5 main effects with 2 df for selected interactions. Moreover, it would provide sensitive error terms based on within-person variability (see below).

**Main Effects.** Main effects of variables usually have primary importance. With several variables, balanced designs that provide equal information on each main effect are usually desirable. Two types of balanced designs are discussed in the next two subsections. Both achieve their goal by sacrificing information on statistical interactions, which become confounded with main effects. This may not be serious, especially when previous work indicates that interactions are small.

Of course, statistically interactions may occur with unequal weighting in the averaging model, as with the negativity effect, source reliability, or other variation in amount of information. Even when real, however, an interaction may require little or no qualification of main effects (see *Understanding “Interactions”* below).

**Latin Square Design.** Great reduction in design size is possible with designs of the Latin square type. In the $3 \times 3$ square below, the 3 levels of each of 3 variables are denoted {A, B, C}, {a, b, c} and {1, 2, 3}. Note the balance: each level of each variable is paired with each level of each other variable exactly once to yield 9 experimental conditions:
This square reduces the full $3^3$ design from 27 to 9 conditions. Remarkably, a fourth variable could be added, reducing 81 conditions to 9 (Note 1). A $4 \times 4$ square could reduce $4^3 = 64$ or $4^4 = 256$ conditions to 16. Latin square design may be especially useful in preliminary work to get an overview of main effects. An experiment from attitude theory that included a fourth variable is given in Empirical Direction (p. 420).

Latin square design has notable potential to reduce design size in moral science. Smaller designs could be essential with professionals as already noted. Using such designs in pilot work could help familiarize a useful tool (see Section 14.3 in Empirical Direction). Standard Latin square design yields no information on interactions. However, any specific interaction that deserved consideration could be assessed by including a specific supplementary design.

A seeming limitation is that Latin squares require all variables to have the same number of levels, 3 in the above example. If some variable had fewer levels, it could be replicated to equalize the number. Thus, if the first variable in the above example had only two levels, A and B, one level could be replicated to yield \{A, B_1, B_2\} where $B_1$ and $B_2$ are identical. Supplementary tests would be needed allowing unequal numbers of observations for A and B.

**Fractional Replication.** Main effects of all variables can be measured with a fraction of a complete design. In a study of obligation, for example, 6 variables, each at 2 levels, could be studied using a $1/8$ fraction, which would reduce design size from 64 conditions to 8. This design leaves 1 df to study a selected interaction. An experimental example from judgment–decision is given in Figure 15.1, page 455, in Empirical Direction (see also Note 4 in Chapter 4).

A clear, simple exposition of fractional replication is given by Cochran and Cox (1957), together with an appendix of specific designs (see also Montgomery, 2001). These designs are straightforward if all variables have 2 levels but more complex with more levels. A variable with more than two levels could still be handled with 2-level fractional replication. Thus, a 4-level variable could be treated nominally as two 2-level variables. A 3-level variable, \{A, B, C\}, might be treated as two 2-level variables, \{A, B\} and \{B, C\}. Supplementary analysis to test all given levels could be needed in either case. As with Latin squares, such replication may entail some loss of power.
Test runs with artificial data are advisable; mistakes are easy to make, hard to rectify. If some interaction not specifically allowed in the design seems a potential problem, it could be included in the artificial data to see whether it would trouble the results. Any specific interaction could be assessed with a specific supplementary design.

**METHODS OF INFORMATION INTEGRATION THEORY**

Present discussion of methods is mainly concerned with the two premises of the parallelism theorem of Chapter 1 (see further Anderson, 1982). Premise 1, additivity, is fundamental, being a substantive base for IIT. This additivity premise has been supported in nearly every field of human psychology.

For the ubiquitous averaging process, however, additivity depends on equal weighting, in which all levels of each separate stimulus variable have equal importance weight. Equal weighting depends on experimental procedure: each level of a variable should convey the same amount of information. Thus, the list 555 personality trait adjectives was screened to represent approximately importance for judgments of likableness (see Batteries of Stimulus Materials below). It is also necessary, of course, to equalize attention to each stimulus level (Note 2).

Premise 2, response linearity, depends on experimental procedure discussed in the next section for the rating method. Response linearity has general importance—then the observable pattern in an integration graph is a faithful image of the pattern in the underlying response. Linear response can also help study interaction and configurality that produce deviations from parallelism (see Configurality and Response Generality discussed below).

**METHOD OF FUNCTIONAL RATING**

The method of functional rating was developed to eliminate the well-known nonlinear biases suffered by rating methods in common use. These biases, it may be noted, prevented the discovery of the simple additive model despite widespread use of analysis of variance (see also Understanding “Interactions” below).

**Rating Schema.** The rating method seems simple but actually involves two complexities. One is its relative nature; the rating of each stimulus depends on its relation to the other stimuli. The end anchors and practice are intended to set up this stimulus–rating correspondence.
Chapter 6

The other complexity is that the rating scale is an abstract quantification of some specified quality. The extensive network of evidence for rating linearity constitutes a major achievement of the many investigators of IIT. Rating linearity represents a fundamental cognitive capability (see Metric Cognition in Chapter 7).

Method of Functional Rating. The two main procedures of functional rating are end anchors and preliminary practice. End anchors are stimuli a little more extreme that the regular experimental stimuli. They are used in the instructions to define the ends of the response scale. End anchors begin the process of establishing the frame of reference for the response. They can also eliminate end bias, the tendency of people to simplify by using scale endpoints for highest and lowest stimuli.

Preliminary practice familiarizes participants with the task and helps firm up the frame of reference for the response. Preliminary practice is generally necessary because ratings are relative judgments. Early work used extensive practice but later work indicates that a dozen or so trials with representative stimuli may suffice (Anderson, 1996a, pp. 92f).

The ideal scale is a continuous graphic scale. Category scales, such as 0–10 or 1–20, have been widely used with satisfactory results. They risk category preferences, however, especially with few categories. Graphic scales can minimize effect of previous responses as well as category preferences. Graphic scales seem essential in studies of children and may be essential for cross-cultural generality.

THEORY OF FUNCTIONAL RATING

Functional rating rests on a mathematical model. This is an application of the decision averaging law, in which rating of any stimulus is located between the two end anchors in proportion to its relative similarity:

\[ R = \frac{\text{Sim}_U}{\text{Sim}_U + \text{Sim}_L}, \]

where Sim_U and Sim_L are the similarities of the given stimulus to the upper and lower end anchors. Sergio Masin and his students have extended this model to study psychological structure of the judgmental representation of the end anchors. This model did well in several experiments (Dai Prà, 2007; Masin & Busetto, 2010) that ruled out three alternative theories, including Parducci’s (1995) range-frequency theory.

Linearity of functional rating has surprised many, especially those who have insisted on choice data in psychological measurement theory.
(see Appendix). For graphic rating, linearity is considered to derive from accuracy of motor movement in local space. The common category scale is considered a more symbolic internalization of motor response.

SELF-MEASUREMENT THEORY

Self-measurement refers to procedures in which persons quantify values for each single stimulus informer. Validity is the basic issue. People readily report these self-measures when asked—but are they faithful measures of their underlying reality (Note 3)?

Valid self-measures of integrated response can be provided with functional rating (benefit 2 of the parallelism theorem). But can people give valid self-measures of the separate stimulus informers? One important form of invalidity is the halo effect discussed below.

Valid self-measures of stimuli are essential in many applications of multiattribute analysis in judgment–decision theory. However, the several methods in common use (e.g., tradeoff, point allocation, part-worth, magnitude estimation, rating) disagree with one another, often markedly. Which is valid—if any?

This validity question can be answered. The algebraic laws can provide valid measures of the stimuli (e.g., benefit 3 of parallelism theorem). These are validity criteria for self-measures. Further discussion of self-measurement is given in Anderson (1982, Section 6.2, Self-Estimated Parameters), Anderson and Zajinski (1991), Surber (1985), Zalinski and Anderson (1989, 1991), and Zhu and Anderson (1991).

Of special importance, self measures allow analysis of situations that do not admit factorial-type integration designs. In a study of attitude change in group discussion, for example, each of three persons received a different biographical paragraph about some U.S. president. They discussed one another’s information and their own attitude and then each separately judged the president on statesmanship. Finally, they judged the polarity value and importance weight of their own information and of the discussions of each other group member on their own final attitude. These self-measures yielded good accounts of their final attitude (Anderson & Graesser, 1976).

In such group discussion, factorial-type design is difficultly applicable. Indeed, exact analysis of uncontrolled discussion might seem utterly impossible. Exact analysis was possible, however, by virtue of Cognitive Unitization (see Addition Law below). A remarkable example of self-measurement with females’ judgments of dates was given by Shanteau and Nagy (1976; see Figure 1.24, p. 76, in Anderson, 1981a).
The part-worth method, which requires judgment of the total contribution of each stimulus informer to the integrated response, showed promise in Surber (1985) and in Zhu and Anderson (1991). Part-worth corresponds to the total effect, weight $\times$ value, of an informer stimulus. This is simpler than getting separate estimation of the two parameters, and could be especially useful in applied multiattribute analysis.

Part-worths would be appropriate for adding models, in which weight and value operate jointly as a single unit. Marginal means thus estimate part-worths on a common scale for each separate stimulus variable. Analogous procedure applies to equal-weight averaging models (Note 22).

As yet, however, self-measurement of stimulus informers is not well-developed. A number of studies have shown promise but systematic analysis is needed (see further Anderson, 1982, Section 6.2; 1991a, pp. 165-178; 1996a, p. 343f, 391f, Note 14; 2002, 2008, pp. 391-393).

PERCENTILE STIMULUS METRICS

*Quality* and *quantity* of stimulus informers may be confounded. In the original task of person cognition, for example, participants judge likableness of hypothetical stimulus persons described by trait adjectives such as *sociable* and *punctual*. Each adjective must be evaluated both for its polarity *value* and for its importance *weight* with respect to the response dimension of likableness. The trait *sociable*, however, is a location on the dimension of sociableness, and hence a composite of quality and quantity.

Percentile stimulus metrics may be able to separate quantity and quality. A paragraph could be used to explicate the quality of sociableness, emphasizing that people show substantial differences but without implicating any specific quantity of sociableness. Each stimulus person could then be characterized as, say, sociable-30, sociable-60, sociable-90. Similarly for other stimulus informers.

Percentile quantification may also provide simple comparison of importance weight. In the personality trait task, suppose that *sociable* and *punctual* are both quantified at 30, 60, 90 in a 3 x 3 design. If the participant quantifies both at equivalent values, then the main effects are direct measures of importance weight. Difficulties of using the Average program are bypassed. If a less important factor has a smaller actual response range, as seems plausible, the main effects are still a valid comparison of relative importance. This method of percentile stimulus metrics thus promises to avoid the insidious concept–instance confounding
that vitiates so many attempts to compare importance of different variables (see Confounding below).

Another advantage of percentile quantification is with complex stimuli, such as family life, school life, job satisfaction, or alternatives in moral dilemmas. Such complex stimuli could be defined initially with paragraphs that describe its various components, emphasizing that each component can vary from low to high. Social reality could be increased by requiring participants to summarize the stimulus description in their own words before beginning the experiment. With quality established, experimental stimuli could be quantified as family life-30 (-60, -90). Similarly for other stimulus variables.

Graphic quantification may be preferable to numeric. Quantity could thus be represented by a mark on a line or length of a stick rather than a number. This graphic format would be usable with young children and with persons unused to numerical quantification.

BATTERIES OF STIMULUS MATERIALS

Integration experiments typically require multiple responses from each person. Batteries of stimulus materials are needed for many such experiments, especially for single person analysis.

Personality Trait Adjectives. A much-used stimulus battery is the list of 555 personality trait adjectives, each with its mean likableness value and variability (Anderson, 1968a). This list is reproduced in Appendix B of Anderson (1982), with demarcation of four ranges of 32 words each of High, Medium-high, Medium-low, and Low value.

This personality adjective task provided the original base for IIT. Participants judged likableness of persons described by a list of such trait adjectives. Analogous person judgments, based on diverse stimulus informers, are a basic personality function of each of us.

One advantage of this list is that most trait adjectives have approximately equal importance weight on the response dimension of likableness. This is ordinarily facilitated with instructions that each adjective was contributed by a different acquaintance who knew the person well. Equal weighting allows simple parallelism analysis. Other response dimensions, such as honesty or industriousness, could require screening to select adjectives with approximately equal weight.

A special advantage of this adjective list is that the same trait adjective may be used in describing different persons. A third advantage is that each stimulus informer is a single word, easily assimilated.
Note that individual value differences must be expected for any trait adjective. Single person design and analysis may thus need to prescreen adjectives for each person.

**Witness Testimony.** Another battery consists of summarized testimony of 6 prosecution and 6 defense witnesses from the Hoag bigamy trial of Figure 4.3. This experiment gave what seems the first definite evidence of basal–surface structure of attitudes. These witness testimonies are reproduced in Hommers and Anderson (1991).

**Marriage.** Marriage studies in IIT have made good use of stimulus batteries, including personal design based on incidents from each person’s marriage (see *Marriage as an Investigational Setting*, Section 4.5.2 of Anderson, 1981a). Margaret Armstrong’s (1984) PhD thesis includes 81 pages of ingenious stimulus materials used in her several experiments (see also Anderson & Armstrong, 1989). Another set of experimental stimuli used in a marriage experiments is given in Anderson (1991g, Appendix). A general-purpose battery based on common marital conflicts and negotiations could be useful.

**Attitudes Using Within Person Experiments.** Within person design has been extremely rare in attitude research because of carryover effects. Unlike the personality adjectives, a typical attitude message can seldom be used a second time because of memory carryover from the first time. The dominating concern of social psychologists with persuasion and changing attitudes led to between person design and diverted the attitude field away from functional theory (Anderson, 2008, pp. 82ff).

**President Paragraphs.** The president paragraphs were developed to allow within person experiments on attitudes. Participants judged statesmanship of a president based on one or two such biographical paragraphs (Figure 6.1). Thus, a High value paragraph about Andrew Jackson could be paralleled with a High paragraph about Woodrow Wilson. Within design can be much more sensitive than standard between design. In Anderson (1973), use of these president paragraphs required fewer than one-tenth the number of participants than a corresponding between person design (Anderson, 1981a, p. 27; *Empirical Direction*, p. 420). Within design has the additional advantage of allowing individual analysis. One experimental study is shown in Figure 6.1 below.

This stimulus battery consists of 220 short biographical paragraphs, 8 or 16 about each of 17 U. S. presidents with end anchors of Washington, Lincoln, and Harding, together with a brief historical overview (Anderson, Sawyers, & Farkas, 1972). These were based on biographies to
yield paragraphs of four graded values from low to high, reproduced in Anderson (1982, Appendix C). Almost every president had such a range of events in his administration. Here are one high and one medium-low paragraph about Theodore Roosevelt (1901-1909).

President Theodore Roosevelt was the first national leader to be concerned with the problem of conservation on a large scale. He took many measures to halt the destruction of the country’s wilderness areas. During his two terms as President, the National Forest Service was established, and acreage for national forests was greatly increased. In addition, 5 additional parks and 13 national monuments were opened. The first federal bird reservation was established by Roosevelt, with 50 opened before he left office. Fervently believing in conservation, President Theodore Roosevelt publicly stated: “As a people we have a right and a duty, second to none, to protect ourselves and our children against the wasteful development of our natural resources.

Theodore Roosevelt was a skilled politician. However, this characteristic is not always necessarily good in a national leader. One example occurred as the time for Roosevelt’s reelection drew near. In order to secure enough votes for himself at the national convention, Roosevelt found it necessary to give a public office to a man whom he had justly denounced as an enemy of the civil service system at an earlier time. Roosevelt excused this action, saying, “In politics we have to do a great many things that we ought not to do.”

Besides usefulness in experimental analysis, stimulus batteries can help improve the moral level of society. The president experiments, for example, provided a small but meaningful learning experience about U. S. history. A similar study of American women is given by Simms (1978). The cited experiment with witness testimony provided a strong historical example of unreliability of eyewitness testimony.

**Cognitive Unitization.** The importance of Cognitive Unitization may be reemphasized with these president paragraphs. Each paragraph requires a complex valuation process for each participant. Yet this complex processing is treated as a cognitive unit in the integration process. Such unitization underlies the parallelism of Figure 6.1 below as with the two paragraphs just quoted about Theodore Roosevelt.

Even stronger unitization is illustrated in Armstrong’s (1984) studies of wife–husband interaction. The success of the integration model implied that the entire discussion of each spouse functioned as a cognitive unit in the integration process for the revised attitude (Figure 3.2).

**Moral Judgment.** Batteries of stimulus materials for moral judgment would be a valuable contribution. Conflict situations from everyday life—marriage adjustments, parenting, growing up, broken promises, getting even, fractured friendships, obligation, and life goals are among
the many issues. Cooperative work by investigators at different institutions would be invaluable.

EXTENDED INTEGRATION DIAGRAM

Stimulus fields in integration experiments typically present two or more stimulus informers to be integrated. This experimental control of the external field, \( \{S\} \), exerts structural control of the internal field, \( \{\psi\} \), that allows easy diagnosis of certain integration laws from the pattern of the integration graph. This control made it possible to establish the three integration laws as general-purpose capabilities.

**Learning.** The Integration Diagram has straightforward application to learning. Each trial in a learning experiment involves valuation of a given stimulus informer and its integration into the response being learned. On each successive trial, therefore, this response is updated by valuation/integration of the stimulus information on that trial.

This learning process was illustrated with the learning curves for witness testimony in the Hoag bigamy trial (Figure 4.3). These curves revealed two-component structure of learning: an enduring **basal component** and a labile **surface component**. This basal-surface structure is important in functional learning theory (see e.g., Figure 8.3).

This integration analysis also led to a functional conception of learning very different from traditional learning paradigms. What is learned usually represents construction of goal-oriented meaning that need have no objective relation to the stimulus informers (see *Functional Theory of Memory* in Chapter 8). Traditional reinforcement, of course, is not generally relevant.

**Factorial Integration Learning Design.** New capability for learning theory is available with the integration laws. Treat some trials as a separate factor with two or more levels in an integration design. The influence of such trials on later responses can then be measured.

This capability extends standard learning curves whose theoretical analysis often depends on some assumption that all trials have similar effect as with analysis of sequential dependencies (Anderson, 1956, 1959a). Other examples are given in the 1959 jury trial experiment of Figure 4.3 and the age effect in children’s learning of Figure 8.2. Both experiments revealed a basal–surface structure of learning.

**Internal Stimulus Informers.** Internal stimuli require explicit consideration in some situations. **Prior state** is one example. This represents an
attitude or feeling the person brings to a situation that is integrated together with external information (see similarly Mood Is Information, Chapter 7). Attitude knowledge systems often include prior states as with positive value of helping or negative value of lying. Habit, emphasized by some moral philosophers (see Moral Philosophy, Chapter 7), may also be treated as a prior state.

**Knowledge Systems.** Knowledge systems are what are learned in IIT. Knowledge systems represent a constructionist conception: they include integrals of goal-directed values that include situational context. Knowledge systems differ markedly from the associationist conceptions of traditional learning theories (e.g., Mowrer & Klein, 2001).

One advantage of this constructionist view may be illustrated with learning of attitudes, traditionally conceptualized as “readiness to respond” on a one-dimensional, good-bad scale (see Response Quality below). This traditional conception is far too narrow to deal with attitude function in everyday life (see Functional Theory of Attitudes, Chapter 8). Similar liberation of learning theory applies in every area of psychology.

Little is known about structure of knowledge systems. They are necessary, however, to deal with the ubiquity of multiple determination and the goal-oriented nature of thought and action (see also Profile Measures below).

**INTEGRATION DATA VS. QUESTIONNAIRE-TYPE DATA**

Integration studies embody a conceptual shift away from the questionnaire framework that underlies much current social–personality. The most obvious need is capability to study joint influence of multiple variables. Such capability, essential both for prediction and for understanding goal-oriented function, is available with the integration laws. No less important is the need to study response structure (see Profile Measures below).

This functional focus of IIT is needed in personality theory which has been struggling to free itself from the traditional trait framework to deal with situational context. The laws of information integration can help study personality function, especially construction of situation-dependent, goal-oriented values. Functional measurement of these values provides a foundation that can help study person–situation interaction (see Analytic Context Theory, Chapter 7).

Current theory of social attitudes also rests on questionnaire-type data, egregiously so in its typical conception of attitude as one-
dimensional, good-bad reaction. Reliance on questionnaire-type data, perhaps only a single question, roadblocked development of functional theory of attitudes.

Attitudes are conceptualized as knowledge systems in Information Integration Theory. Integration experiments can help study how these attitude knowledge systems function in various contexts (see Functional Theory of Attitudes, Chapter 8).

Attitude integration theory recognizes that attitudinal reactions depend on multiple determinants (see Integration Diagram). The need for methods that can deal with combined effect of multiple variables in the earlier quote from Aronson, et al. (1998) was repeated by Wilson, et al (2010, p. 79) in their call for a “new synthesis” that can assess “relative importance of several variables.” Such synthesis of “multiply-determined behavior” was already well underway with the three laws of information integration (e.g., Anderson, 1974a,b,c, 1981a,b).

**INTEGRATION LAWS**

The three basic models of information integration are summarized briefly in the following sections. A two-variable integration task, $A \times B$, is assumed. Extension to more variables is mostly straightforward. Other discussion is given in Empirical Direction, Chapters 20-21 (see also Anderson, 1982, Sections 3.3, 3.4, and pp. 80f). Additional detail on testing a law and estimating parameters is given in the final Note 22.

**ADDITION LAW**

The addition model for a two-variable design may be written

$$\rho_{jk} = \psi_{Aj} + \psi_{Bk}. \quad (1)$$

Here $\rho_{jk}$ is the internal psychological response to stimulus combination $\{S_{Aj}, S_{Bk}\}$ in row $j$, column $k$ of the integration design, with respective psychological values of $\psi_{Aj}$ and $\psi_{Bk}$ (see Integration Diagram, Figure 6.2 below; see also Note 4).

Testing even this simple model might seem impossible; it involves three nonobservables: $\rho$, $\psi$, and $\psi_{Bk}$. Fortunately, it suffices to measure $\rho_{jk}$ by virtue of parallelism analysis.

**Parallelism Analysis.** If the addition model is true, the row $\times$ column graph of $\rho_{jk}$ will be parallel. Of course, this graph of $\rho_{jk}$ is unobservable.
However, if your measured R is linear \((R_{jk} = c_0 + c_1 \rho_{jk})\), then its row \times column graph will also be parallel. If you have a linear response measure, therefore, you need only test whether your observed graph is parallel. You need know nothing at all about the stimulus values, \(\psi_{Aj}\) and \(\psi_{Bk}\).

Fortunately, the addition model holds in many empirical situations. The first empirical demonstration (Anderson, 1962a) succeeded because it used the method of functional rating (see above), which avoids the nonlinear biases of common rating methods. Since then, parallelism analysis has done well in most fields of human psychology (Note 5).

**Benefits of Parallelism.** Observed parallelism supports multiple benefits noted in Chapter 1 that are repeated here.

*Additive Integration.* Parallelism supports an adding–type model, either averaging with equal weights or strict adding.

*True Response Measurement.* The observed \(R_{jk}\) is a linear measure of the unobservable \(\rho_{jk}\). This benefit has special value because of the wide applicability of the method of functional rating. With configural integration, moreover, pattern of nonparallelism in an integration graph is a valid picture of configurality in the nonobservable response (see *Response Generality* below).

*True Stimulus Measurement.* The true stimulus values, \(\psi_{Aj}\) and \(\psi_{Bk}\), are estimated by row and column means of the data table (see Note 4). This stimulus measurement holds for individuals.

*Meaning Invariance.* Each stimulus informer has constant value, regardless of which other stimulus it is paired with. Still-popular claims about interactive change of meaning were shown to be invalid.

*Cognitive Unitization.* Complex stimulus fields function as cognitive units in an algebraic law. Functional measurement can finesse all complexity of the valuation operation to yield the functional value of a complex stimulus field (Anderson, 1981a, Section 1.1.5).

Unitization is invaluable for psychological theory. Complex stimulus fields are common, but the integration laws can treat them as units. The psychological laws justify Cognitive Unitization, a unique tool for studying cognition. As one example, an integration law such as Blame = Responsibility + Consequences implies that all three terms are unitary cognitive constructs at the level of judgment.

Cognitive Unitization seems a general-purpose capability. Hence it may hold even with nonsimple integration processes. An excellent explanation with reference to face cognition and pain is given by Oliveira, Silva, Viegas, Teixeira, & Gonçalves, 2012).
MULTIPLICATION LAW

Some variables are expected to multiply. Subjective Expected Value = Subjective Probability × Subjective Value is the classic example. This model may be written formally as

\[ \rho_{jk} = \psi_{Aj} \times \psi_{Bk}. \]  

(2)

This SEV model had been widely conjectured but the first valid test was given with the linear fan analysis introduced by Anderson and Shanteau (1970). This test supported the SEV model.

This multiplication model predicts a fan of straight lines in the integration graph when the \( \psi_{Bk} \) are spaced at their functional values on the horizontal. These functional values are estimated by the column means of the integration data table (see Note 22).

This linear fan analysis has done well empirically. Besides expected value in children and adults, other applications include motivation, predictions of behavior, and language (see e.g., Anderson, 1981a, Figures 1.13-1.19; Empirical Direction, pp. 711-716).

AVERAGING LAWS

The averaging model makes explicit allowance for importance weights that multiply polarity values. Analogous to Equation 1,

\[ r_{jk} = \frac{A_j}{A_j} \frac{B_k}{B_k} \frac{A_j}{A_j} \frac{B_k}{B_k}, \]  

(3)

Weight and Value. The distinction between importance weight (\( \omega \)) and value polarity (\( \psi \)) deserves comment. Weight refers to amount of information constructed from a stimulus informer; value refers to its polarity on the dimension of response.

As a concrete illustration of this weight–value distinction, consider the task of judging the proportion of women to men in some group. Samples of 3 women and 1 man have the same value (.75) as samples of 6 women and 2 men. But the larger sample contains more information and so has greater weight.

Equal Weight Averaging. Equal weight means that all \( \omega_{A_j} \) are equal and so also all \( \omega_{B_k} \) in Equation 3. The denominator of Equation 3 is then constant so the model is formally equivalent to the addition model. All benefits of the addition model listed above apply to equal weight averaging.
The simplicity and power of parallelism analysis mean that experimental procedures to produce equal weighting may be well worthwhile. All row stimuli should thus contain equal amounts of information and so also all column stimuli. Equal attention by participants to all levels of each stimulus variable is similarly desirable (Note 2).

Equal weighting may be adequately approximate in some tasks. This holds for the standard personality adjective task—for the standard response of likableness. For judging honesty, in contrast, the traits reliable and humorous would have unequal importance weights. The many empirical findings of near-parallelism indicate usefulness of empirical procedures to facilitate equal weighting within each variable separately.

**Unequal Weight Averaging.** With unequal weights within any one variable, the averaging model will generally produce nonparallelism. The pattern of nonparallelism may reveal the pattern of weighting, as with the negativity effect (greater weight of more negative stimuli).

The averaging model has the notable property of making it possible to measure importance weight separately from polarity value. Exact measurement requires the Average program (Zalinski & Anderson, 1989, 1991). Special cases can yield a linear scale or rank order of importance (Anderson, 1982, p. 97). A simpler approach may be possible when weight can be expressed as a simple function of value as with the negativity effect (see Note 22).

**Adding Versus Averaging.** What produces averaging rather than adding has long been puzzling. Insightful work with children by Schlottmann, Harman, and Paine (2012) found an averaging law when the task required an inference from the sample to some underlying property but an adding law when the inference rested on the sample itself.

**Decision Averaging Model.** The decision-averaging model may apply when the task involves compromise between two alternatives. The two alternatives correspond to values, and these may be set at 1 and 0. Fair sharing between two persons, A and B, is one example. Deserving of each person corresponds to the weights. Equation 3 then becomes

\[
\begin{align*}
n_k &= \frac{A_j}{A_j + B_k} \\
&(4)
\end{align*}
\]

(see Anderson, 1981a, Section 1.6.4).

This decision averaging model has the same ratio form as a popular Bayesian model for two-choice tasks. The same ratio form also appears in Luce’s (1959) choice model. These Bayesian and choice models,
however, apply only to response probability, whereas the decision averaging model of IIT applies generally to metric response (Anderson, 1981a, Section 1.7.4). This metric ratio model has done well empirically.

Opposite Effects. The averaging model makes a counterintuitive prediction—the same stimulus informer may have opposite effects illustrated in Figure 6.1, which shows attitudes toward U. S. presidents based on one or two biographical paragraphs. The near-parallelism of the three solid curves based on two paragraphs supports an add-ave model. But the dashed curve, based on just one paragraph, crosses over the two-paragraph Med curve. This rules out strict adding, supports averaging—the Med paragraph averages up the Lo paragraph, averages down the Hi paragraph. Opposite effects also rules out the sure-thing axiom, once seen as foundation for utility theory (Anderson, 1996a, pp. 322ff).

Prior State. People often have some prior opinion about any judgment situation. In the personality adjective task, for example, prior opinion corresponds to belief or expectation about people in general. Prior state acts as an additive constant in the addition model and also in the averaging model with equal weights. Hence it can be ignored for many purposes. The parallelism theorem still applies, together with all its listed benefits (Note 6).

Figure 6.1. Parallelism of the three solid curves is strong support for an add-ave model. Crossover of dashed and medium curves eliminates addition/summation models, supports averaging theory.

Each of 48 person served in all eight experimental conditions; to get equivalent power using between person design would have required 510 participants. This within person design was made possible with the standardized president paragraphs (Batteries of Stimulus Materials, above).

(After Anderson, 1973.)

With unequal weights in the averaging model, however, prior state cannot be neglected in estimating parameters. In Equation 3, the term \( \omega_0 \psi_0 \) would be added in the numerator, the term \( \omega_0 \) in the denominator. These terms would need to be included in the data analysis which can be done using the Average program (Zalinski & Anderson, 1991, pp. 377ff).
Impressive study of pain descriptors is given by Oliveira, et al. (2007).

**Matching Law.** Information Integration Theory (IIT) has advantages for Herrnstein’s “matching law” (see Herrnstein’s collected papers in Rachlin and Leibson, 1997). The matching law asserts that each of two choice alternatives is chosen in proportion to the relative frequency of its reinforcement:

\[
\frac{R_1}{R_2} = \frac{r_1}{r_2}, \quad \text{or} \quad \frac{R_1}{R_1 + R_2} = \frac{r_1}{r_1 + r_2},
\]

where \( R \) and \( r \) denote response rate and reinforcement rate, respectively.

The matching law cannot deal with reinforcers of different quality as with different foods. This limitation was denied by Rachlin (1971) and Killeen (1972), who argued that it implicitly defines the concept of reinforcement. Their argument is incorrect; the matching law can be supported or disproved with linear fan analysis (Anderson, 1978, Note 1). Linear fan analysis is markedly superior to the tests that have been used in studies of the matching law (Anderson, 1978, p. 375, 1996a, p. 330) although such analysis seems not to have been made.

Herrnstein has presented many ingenious attempts to extend the matching law to a general law of behavior that deserve careful consideration. These attempts are roadblocked, however, by behaviorist fixation on the external world of observables. IIT employs a different conception, grounded on structure of the internal world (*The Two Worlds: Internal and External* in Chapter 7).

IIT is more general than the matching law. Thus, it applies to the concept of equity (Chapter 2), which is included in addition to the concept of reinforcement in *Crime and human nature* (Wilson & Herrnstein, 1985), which makes no mention of the matching law (see Chapter 7; see also Farley & Fantino, 1978). Of special importance, IIT applies even when there is no reinforcement.

**Qualitative Tests.** Unequal stimulus weights yield predictable deviations from parallelism in the averaging model. To illustrate an often useful qualitative test, suppose more serious Consequences have greater importance weight in the blame law: Blame = Responsibility + Consequences. Then the Responsibility curves in the integration graph will be closer together for more serious Consequences. Three simple qualitative tests are discussed in Anderson (1981a, pp. 65f). Equal weighting on one variable allows rank ordering of weight for levels of other variables (Anderson, 1982, p. 97). Valid comparisons of weight of different levels of
another variable would thus be available directly from the integration graph, without the Average program.

QUALITATIVE INTEGRATION MODELS

Qualitative integration models can portray main trends in the data without claim to be exact. Qualitative models have not yet been much used. Previous work has been focused on exact models in part for their substantive interest, in part as a base and frame for establishing methods for linear response. For some purposes, however, approximate quantitative models may be quite satisfactory.

One qualitative integration model is given in the amnesty study in Togo (see Note 6 in Algebra of Forgiveness, Chapter 7). Analogous qualitative models may be expected to be common in multiattribute judgment–decision. The usefulness of qualitative models depends in good part on using a response measure that is approximately linear.

CONFIGURALITY

The method of functional rating has the invaluable property of response generality (see Response Generality below). Hence deviations from parallelism suggest some configural component. The negativity effect was discovered in this way (Anderson, 1965; Hendrick & Costantini, 1970). Moreover, discounting from stimulus inconsistency was found to be much smaller than expected from the many claims that had been made (Anderson & Jacobson, 1965). Howe (1991) found that court judges down-weighted justification for a harmful action when the harm was small whereas students used an adding-type rule (Chapter 4).

An interesting configurality in judgments of anticipated quality of life was reported by Muñoz Sastre and Mullet (2012). Anticipated quality of life was an additive function of five troubles such as anxiety/depression and pain/discomfort with a one-point exception: with no troubles, anticipated quality of life was higher than the additive model predicted. This finding illustrates the power of integration models for configural analysis.

A different kind of configurality that involved imputations about missing information was discovered by Leon (1980). Important work on imputations has been done by Singh (1991, 2011) and by Colleen Surber Moore on self-reports about medication acceptance from different perspectives (Wills & Moore, 1994, 1996; see also Oliviera, et al., 2012).

Michael Birnbaum (see Birnbaum & Zimmerman, 1998) has report-
ed studies of averaging theory with a special form of configural weighting: the weight parameter of any stimulus informer depends on the rank of its value in relation to the other levels of that variable. The second highest stimulus, in particular, would get reduced weight.

This rank-weighting assumption is limiting. As one limitation, the second highest stimulus might contain more information in several different ways and so have greater weight. The highest stimulus, for example, might come from a source of lower reliability and so have lower weight (see also Anderson, 1996a, pp. 133f, Note 4). Other models with rank-dependent weighting are discussed by Weber (1999).

A different conceptual view is indicated by averaging theory: the weight parameter of a stimulus informer depends on the amount of information constructed from it. Rank-dependence may merely reflect weight–value correlation, as with the negativity effect. This alternative could be tested by manipulating weight independently of rank value, as with source reliability or amount of information.

MULTIATTRIBUTE MODELS

Multiattribute models have been much used in judgment-decision theory for choosing among alternative courses of action. An early example was given by Benjamin Franklin (Note 7). The basic idea is simple cost-benefit analysis. Represent each alternative by a set of independent attributes, assign a polarity value and an importance weight to each attribute. Choose that alternative with the largest weighted sum.

We all do something of this sort in making choices although seldom in a systematic way. Bok’s (1999, pp. 49f) Lyin g follows a similar mode of evaluating justifications for lies as “questions of benefit and harm,” although repeatedly pointing out the diverse social–moral complications from overemphasizing personal benefits and underemphasizing harm to others and to self.

Cost-benefit analysis is often used in industry, as in selecting location for a new plant or store. Among the attributes would be labor supply, tax breaks from local government, roads, transportation, and so on. Measurement of values and weights often depends on expert opinion.

A critical obstacle is that the several methods for measuring expert opinion (e.g., tradeoff between pairs of attributes; distributing 100 points among the attributes; magnitude estimation; rating; part-worth) give different results, often quite different. The best alternative using one measurement method may be poor using another. Although books have been
written on multiattribute analysis, this critical measurement problem has been left unresolved, largely ignored.

This measurement problem can be resolved with functional measurement. Run an integration experiment on tasks such as job satisfaction that obey the averaging law. This law will provide correct measures of each attribute (Zalinski & Anderson, 1991). These measures provide validity criteria for those obtained by standard methods such as tradeoff or point allocation. Both of these methods did poorly in Zhu and Anderson (1991) whereas part-worth showed promise (see also Wang & Yang, 1998). The main goal, of course, is to use this more tedious method to develop valid methods for self-measurement in the many tasks in which it is needed (see Self-Measurement Theory above).

GOODNESS OF FIT

Perfect fits between model and data are not expected. Discrepancies from model predictions will result from normal response variability. Are the observed discrepancies any more than normal response variability? This is what it means to test goodness of fit of a model (Note 22).

Analysis of Variance. Standard analysis of variance can give optimal tests of goodness of fit for all three integration models. This is simple with the addition model. The statistical interaction in analysis of variance is precisely a test of deviations from parallelism in a two-variable graph. This test also holds for the averaging model with equal weights.

Statsig deviations may result from nonadditive integration or from nonlinear response bias. The method of functional rating is expected to eliminate response bias so that statsig deviation may reasonably be considered real nonadditivity.

For the multiplication model, the linear × linear component of the statistical interaction should be statsig. The residual interaction should be nonstatsig. Weiss (2006) includes a disc with a computer program. More detailed discussion is given in Anderson (1982, pp. 72-85).

The averaging model with unequal weights can be analyzed using the Average program. This is not simple and is not considered here (Zalinski & Anderson, 1991; Empirical Direction, p. 732, Note 21.4.3a).

How Not To Test A Model. Standard correlation–regression analysis is generally invalid for testing models of psychological process. Correlations are invalid in principle; they fail to test the discrepancies between model predictions and data. Examples in which additive regression models yielded correlations from .977 to .996 for severely nonadditive data
are shown in Anderson (1982, Figures 4.2-4.5). Correct analysis is possible with functional measurement (Anderson, 1982, Section 4.3, Regression Analysis; see similarly Blanton & Jaccard, 2006c).

This issue is related to the process–outcome distinction discussed previously. Prediction of behavior is an outcome concern for which high correlations are desirable and usually sufficient.

But understanding behavior is a process concern that usually requires analysis of discrepancies from prediction. Extremely high correlations can easily be obtained from models that seriously misrepresent cognitive process (Anderson, 1962a; Anderson & Shanteau, 1977; Parker, Casey, Ziviar, & Silberberg, 1982).

Relevance of this process–outcome distinction to model analysis may need emphasis because of lingering behaviorist focus on prediction to neglect of understanding. This issue needs consideration in the planning stage. Otherwise a valid test of the model may not be available. The eight models of attitude ambivalence discussed in Anderson (2008, pp. 140-145) were earnest attacks on an important problem that accomplished nothing at all owing to failure to use appropriate methods.

Interpreting Statsig Deviations. Statsig deviations from model prediction do not necessarily mean the model should be abandoned. The rating scale, for example, may be troubled by residual number preferences or end bias. The process envisaged in the model may be valid.

Alternatively, the deviations may result from some additional process not included in the model. The negativity effect (greater weight for more negative information) was discovered in this way as a deviation from parallelism (Anderson, 1965; see Negativity Theory below). Statsig deviations should be taken seriously but they need not be fatal. Indeed, they may reveal something new, as with the negativity effect (see e.g., Interaction and Configurality, pp. 357-364, Anderson, 2008).

UNIQUENESS

We are so familiar with numbers that have objective value, as with hours, miles, and dollars that we tend to take all numbers at face value. This is usually a mistake in psychology. “Interaction” in factorial design is a common example. Empirical reality of a statistical interaction depends on the assumption that the response measure is a linear (equal interval) scale. Without this assumption, which is rarely given justification, statistical interaction may be empirically meaningless (see Understanding “Interactions” below).
**Comparison of Stimulus Values.** Estimates of $\psi_{A_j}$ and $\psi_{B_k}$ from the marginal means of the integration design are measured in terms of the response. Each set of estimates is thus on a linear scale.

Can a row mean be compared with a column mean? Not generally; they may have different zero points. However, both have the same unit as the response. Hence a difference between two row means can be compared with a difference between two column means because their zero points cancel out in the differences. One example appears in the relative range index below (see also Note 22).

The averaging law has the remarkable property that it can separate weight from value and measure weights that are on a common proportional scale and thus properly comparable across different variables. Detailed discussion of uniqueness is given in Anderson (1982, Chapter 2).

**Conflicting Goals.** Interpersonal comparisons of value appear throughout everyday society in terms of fairness and justice. Elster (1995) gives an illumination discussion of many such situations that involve integration of conflicting determinants, as with allocating scarce medical resources to those who will benefit most or to those in most need but with poor prospects (see further contributors to Elster, 1992).

Kahneman and Varey (1991) give a perceptive discussion of psychological considerations in judgments of fairness and justice that are neglected in the standard objectivist view in decision science. One is that people adapt to present circumstances and are poor at predicting their future hedonic state.

**PSYCHOLOGICAL MEASUREMENT**

True measurement of psychological quantities has been sought for over a century. True measurement means that our observed response is a linear function of the unobservable quantity, R and $\rho$, respectively. For an adding-type model, similarly, the marginal means of an integration design should be linear functions of the stimulus $\psi$ values. The roadblock is that $\rho$ and $\psi$ are unobservable, as emphasized in the Integration Diagram of Figure 6.2 following.

Most measurement in psychology is monotone (ordinal), in which R and $\rho$ have the same rank order. Monotone measurement is widely useful for testing whether some variable has an effect and even for giving a rough idea of the size of the effect. But it is not true linear measurement.
Empirical laws of information integration are the foundation for psychological measurement. Functional measurement theory is grounded on this base and frame.

A guiding idea of functional measurement is that measurement scales are derivative from substantive theory (Anderson, 1970, p. 153).

The logic of the present scaling technique consists of using the postulated behavior laws to induce a scaling on the dependent variable (Anderson, 1962b, p. 46).

The potential of this functional approach was illustrated with the six benefits of the parallelism theorem (Chapter 1). Such laws must have empirical reality, of course, for these benefits to be real. Such empirical laws are the foundation for theory of psychological measurement.

Algebraic laws had been widely conjectured, of course, as with the equity models of Chapter 2 and with Subjective Expected Value = Subjective Probability × Subjective Value. But without capability for psychological measurement, these conjectures remained conjectures. Indeed, the multitudinous empirical applications of analysis of variance failed to reveal even the simple adding law.

Using functional measurement, however, the initial 1962 study of person cognition supported an adding-type law in single person design and analysis. Later applications of functional measurement have done well throughout human psychology.

The three integration laws also showed that psychological measurement theory differs conceptually from what were and remain common conceptions (see also Appendix).

THE NATURE OF PSYCHOLOGICAL MEASUREMENT

Psychological measurement differs fundamentally from standard conceptions, largely derivative from physical science. The nature of psychological measurement is implicit in the Integration Diagram, repeated here from Chapter 1. Metrication occurs primarily in the valuation operation, which transmutes informer stimuli, S, into goal-oriented values, ψ. This metrication is continued with the next two operations, integration and action. Metric value is not in the stimuli themselves, as with length and gram weight in physics. Instead, metric value is constructed by the organism—in relation to the operative goal.

Metrication derives from purposiveness, especially the approach–avoidance nature of goals and action (see Metric Cognition, Chapter 7). Metrication originates in goal-directed thought and action.
True measurement of $\psi$ and $\rho$ becomes possible by virtue of the algebraic laws of information integration (benefits 3 and 2 of the parallelism theorem). Monotone (ordinal) scales are widely useful to assess whether a given stimulus variable has an effect. But monotone scales have limited value with the fundamental problem of information integration (see e.g., Measuring Importance and Understanding “Interactions” below). Empirical integration laws are the true foundation of psychological measurement theory.

**Figure 6.2.** Information integration diagram. Chain of three operators, $V-I-A$, leads from observable stimulus field, $\{S\}$, to observable response, $R$.

Valuation operator, $V$, transmutes stimuli, $S$, into subjective representations, $\psi$.

Integration operator, $I$, transforms subjective field, $\{\psi\}$, into internal response, $\rho$.

Action operator, $A$, transforms internal response, $\rho$, into observable response, $R$.


Person cognition, because of its ubiquity in everyday life, is a prime area for theory of psychological measurement. In the basic trait adjective task, the value of *critical*, for example, is not in the adjective itself. Instead, it arises from goal-oriented valuation. Its value will differ if the goal is to judge research potential or friendship. Judgments of blame, to take a second example, may require preliminary metricalation of harm from an action that involves integration of a complex stimulus field including potential harm that did not actually occur (Chapter 3).

Influence of context is a basic problem discussed by many writers
from Aristotle through the Gestalt psychologists to Person × Situation personality theorists. The integration laws provide a base for context theory because they can reduce a complex context to a goal-oriented cognitive unit (see Analytic Context Theory, Chapter 7).

The internal field elicited by a given stimulus may contain substantial metric components from previous learning. This is the case with many attitudes, social–moral attitudes especially. These components may be partly responsible for the common misconception of attitudes as one-dimensional, good-bad evaluations ("readiness to respond"), which imposed a misleading conceptual framework on the attitude field.

This integration-theoretical conception of psychological measurement applies also in psychophysics. Unfortunately, traditional psychophysics induced a conception of measurement derived from physical science, in part because many sensory stimuli have physical metrics and many psychophysical sensations seem one-dimensional. The present integration-theoretical conception of measurement is necessary, however, as may be illustrated with the size-weight illusion, in which felt heaviness of a given gram weight depends also on its visual appearance. In the experiment of Figure 7.2, weight was measured in grams and size by the centimeter side of cubical blocks. But "size" could be varied in irregular shapes and influenced by visual cues such as hue. The integration law will still apply (no doubt), allowing a true psychophysics.

True measurement in psychology rests squarely on our inestimable good fortune of the three algebraic laws of information integration. These empirical laws are the foundation of true measurement.

RESPONSE GENERALITY

A response method that has proven linear in a variety of situations may reasonably be expected to be linear in others without requiring specific evidence. Such response generality holds for the method of functional rating—including the practical precautions already discussed. This method may thus be useful in situations in which parallelism validation may be overly demanding or not possible (see e.g., Interaction and Configurality). A similar approach may be feasible more generally with behavioral responses such as bar press rate by rats (Anderson, 2002).

RESPONSE QUALITY

Although quality of what is being measured has paramount importance, quality has been relatively neglected. Most empirical investigators take
for granted that their instructions to judge blame, attitude, well-being, and so on, elicit a unitary concept, the same for different persons. This approach is undoubtedly useful but it has limitations and dangers.

Measurement theory in psychology has fixated even more strongly on quantity and neglected quality. Nearly all these theories have been constructed in the image of physical science, reinforced by physical metrics that underlie common sensations such as loudness and heaviness.

This neglect of quality reflects a widespread tendency to impose one-dimensional views on complex entities. The great usefulness of one-dimensional measures has obscured real limitations. A fateful misuse appears in the traditional definition of attitude as one-dimensional evaluative reaction. This misconstrues the phenomena (see Functional Theory of Attitudes in Chapter 8).

Cognitive Unitization (benefit 5 of the parallelism theorem) can help with quality analysis. Complex qualities, such as responsibility in the praise and blame laws, can be exactly measured. These overall measures provide boundary conditions for deeper analysis (e.g., Responsibility and Consequences as Integrals, Chapter 3).

PROFILE MEASURES

A single dimension is inadequate to represent many qualities. This issue may be illustrated with a well-known scale of attitudes toward women. Participants made separate positive/negative judgments of statements about women in multiple contexts, including workplace, home, personal conduct, and so on. Factor analysis was used to enforce a single factor, in line with the prevalent conception of attitudes as one-dimensional, good-bad evaluations. Such measures can be useful for some purposes, such as assessing population stereotypes or work opportunities.

But attitudes toward women have multiple aspects, as this scale implicitly recognized. A person strongly in favor of gender equality in work might still be averse to similarity in dress or makeup and shrink from female obscenity. Profile measures may thus be desirable, with separate measures for different social contexts (see Profile Analysis, pp. 185f, in Anderson, 2008).

Multiplex response technique may be useful. In legal psychology, duplex response showed that punishment responses may have distinct components of restitution and retribution (Hommers, 2007; Hommers & Anderson, 1991, pp. 122f). In deserving theory, Farkas showed that praise and money were distinct components of outcome, both of which obeyed averaging theory (Figure 2.5). In both cases, the usual single
response would obscure quality of the underlying feeling.

An obvious approach to profile analysis could ask for joint judgment of several qualities. Judgment of gratitude, for example, could ask for separate judgments of positive feeling toward the benefactor, personal benefit from the benefaction, obligation to, and cost to the benefactor.

A similar approach could be used with other qualities such as forgiveness (see Defining and Measuring Forgiveness, Chapter 7). Such component judgments will be correlated and present challenges to development of useful methodology, especially for single person analysis.

Profile measures may be especially desirable to represent the conflict and ambivalence that are so common in moral cognition. Separate measures of positive and negative have particular importance. Examples include attitudes about wife–husband–child interactions, about lying, forgiveness, moral dilemmas, and other common conflict situations discussed in the next chapter.

COMPARISON OF PERSONS AND GROUPS

Some difficulties of comparing different persons or groups are well recognized, as shown in attempts at statistical control (see Illusion of “Statistical Control” below). True measurement is possible for each individual with an algebraic law but individual differences in zero and unit trouble comparisons of their responses. Pattern of response, however, may be comparable with a linear response (e.g., Figure 1.2).

Rating responses are often compared across different groups of persons. Examples include comparison of subjective well-being, marital satisfaction, or moral judgment, across gender, groups, or cultures. Such comparisons are fairly common but their validity is often taken for granted. Actual evidence for validity, however, hardly exists (see also Uniqueness above). Indeed, the meaning of validity is often unclear.

Comparison across different cultures is a special problem about which little is known. A cogent instructive beginning using Information Integration Theory to study Quality of Life (Well-being) in three different cultures (Belgium, Poland, Algeria) is presented by Theuns, Baran, Van, Vaerenbergh, Hellenbosch, and Tillouine (2012).
FAULTY METHODS

Reliance on faulty methods has undercut much earnest effort. Some common faulty methods are discussed here.

ILLUSION OF “STATISTICAL CONTROL”

Comparisons across groups of people who differ preexperimentally suffer from confounding with correlated variables that undercut causal interpretation. Examples include family background in moral development, personality variables in marriage, school and aptitude variables in education programs, a large proportion of results cited in health psychology, and many, many others.

Some investigators attempt to eliminate such confounds by employing “statistical control” such as multiple regression, partial correlation, quasi-experimental design, analysis of covariance, or causal, structural equation models. These are nearly always statistical illusions.

Many writers assert that multiple regression “controls,” or “holds constant,” or “partials out” uncontrolled variables. Such phrases seem to justify some causal interpretation. It would be wonderful if this were true, but it is false. Regression equations do not control or hold constant in any substantive sense. (Empirical Direction, p. 501.)

Two confoundings are critical for such “control.” Missing variable confounding refers to a variable that is operative in the empirical situation but not measured, directly or indirectly, for inclusion in statistical analysis. Hence it is impossible to “control.” Statistical “control” can, as various writers have shown, seriously misrepresent importance of variables. Importance weights can even change sign.

Missing variables are almost unavoidable. One major cause is that the usual measured variables are one-dimensional whereas the corresponding psychological variables are usually multidimensional, as with attitudes towards women.

Person–variable confounding refers to the assumption that variable effects are equal across different individuals. This improbable assumption further vitiates claims to control uncontrolled variables (Empirical Direction, Sections 13.2 and 16.2).

Quasi-experimental design suffers in both these ways in its reliance on analysis of covariance to “control” uncontrolled variables. This artifact has since been acknowledged by the primary inventor of quasi-experimental design (Campbell, 1978). Causal, structural equation analy-
sis suffers similar problems plus another of its own (see references in *Empirical Direction*, pp. 505f).

The popularity of these attempts to “control” what is not controlled is due in large part to textbooks written by persons who lack understanding of relations of statistical analysis to empirical reality. These methods can be valid in certain narrow circumstances. Establishing these is no easy task, however, that is usually glossed over or just ignored.

I sympathize with persons who have been taught that multiple regression is a means of “statistical control.” It took me longer than I care to think to see through the smoke and mirrors. Disbarring such terms would prevent much confusion. (*Empirical Direction*, p. 514.)

**MISUSE OF CORRELATION**

Field investigators love to use correlation to imply causation. This misuse of correlation is ubiquitous in health psychology and in current positive psychology (see *Positive Psychology*, Chapter 7). It is often disguised by calling it “association” and/or by leading the reader to infer causality. Here is one example taken from the editors’ introduction to *Understanding marriage* (Noller & Feeney, 2002, p. 1):

Waite and Gallagher (2000) present empirical support for the proposition that there are several major advantages to marriage. First, married men and women tend to enjoy better mental and physical health than the unmarried. Second, married men and women are likely to have more assets and income than the unmarried, with marriage even being described as a ‘wealth-enhancing institution’ (Hao, 1996). Third, married people have more and better sex than the unmarried. Fourth, children of married parents also enjoy a number of advantages, including better physical and mental health, and higher levels of education and career success . . . . Marriage has clear implications for individuals’ general sense of well-being.

This statement is intended to lead the reader to think that these benefits are *caused* by marriage—as the final sentence makes explicit. But the opposite direction of causality seems at least as likely; the married may have been better before they were married. People with ill health or psychological problems, for example, may be less likely to get married, to get well-paying jobs, or enjoy more and better sex. Much of what is written about observational data represents similar double talk.

Correlations can be valuable clues to causality. Finding poorer communication skills in less happy marriages, for example, might help develop experimental methods to improve such skills, together with valid tests of their efficacy. What is not appropriate is language that misleads readers to infer causality from correlation (Note 8).
I wish to add that the contributors to *Understanding marriage* were chosen for their interest in family interaction. Their chapters can be helpful for further study of this important social problem. This, however, requires better understanding how experiments can be useful for studying and bettering wife–husband interaction. Couple experiments offer one opportunity, as in Armstrong’s work illustrated in Figure 3.2.

CONFOUNDING

*Confounding* is a major concern in empirical analysis. An experimental treatment intended to produce one causal process may be effective by virtue of another process that it also produces. The medical placebo effect, in which suggestion masquerades as medicinal effect, is the classic example (see *Confounding*, Chapter 8 in *Empirical Direction*). Besides the confounds of the two previous sections, two other important confounds are noted here.

**Concept–Instance Confounding.** Concept–instance confounding is common but often not recognized. Experiments that seek to manipulate some concept usually do so with specific stimulus instances. The concept is thus confounded with the specific instances.

*Concept–instance confounding* undercuts the frequent practice of comparing importance of two variables by comparing their main effects or statistical effect sizes. One of many examples is attempts to compare relative importance of objective and subjective variables (e.g., physical damage and intent) in judgments of blame (Chapter 3). Each main effect is completely confounded with its specific instances; opposite conclusions could generally be obtained with different instances. Using regression analysis only makes matters worse (see *Invalidity of Regression Weights* below).

Correct analysis is possible when the averaging law holds; this law allows valid measures of importance weight. A simple application was given in ingenious work by Surber (1982, 1985). Other simple applications are possible with *Qualitative Tests* discussed above. Also, comparing main effects may be valid when variables cover some natural range (see *Measuring Importance* below).

**Response Confounding.** Researchers often take their instructions for granted—that when they tell participants, “judge X,” participants do judge X. This practice seems plausible with fair division and with blame. Some moral judgments, however, may have more than one component and/or may mean different things to different people.
Gratitude is a simple example. One may be personally grateful to one’s benefactor; one may be thankful for the benefit; or one may feel under some obligation. These have rather different quality and deserve separate measurement which has yet to be done (see Gratitude and Ingratitude in Chapter 7). Multiple meanings are not uncommon, as with blame and forgiveness. Profile Measures may be useful (see above).

HALO EFFECT: A CONCEPTUAL PITFALL

Halo means that an overall impression of a whole influences judgments of some part of that whole. Halo effects have long been a concern in applied psychology. Supervisors’ ratings of subordinates’ performance are often influenced by their likableness which may have little relation to actual performance. This work, however, rests largely on correlations. Rigorous experimental analysis is possible with IIT (see Halo Integration Theory, pp. 55-58 in Anderson, 2008).

Halo effects should be suspected whenever judgment is required about any component of an integrated whole. The classic example is the recurrent claim that trait adjectives change their meaning when integrated into a person cognition. This was found to be a halo artifact (see Foundations of Person Cognition, Chapter 3 in Anderson, 2008). An unresolved case from legal judgment is cited in Chapter 4. The halo effect illustrates the need for cognitive theory to validate introspection (see Science of Phenomenology in Chapter 7).

MEASUREMENT PITFALLS

Some popular methods depend on untested and unlikely assumptions about measurement. One of these concerns statistical interaction in analysis of variance, widely confused with everyday English meaning of interaction. A group of others concern measurement of importance. Two others relate to regression analysis and arbitrary metrics.

UNDERSTANDING “INTERACTIONS”

“Interactions” in analysis of variance are often meaningless. Statistical interaction is defined as a deviation from additivity in observed data. Any deviation from parallelism in a two-variable graph is thus an interaction. But such deviation may be merely artifact of a nonlinear response measure, devoid of substantive meaning (Anderson, 1961; Empirical Direction, Table 7.1, Section 7.6.4, and Note 7.3.5a).
To illustrate the issue of nonlinear response, consider a task for which either time or speed may be used to measure performance. Both have often been used since shorter time and faster speed both signify better performance. But speed = 1/time. Hence an additive law for time would yield a nonadditive interaction for speed. And vice versa; an additive law for speed would yield a nonadditive interaction for time. Analogous ambiguity is common in the literature. Unless evidence for linear response is given, reported interactions may be devoid of meaning (Anderson, 1961; Empirical Direction, Table 7.1, p. 193).

Statistical “interaction” may also be produced by applying standard analysis of variance to data from a nonadditive model, for example, a multiplication model such as Subjective Expected Value = Subjective Probability \times Subjective Value. This interaction merely reflects use of the wrong integration model, not from any interaction that changes values of the stimuli themselves. If the correct model is used (and if the response scale is linear), the “interaction” will be properly represented in the linear \times linear component.

Most statistics texts reify statistical interactions as though they had substantive reality (see e.g., Anderson, 2001, p. 208). This is one symptom of failure to appreciate importance of psychological measurement theory. Statistical interactions always deserve attention but they are often unreal. Even when real, moreover, they are often unimportant.

Besides Empirical Direction, no other statistics text I know of tells how to assess response linearity on which meaningfulness of “interaction” depends. Most texts seem unaware of this problem (see Chapter 7, Understanding Interactions, in Empirical Direction which gives a thorough discussion). Much confusion could be avoided if “interactions” were called by their correct name—residuals from an arbitrary, Procrustean additive model to use Tukey’s apt adjective.

True linear response measures can be established with functional measurement theory. Statistical interactions may then be psychologically meaningful (Note 9).

MEASURING IMPORTANCE

Many investigators desire to assess relative importance of two variables to show meaning and value of their results. Satisfying this desire, which might seem straightforward, turns out to be treacherous and difficult. It is possible, however, with averaging theory using the Average program (Zalinski & Anderson, 1989, 1991; see also Comparison and Measure-
**Main Effects In Factorial Design.** In this popular method, the importance of each variable in a factorial design is measured by its main effect, specifically, by the difference between its largest and smallest levels. This is not generally valid because it depends on arbitrary choice of stimulus levels of each variable. Different choices could give opposite conclusions (see Concept–Instance Confounding above).

Main effects can be valid measures of importance when the levels of a variable cover a natural ecological range. Then its main effect represents its ecological importance. This may be properly compared with another such variable. An impressive application to face cognition was given by Oliveira, et. al., (2007; see Note 10).

**Relative Range Index.** The relative range index is a ratio of main effects. With two variables, A and B, the range $R_A$ of variable A is defined as the difference between effects of its largest and smallest levels, and similarly for $R_B$. The relative range index for $R_A$ is thus

$$RR_A = \frac{R_A}{R_A + R_B}.$$

When A and B each cover some ecologically natural range, $RR_A$ measures relative ecological importance of variable A (e.g., Note 10). But if the range of $R_A$ or $R_B$ is arbitrary, the index suffers similar arbitrariness though it may still be useful, as in the following marriage example. Detailed discussion of this and other proposed indexes is given in Anderson (1982, Section 6.1).

**Relative Range Index in Marriage.** An instructive use of the relative range index was included in extensive work by Armstrong (1984) on marital interaction. In one part of one experiment, spouses made independent judgments of deserved blame for a child’s misdeeds characterized by the two variables of damage and intent. Each spouse was given a relative range score, $\text{Damage}/(\text{Damage} + \text{Intent})$. The wife-husband correlation of these scores was .56.

Of potential value, three of the four couples who had distressed marriages showed widely different range indexes, a likely source of parental disharmony. A battery of such indexes covering important areas in marital interaction could be a simple diagnostic tool. Given as part of preparation for marriage, such a battery might help iron out differences before they became daily discords (see Group Dynamics, Chapter 7).
Meretricious \( p \) Values. The \( p \) value of a statistical test has only one valid use—as an indication whether the null hypothesis may provisionally be rejected. The \( p \) value is a bad measure of effect size. With large samples, tiny effects can be “highly significant.” And large effects may miss significance with small samples or high variability.

The \( p \) value is not a measure of power. If \( p = .05 \), a best guess of the power of an exact replication of the experiment is approximately .50 (Empirical Direction, p. 104).

The \( p \) value is not a measure of the probability that the null hypothesis is false. It is invalid for this purpose, not only numerically, as in the previous paragraph, but also conceptually, as Bayesian statisticians have repeatedly emphasized.

The primitive ritual of \( p \) value worship evident in articles bespangled with *, **, and *** stems from misappreciation of empirical science and misunderstanding of statistics. This statistical clutter can be avoided by saying once that cited effects are statsig at \( p = .05 \) (or .01). Any reader who really desires the exact \( p \) value can get it from the given F, t, or r. This practice helps focus attention on what is important—the actual data (Empirical Direction, Section 2.4.3).

Confidence intervals are much better than \( p \) values. They not only provide significance tests but also estimates of the size and variability of the effect (Empirical Direction, Sections 2.4, 18.1, and 18.3).

Statistical Effect Sizes. Some statistics texts seek to go beyond tests of significance to present effect sizes. One useful index of effect size is a confidence interval about a mean difference. This estimates the true effect together with an estimate of its reliability. Power effect size is also useful, almost routine in designing an experiment.

Except for the confidence interval, however, indexes of effect size are usually statistical window dressing that obfuscate rather than illuminate. Effect size is basically an extrastatistical, empirical matter (see Size and Importance of Effects, pp. 551-559 in Empirical Direction; see similarly Blanton and Jaccard, 2006a).

Negativity Theory. Negativity—greater importance of negative stimuli—seems clear to common sense and has generated a minor literature. Much of this work, however, rests on misconceptions about psychological measurement. Most investigators have recognized that demonstrating negativity requires separating importance from value. One common attempt was to preselect positive and negative stimuli that were “equal and opposite” in value and then show that their combined effect was nega-
tive. But this “equal and opposite” method, which is critical, rested on mere hope; instead, it requires grounded theory of measurement. Indeed, it appears to be incorrect as shown by Oliveira, et al. (2006).

Valid negativity theory is possible with functional measurement. The averaging law can assess importance weight separately from value. A qualitative application was used in what seems the first definite evidence for negativity (Anderson, 1965). The averaging law is notably more general than the “equal and opposite” condition; it can compare importance of only negative or only positive stimuli. Detailed discussion is given in Negativity Theory in Anderson (2008, pp. 349-356).

**Valid Importance Weights.** Valid measurement of importance is possible with the averaging law; this law can separate importance weight, $\omega$, from value polarity, $\psi$. This removes the confounding suffered by regression coefficients (see also *Self-Measurement Theory*).

Estimation of importance weights may require the Average program. This requires suitable experimental design and is not routine analysis of variance (Zalinski & Anderson, 1991).

**REGRESSION MODELS: PREDICTION VS. UNDERSTANDING**

For *prediction*, standard regression analysis has two remarkable advantages. It can utilize convenience values of predictor variables. And it automatically allows for intercorrelation among these predictors, as is typical in prediction tasks. No less remarkable, regression models out-predict experts in nearly every field, from clinical psychology to personnel selection (see Sections 16.1 and 16.2 of *Empirical Direction*).

But for *understanding* cognitive process, regression analysis suffers treacherous pitfalls. Detailed discussion of regression analysis, including tests of multiplication models, is given in Anderson (1982, Section 4.3).

**Invalidity of Regression Weights.** Weights of regression variables are sometimes interpreted as measures of importance. That such weights demonstrate “the relative importance placed on” the regression variables is a common misconception. In fact, regression weights are typically invalid as measures of relative importance of variables.

A major source of invalidity is that each regression weight is confounded with the unit of its scale (see *Uniqueness* above). Celsius and Fahrenheit scales, for example, are both linear scales of temperature but their regression coefficients would differ by 5 to 9. Hence they could yield opposite conclusions about relative importance.

Some writers have thought to avoid this unit confounding by stand-
ardizing the values of each variable. This makes matters worse; it further confounds the scale unit with the range of values. Detailed discussion is given in Anderson (1982, pp. 262-265; see Note 11).

Integration Analysis. Standard additive regression models are usually invalid and misleading for analysis of integration process. Correlations higher than .97 can easily be obtained with severely nonadditive models of cognitive process (see Chapter 4 of Anderson, 1982).

Nor does statsig deviation imply a nonadditive model. Deviation may result because values of the regression variables are inaccurate estimates of the true values, or because the response measure is nonlinear.

Analysis of variance, in contrast, avoids the first pitfall because it does not rely on prior values of the stimulus variables. It can also avoid the second pitfall by using an integration law to develop a method for linear response (see also Response Generality).

Nonlinearity and Interaction. Claims for nonlinear or interactive relations based on regression analysis require explicit justification but this is rarely given. Observed nonlinearity may reside entirely in the arbitrary predictor variables and/or in a nonlinear response measure.

Process Analysis. For analysis of cognitive process, standard regression analysis is extremely limited as just discussed. As noted in Empirical Direction, page 514:

Most texts do warn that substantive theory is generally prerequisite for process analysis with multiple regression. These warnings, however, are obscured under the mass of statistical detail, by such phrases as “statistical control,” and especially by students’ implicit assumption that what is being taught must be worth learning. At best, these warnings are little help because little is said about what constitutes adequate substantive theory.

Brunswik’s Lens Model and “Policy Capturing.” The lens model of Brunswik (1956) has been employed by a number of writers (e.g., Brehmer & Joyce, 1988; Hastie & Dawes, 2001) without recognition of its fatal flaws. Brunswik’s lens model is a superficial form of the Integration Diagram. The “lens” is a superficial analogy in which influences are presumed to radiate from variables in the environment and impinge on an imaginary “lens” which “focuses” [integration] them into a response. This lens analogy is helpless with the integration problem.

Integration has usually been handled with an arbitrary assumption of multiple regression; the regression weights are considered to “capture” the person’s “policy.” Fatal flaws of this “policy capturing” have long been known.

One fatal flaw is that the regression coefficients are generally invalid
measures of importance of variables (see *Invalidity of Regression Weights* above). Of course, this vitiates claims for “policy capturing” (Anderson, 1982, Note 6.1.3a). No less fatal, the regression model is generally invalid for integration. One invalidity is that it is blind to what is by far the most common “policy,” namely, averaging (see also Birnbaum, 1976). To capture “policy” requires true psychological measurement which is inherently outside Brunswik’s formulation (see pp. 255, 396f in Anderson, 2008; see also Note 12 below).

**NONARBITRARY METRICS WITH FUNCTIONAL MEASUREMENT**

Functional measurement can contribute to the important task of developing “nonarbitrary” measures of psychological qualities, that is, measures that reflect functional relevance of variables.

**Arbitrary Metrics.** The issue of importance of a measure was emphasized in clear, cogent articles by Blanton and Jaccard (2006a,b). Many measures are “arbitrary,” they say, in the specific sense of being uninformative about their importance in a person’s thought and action. For illustration, they used the Implicit Association Test (IAT) advocated by Greenwald, Nosek, and Sriram (2006), a reaction time measure to variables such as race and gender. Blanton and Jaccard (p. 35) rightly point out that this method lacks both internal and external validity:

> The arbitrary nature of the IAT metric and the fact that the diagnoses have not been linked to any observable acts of automatic preference suggest that researchers have no way of gauging the true magnitude of the implicit preference expressed by a given IAT score.

This is the problem. To say that one person’s IAT race reaction time is twice that of another says nothing about the role of race in either person’s thought and action. It could be unimportant for both.

A pertinent example comes from the study of forgiveness in Lebanon. It seems a safe conjecture that the IAT would have revealed clear prejudice between Christians and Muslims. But the forgiveness judgments showed no sign of this; forgiveness of Christian and Muslim gunmen was virtually identical for Christian and Muslim participants (see Figure 7.5 in *Algebra of Forgiveness*, Chapter 7).

**Nonarbitrary Metrics With Information Integration Theory.** This problem of arbitrary metrics had been explicitly recognized in the earlier criticism of stereotype research in Anderson (1981a, p. 248):
Notably lacking in studies of social stereotypes is the use of tasks that require information integration. If another piece of information that had solid relevance to the judgment were to be included, then a meaningful relative importance could be determined.

The common practice of eliminating everything besides the stereotype information thereby eliminates the possibility of determining importance, at best a treacherous problem (see *Measuring Importance* above). This criticism was repeated in *Stereotype Theory*, Chapter 5 in Anderson (1991b, p. 232):

Integration designs seem essential for stereotype theory. Most stereotype studies use simplified tasks that contain only stereotype information. This can yield artificially large effects because the subject has little else on which to base a judgment. Such effects might be relatively weak.

These comments suggested that stereotype experiments should routinely use integration designs with a pertinent, nonstereotype variable as a standard for assessing importance. With the IAT, for example, participants with different levels of IAT score could judge persons characterized by race or gender, together with evidence on suitability for some position, such as level of education or amount of relevant experience. Such integrated judgments could provide a nonarbitrary metric of racial prejudice (Anderson, 2008, pp. 197, 331).

Integration theory also implies that the concept of “true magnitude” of stereotype scores such as IAT is simplistic; it fails to recognize that expression of any stereotype depends on operative goals. The small effect of religion in the cited forgiveness judgments does not mean it would have small effects in social interaction. The IAT embodies the dominant misconception of social attitudes as one-dimensional, good–bad reactions (see *Functional Theory of Attitudes* in Chapter 8).

**ACHIEVEMENT**

All of us strive for achievement. We hope that, when our lives draw to their close, our teaching and research will have left behind some worthy contribution to the benefit of our students and the progress of our field (see also *Achievement*, pp. 365-371, Anderson, 2008).

*Method* is one guide to achievement, a concern of this chapter. Much earnest effort is being wasted owing to reliance on faulty method. Multiple determination is one example. The importance of multiple determination is widely recognized but the common methods of analysis of variance and multiple regression have serious pitfalls as discussed above with “interactions” and with measurement of importance.
Respect for phenomena is a second guide to achievement. Much of past progress in psychology has consisted of recognizing new phenomena that enlarge and enrich our conceptual horizons. The 20-some issues of the next chapter are grounded on respect for moral phenomena. Moral considerations pervade everyday life. Moral science constitutes a conceptual framework that can unify our fragmenting field (Chapter 8).

APPENDIX: MEASUREMENT THEORY

True measurement of psychological quantities has been actively sought since 1860. This measurement problem appears in the Integration Diagram above: how can we tell whether our observed response, R, is a true measure of \( \rho \)? This might seem impossible—\( \rho \) is unobservable.

An obvious approach is to ask people to give numbers to represent the magnitude of their sensations or feelings. But are these response numbers valid—linearly related to their unobservable feelings?

Metric response methods have been considered invalid by most persons who have sought to develop psychological measurement theory. Instead, they have relied on judgments of greater than/less than, as in Thurstone’s pair comparisons and in conjoint measurement. Solid ground for this denigration of metric response appeared in the nonlinear rating biases noted by Thurstone and reemphasized by the large difference between the rating method and the once-popular, now-defunct method of magnitude estimation (see e.g., Anderson, 1972a, 1981a, Section 5.4, 1996a, Chapter 3; Weiss, 1972; Note 13).

Fechner (1860) proposed a clever assumption for psychophysics: just noticeable differences in sensation are psychologically equal. Hence just noticeable differences may be used as units to measure sensory value, just like centimeters on a meter stick. Fechner’s plausible assumption has continually eluded proof (Note 14).

Thurstone’s (1927) method of pair comparisons finally allowed a proper test of Fechner’s assumption for the special case of psychophysical sensations, such as heaviness and loudness, that can be varied continuously for each individual (see also Link, 1994).

Thurstone’s big claim, however, was that his method also applied with discrete stimuli that are the norm in social–moral judgment, as with seriousness of his list of criminal offenses and especially with general social attitudes. Thurstone’s claim was not justified because it made illegitimate use of individual differences (Anderson, 1981a, Sections 5.3.1 and 5.3.2, 1996a, pp. 85f, 2008, p. 186).

A new approach came in the 1960s with realization that a two-
variable additive law could provide a firm foundation. Two variables would seem to complicate the matter because it is then necessary to take account of the two unobserved $\psi$ values in the Integration Diagram as well as the unobserved response, $\rho$, as in Equation 2 above. Two variables, however, can provide enough mathematical constraint to find a best monotone transformation to additivity and still retain degrees of freedom to test nonadditivity. Two qualitatively different proposals were made to capitalize on additivity structure: conjoint measurement (Luce & Tukey, 1964) and functional measurement (Anderson, 1962a,b).

FUNCTIONAL MEASUREMENT

Empirical laws of information integration are the foundation for psychological measurement. Functional measurement theory is grounded on this base and frame.

A guiding idea of functional measurement is that measurement scales are derivative from substantive theory (Anderson, 1970, p. 153).

The logic of the present scaling technique consists of using the postulated behavior laws to induce a scaling on the dependent variable (Anderson, 1962b, p. 46).

The potential of this functional approach was illustrated with the benefits of the parallelism theorem listed above. Of course, such laws must have empirical reality for these benefits to be real. Such empirical laws are the foundation for theory of psychological measurement.

Algebraic laws had been widely conjectured, of course, as with the equity models of Chapter 2 and with Subjective Expected Value. But without capability for psychological measurement, these conjectures remained conjectures. Using functional measurement, however, the initial 1962 study of person cognition supported an adding-type law in single person design and analysis. Later applications of functional measurement have done well throughout human psychology.

The three integration laws also showed that psychological measurement theory differs conceptually from what were and remain common preconceptions. Six conceptual differences deserve consideration (see also Anderson, 1982, pp. 101-104).

Metric Response. Much cognition is metric, a consequence of the goal-directedness of approach–avoidance in the external world (Metric Cognition, Chapter 7). Linear metric response should thus be a prime goal of psychological measurement. Metric responses can suffer nonlinear biases, however, as with ratings, so virtually all other attempts to develop
measurement theory abjured metric response and grounded themselves on nonmetric, choice response.

Fortunately, the experimental procedures introduced with the rating method in the initial 1962 experiment have been generally successful in eliminating nonlinear rating biases. This method of functional rating can provide true linear response scales even with young children and nonliterate persons.

Metric response was a key to the psychological laws. And thereby a key to true psychological measurement.

**Response Generality.** Metric response methods can have the priceless advantage of *generality*. A method that has yielded a linear scale across a number of empirical situations, as functional rating has done, may reasonably be expected to do the same more generally.

Metric response is important for situations that do not obey a simple algebraic law. Many such situations are known. With a linear response, pattern in an integration graph will be a faithful image of pattern in underlying response—regardless of the integration process.

*Metric response has central importance in psychological science.*

**Interaction and Configurality.** Metric response is invaluable for studying configural integration. With a linear response, deviations from parallelism are clues to understanding interaction and configurality, as with the negativity effect and inconsistency resolution (see *Interaction and Configurality*, Anderson, 2008, pp. 357-364).

**Goal and Context.** *Stimulus values always depend on goal and context.* The same stimulus informer may have very different values relative to different goals. This value dependence is recognized by GOAL in the Integration Diagram of Figure 6.2. This dependence of value on goal is explicit in the valuation operation. This goal dependence of value seems unrecognized in most other measurement theories.

**Weighted Average Model: Importance Weight and Polarity Value.** An essentially new conception of psychological measurement theory is entailed by the averaging law. Most tasks that might have been expected to follow an addition law have instead followed the averaging law. One consequence is that *importance weight* and *value polarity* become coequal measurement parameters.

This two-parameter, weight–value representation emerged from the averaging law with unequal weighting across levels of a single variable. To illustrate, consider judging proportion of blue balls in an urn of red and blue balls. Random samples of 3 red/1 blue and 6 red/2 blue have the
same value, .25. The larger sample carries more information, however, and so has greater weight. Unequal weighting would thus result if sample size was varied across one variable in an integration design.

This unequal weighting was initially unwelcome because it does not follow the simple parallelism theorem and so cast doubt on what parallelism had been obtained. It was a blessing in disguise, however, because it accounts for several observed phenomena such as source reliability and negativity/positivity effects. Moreover, it makes possible measurement of the weight parameter separately from value.

Strict adding models, it may be emphasized, predict parallelism even with unequal weighting. Indeed, the weight parameter is not generally separable from the value parameter in such models.

**Self-Measurement.** Self-measurement has basic importance in functional measurement theory. Self-measurement of response rests on success of an integration model, as with benefit 2 of the parallelism theorem. These response data can be used to derive valid stimulus measures, as with benefit 3 of the parallelism theorem. These stimulus measures may then be used as validation criteria to develop valid methods of stimulus self-measurement.

Self-measurement needs to be extended to handle situations that may not allow formal integration designs or that do not obey an integration law. Much work on multiattribute analysis is of this type (see *Self-Measurement Theory* and *Response Generality* above).

**Scale Types.** The functional conception of scale type implied by the Integration Diagram of Figure 6.2 differs conceptually from the standard conception. Specifically, scale type is defined in terms of the relation between \( R \) and \( \rho \), that is, between responses in the external and internal worlds (see *The Two Worlds*, Chapter 7).

The three common scale types (ordinal, equal interval, and ratio) thus become monotone, linear, and proportional:

- **monotone**: \( R_1 > R_2 \) if and only if \( \rho_1 > \rho_2 \);
- **linear**: \( R = c_0 + c_1 \rho \), with zero and unit constants, \( c_0 \) and \( c_1 \);
- **proportional**: \( R = c_1 \rho \).

The conceptual difference between these two conceptions of scale type may be illustrated by contrasting equal interval scales with linear scales. Equal intervals derive from the conception of measurement scale in terms of additive units, as with additive unit weights or successive marks on a meter stick. This conception of equal intervals entered psychology with Fechner’s jnd scale (Note 14) and has been widely accept-
ed. This traditional conception attempted to place the meaning of equal intervals within the scale itself.

The present functional view, in contrast, places scale type in the relation between the external and internal worlds, R and ρ, respectively. This view is needed to recognize that value depends on operative goals. Establishing scale meaning thus depends squarely on empirical integration laws. Thus, linearity of the method of functional rating was established by empirical success of the parallelism theorem (benefit 2).

**Fundamental Measurement.** Functional measurement is *fundamental measurement*—no prior measurement is necessary to establish true linear scales. Qualitative, rank-order data suffice.

With two or more stimulus variables in factorial-type design, sufficient constraint is potentially available to solve both measurement problems and to provide the necessary test of goodness of fit. No auxiliary assumptions are needed. No prior scales are needed. All that is at issue is the algebraic structure of the model. That provides the base and frame for measurement that is scale-free, or fundamental, not dependent on prior measurement. (Anderson, 1982, p. 207.)

This monotone parallelism theorem requires only a monotone, rank-order response such as may be obtained with choice data. The first step is to estimate a best-fitting additive response (e.g., Kruskal, 1965). The critical problem of testing goodness of fit has been resolved and successfully applied to empirical data (Anderson, 1982, Chapter 5, *Monotone Analysis*; see Note 15).

Behavioral metric responses, such as response rate or amplitude, may thus be validatable as true metrics, which can greatly facilitate experimental analysis, even with infrahumans (Anderson, 2002).

Functional measurement theory implies that measurement in physics also rests on empirical law (Anderson, 1981a, pp. 361f; Masin, 2007).

**CONJOINT MEASUREMENT**

Conjoint measurement is grounded absolutely on nonmetric response. Only ordinal (greater than/less than) response is allowed. Such choice response can be trusted; metric responses such as rating scales were well known to suffer nonlinear response biases.

It seemed a triumph, therefore, when Luce and Tukey (1964) proved that ordinal data were, in principle, sufficient to establish an additive model. This triumph is fruitless, of course, unless their axiomatic base can be used to show that addition laws have empirical reality. Nonexist-
ent laws cannot yield real measurement.

In fact, conjoint measurement never succeeded in establishing any empirical law. Despite extensive mathematical elaboration by persons of high ability, the critical problem of testing goodness of fit was never solved (see Luce, Krantz, Suppes, & Tversky, 1990, p. xiii). Not one single positive empirical application has ever been made in psychology—conjoint measurement has been empirically empty (Notes 16-19).

Indeed, Cliff (1992), formerly a strong proponent of conjoint measurement and critic of functional measurement (Cliff, 1973), concluded that conjoint measurement was “the revolution that never happened.” Cliff reaffirmed earlier evaluations (Anderson, 1974a, pp. 286ff, 1981a, Section 5.5, 1982, Sections 5.4 and 5.5). Indeed, Cliff adopted a standpoint very like functional measurement. Conjoint measurement has been a sterile blind alley in psychology.

The alternative approach of reliance on an empirical algebraic model, now advocated by Cliff, had already been put on a solid empirico-theoretical base with functional measurement (e.g., Anderson, 1974a,b,c, 1981a, 1982).

Functional measurement is the revolution that did happen.

Conjoint measurement rested on simplistic preconception of psychological measurement. Six aspects of this misconception appeared in the preceding discussion of functional measurement. Most important are:

- Conjoint measurement is empirically empty. Although it grounds itself on algebraic models, it has been unable to show empirical reality of any model. Conjoint measurement thus lacks scientific usefulness in psychology.
- Conjoint measurement missed the fundamental importance of metric response in the approach–avoidance actions of living (see Metric Cognition in Chapter 7).
- Metric response allows response generality which can analyze configural integration outside the scope of conjoint measurement theory.
- Conjoint measurement cannot handle the ubiquitous averaging model because this model requires two coequal parameters—polarity value and importance weight. Hence the averaging model can be disordinal (see Opposite Effects in Chapter 1).
THE NATURE OF PSYCHOLOGICAL MEASUREMENT

Measurement has fundamentally different nature in psychology and in physics. Typical physical measures are properties of physical entities, as with length and mass. These can be measured in themselves with additive units.

Psychological measures, in sharpest contrast, are goal-oriented constructions of the organism—functional measures. The same external situation may thus yield different measures depending on the goal of the organism. This is clear with social–moral judgment but holds generally, even with vision or emotion.

The difference between psychological and physical measurement also appears in the multi-quality nature of many responses, noted above with deserving and punishment. Conflict situations, similarly, often involve resultants of two conflicting tendencies, as with joint feelings of forgiveness and nonforgiveness (see *Algebra of Forgiveness*, Chapter 7).

The integration laws arise out of the goal-directedness of living. And they provide a metric base for deeper analysis of thought and action which deserve systematic study (see *Response Quality* and *Profile Analysis* above; Notes 20, 21).

We are fortunate in the extensive validity of the integration laws; they allow true measurement for individuals, both for response and for stimuli (benefits 2 and 3 of the parallelism theorem). These measures provide a priceless foundation for psychological science.

NOTES

Note 0. I should acknowledge that my own practice falls short of ideal. In part, this results from my gradual realization of some of the issues discussed in this chapter (see e.g., *Gratitude and Ingratitude*, Chapter 7; see also Note 7.18a in Anderson, 1982).

Note 1. Serial integration designs (e.g., Figure 8.3) may profit from fractional replication. As one illustration, 6 serial positions could be included in a 1/8 replication of a 2^6 design. This would estimate main effects for all 6 serial positions with 1 df for selected interaction. An example is given in Figure 10.9, p. 340 in Anderson (1996a).

To include a fourth variable in the Latin square design tabled in the text, couple one of its levels with the three conditions in each row of the table. The SS for each of the four variables is obtained in the standard way from the three totals, one for each level of that variable on 2 df. These four SSs are orthogonal, using all 8 df available from the 9 conditions. An error term requires replication, either between subjects, or within subjects for single subject design and analysis (Anderson, 2001, 2002).

Note 2. Equal attention to each stimulus informer is important for the parallelism predicted by the averaging model. Accordingly, instructions in the personality adjective task
Chapter 6

stated that each adjective was contributed by a different acquaintance who knew the person well. Timing should be controlled to prevent hasty responding. Previous response may influence present response, one reason for using graphic rating. It may be useful to present end anchors occasionally during the experiment.

Stimulus value \( \psi \) might properly be conceptualized as a distribution rather than a fixed number (Anderson, 1982). Studies with the personality adjective task indicated that operative value was influenced by the other adjectives on an initial trial but thereafter remained fixed (Anderson, 1969; Anderson & Clavadetscher, 1976). This is one reason for stimulus familiarization in the preliminary practice. Of course, such value interaction during the experiment would be expected to violate parallelism (see also Construction of meaning by association, p. 138 in Anderson, 2008).

Note 3. The extreme claim that people are never aware of the causes of their behavior (Nisbett & Wilson, 1977; Nisbett & Bellows, 1977) would disable self-estimation. And indeed there are multiple lines of evidence for nonconscious cognition including blindsight and posthypnotic suggestion as well as the size-weight illusion of Figure 7.2.

The cited articles, however, claimed that any accuracy of self-estimates derived entirely from shared cultural norms. This claim of zero personal knowledge was disproved in ingenious work by William Wright (1995), who resolved two subtle difficulties that had vitiated previous attempts (see Note 14, p. 391f, in Anderson 1996a).

Note 4. For completeness, the addition model of Equation 1 would include weights for each stimulus variable as well as an additive constant to represent prior state of the participant, denoted with subscript 0:

\[
\rho_{jk} = \omega_o \psi_o + \omega_{Aj} \psi_{Aj} + \omega_{Bk} \psi_{Bk}.
\]

This model makes the same parallelism prediction. It is convenient to use the simpler Equation 1, in which \( \psi \) actually stands for \( \omega \psi \).

Note that importance weight and value polarity are completely confounded in the addition model. They act jointly as the effective value; what is estimated by the marginal means is thus the product, weight \( \times \) value = \( \omega \times \psi \), also called part-worth (Note 22).

Note 5. Observed parallelism is not absolute proof of additivity. It is logically possible that nonadditivity in the integration operator, \( I \), is exactly cancelled by nonlinearity in the action operator, \( A \), to yield net parallelism. This logical possibility is no longer a serious concern (see Anderson, 1982, p. 71, 1996a, pp. 94-98, 105).

Note 6. Prior State. Prior state was originally called initial impression in the personality adjective task. It was needed, in particular, to harmonize the averaging model with the set-size effect (more polarized response for more stimuli of equal value) which was verified quantitatively (Anderson, 1967) Prior state is essential in parameter estimation for the averaging model with unequal weights. The new term, prior state, was adopted in place of initial impression by analogy to prior belief in Bayesian theory.

It should be recognized, however, that prior state is more general than Bayesian prior belief. It applies to the averaging model, which seems outside the scope of standard Bayesian theory. Also, it applies to metric judgments such as the president attitudes of Figure 6.1. The Bayesian model seems limited to response probability.
Note 7. Franklin’s simple form of multiattribute analysis for choice between two actions was given in a 1772 letter to his friend, Joseph Priestly, a famous British chemist and a nonconformist minister who opposed his government’s policies toward the American colonies. Franklin’s method was to list pros and cons in separate columns and cross out combinations that seemed to cancel; what remained would then determine his choice. This short letter, reproduced on pages 253-254 of Franklin (1792/1983), ends by calling his method “moral or prudential algebra” (see Note 6 in Moral Philosophy, Chapter 7).

Note 8. Correlational studies are stock-in-trade in health psychology, but seldom with honest acknowledgment of their severe limitations. As one of many examples, Taylor’s (1994) Health psychology rested almost entirely on correlational “associations” with almost no discussion of their many limitations, even less on how to do valid investigations.

Correlations can, of course, be useful clues to causation, but they deserve clear indication of confounding factors. Wolf’s (2011) critique of breast- versus bottle-feeding rightly emphasizes the many confounds, especially diverse mother-infant attitudes.

One experimental approach could manipulate “contact comfort,” which accompanies breast feeding, seeking for optimal mode. And which may have important effects with bottle feeding as well. This approach could be helpful with mothers who have little milk or to whom breast feeding is painful. An interesting experimental study by Bakker and Van Acker (2011) studied algebraic rules for integrating advantages and disadvantages on attitude toward breast feeding.

Note 9. A number of writers have advocated systematic study of Anova interactions as a means to deal with the multiplicity of operative variables and context effects. This strategy rests on implicit reification of Anova with no recognition of the dual problems of response linearity and integration model discussed in the text (see Section 7.4, Interactionist Theories and especially Section 7.6.4, Statistics Teaching, in Empirical Direction; see also “Interaction” as Attitude Integration Theory, pp. 133ff, Anderson, 2008). A pertinent example is given in Note 2 under Person Science and Personality in Chapter 7.

Note 10. Relative Range Index in Face Cognition. Pregnant application of the relative range index to measure importance of facial action units in pain perception is presented by Oliveira, de Sá Teixeira, Oliveira, Breda, and da Fonseca (2007; see also de Sá Teixeira & Oliveira, 2007). They used ecological ranges of three muscularily-based facial action units (brow lowering, levator contraction, orbit tightening) with natural-looking synthesized faces. Hence relative range indexes were valid measures of relative importance of these action units. Cogent extension to much-needed theoretical–empirical clarification of holistic processing of faces has been given by Oliveira, Silva, Viegas, Teixeira, and Gonçalves (2011, 2012).

This work represents a basic shift in face cognition—away from conventional taxonomies to functional analysis. Integration of facial action units is fundamental in face cognition, as Oliveira, et al. point out. This and other of their studies indicate the importance of algebraic integration laws for functional theory of face cognition. As one example, they extend three published sets of verbal-categorical rankings of pain levels to exact metric values.

Their approach also has notable generality; they can go beyond face cognition per se to study general social interaction. This involves integration of verbal cues together with nonverbal cues such as gesture and tone of voice, as well as facial cues per se.
Chapter 6

Note 11. To illustrate the invalidity of standardized regression coefficients as measures of relative importance, consider the equal weight regression, \( R = X + Y \). Assume \( X \) and \( Y \) both have mean 0, standard deviations of 1 and 2, respectively. The standardized variables are \( X' = X \), \( Y' = Y/2 \). Regression with standardized variables is \( R = X' + 2Y' \)—contradicting the given condition of equal weights.

Note 12. Ecological Validity and Invalid Ecology. Brunswik’s (1956) lens model rests squarely on the assumption that the environment constitutes an ecology that operates as a validity criterion. This assumption may have seemed reasonable for perception of the physical world, with which Brunswik was originally concerned. Some writers, however, have transposed this approach to the human world, failing to realize that the human ecology is often invalid.

A striking case of invalid ecology appeared with the study of bail setting by Ebbesen and Konečni (1975) discussed in Chapter 4. Judges integrated relevant variables such as family ties sensibly in the privacy of their chambers but ignored such variables when setting actual bail in the courtroom. These actual bail settings constitute the ecology but are evidently invalid justice.

In this example, as in much of human affairs, the main problem is to change the ecology. Other prime examples include family life, school education, and the social–moral world.

Note 13. Magnitude estimation uses metric response and was once extremely popular. Magnitude estimation repeatedly failed tests of validity, however, and has been virtually abandoned, a blind alley that contributed almost nothing of substance (see e.g., Anderson 1974a, 1981a, Section 5.4, 1982, pp. 19-21, 1996a, Chapter 3; see also Achievement, pp. 365-371 in Anderson, 2008).

Note 14. Fechner’s just noticeable difference, \( \Delta S \), may be defined in terms of that stimulus intensity, \( S + \Delta S \), that is judged larger than \( S \) on (say) 75% of the trials. Empirically, \( \Delta S \) is approximately proportional to \( S \) over the main range of many physical sensory dimensions, such as heaviness (grams). In physical units, therefore, \( \Delta S / S \) is approximately constant (Weber’s law).

Fechner’s basic assumption was that all \( \Delta S \)s, although different in physical size, are equal in psychological size by virtue of their just discriminability. This plausible assumption yielded Fechner’s psychophysical law, \( \psi = c \log S \), where \( c \) is a unit constant of proportionality, which is approximately correct for many sensory dimensions, as in the common decibel scale of loudness. But 150 years of determined efforts failed to prove Fechner’s plausible assumption.


Note 15. This base in monotone functional measurement justifies treating the parallelism theorem as fundamental measurement. The metric response is what would be obtained with monotone analysis but more simply and more exact.
Note 16. Conjoint measurement is a failure in psychology; it has failed to measure anything. It lacks capability for the essential step of testing goodness of fit. As Luce, Krantz, Suppes, and Tversky (1990, p. xiii) admit: "The chapter on statistical methods was not written because the development of statistical methods for fundamental measurement turned out to be very difficult."

In fact, statistical methods for fundamental measurement with choice data had been provided with functional measurement. Monotone functional measurement can provide the needed statistical analysis and has been successfully applied to empirical data (Anderson, 1982, Chapter 5). Advocates of conjoint measurement could have used these nonmetric methods to measure something but they have never done so.

As Shanteau, et al. (2007) point out, Coxon (2005) was misled in believing the claim by Krantz, Luce, Suppes, and Tversky (1971) that conjoint measurement analysis showed that the city-occupation data of Sidowski and Anderson (1967) were additive, not nonadditive as Sidowski and Anderson claimed. Krantz, et al. reported that the first replication of this experiment did not violate their rank order test for additivity. But they failed to report that the same test on the second replication, which they used to break a tie in the first replication, did violate their rank order test (Anderson, 1982, pp. 222ff).

Note 17. This distrust of rating scales was succinctly expressed by Luce and Galanter (1963, pp. 264f):

To the theorist, however, the whole business is a bit hair-raising. To calculate the means of category labels, to plot them against physical measures of the stimuli, and then to discuss the form of the resulting function strikes him as close to meaningless. . . . we do not think that the absolute form of the obtained function using the first \( k \) integers as labels has any meaning (Luce & Galanter, 1963, pp. 264-265). [But see Note 18 below.]

This quotation missed the biopsychological importance of metric cognition. The standard category rating scale is an internalization of the goal-directedness of living (see Metric Cognition, Chapter 7). Its latent linearity has been actualized with the method of functional rating and especially by the extensive success of the laws of information integration. The method of functional rating solved this long-standing roadblock to theory of psychological measurement.

Note 18. Nonmetric choice response was taken as fundamental in Luce’s choice model as well as in all work on conjoint measurement. Luce’s position seems to have changed. An about-face may have appeared in Luce’s position on psychological measurement. Whereas functional measurement has been dedicated to continuous response measures, Luce has been dedicated to discrete choice measures, both in his choice theory and in his extensive work on conjoint measurement. About-face appears in Luce, Mellers, and Chang (1993, p. 115), who rely on continuous response measures and conclude that “Choice is viewed as a derived, not a primitive, concept.” (Empirical Direction, p. 736)

In IIT, continuous response measures have always been primitive concepts (Anderson, 1962a,b). Choice has thus been viewed as a derived concept from the beginning.

Note 19. Conjoint scaling, sometimes misnamed conjoint measurement, usually relies on metric response analyzed with multiple regression or analysis of variance. The term “conjoint” may be misleading because conjoint scaling differs sharply from conjoint measurement which absolutely disallows metric response.
Practical methods and applications of conjoint scaling are discussed systematically in the text by Louviere (1988). Louviere recommended functional measurement as conjoint scaling; it was the only one that dealt with the critical question of goodness of fit and hence of measurement validity. Functional measurement was thus the only one that could provide true measurement. Moreover, it had actually been successful.

Note 20. Hedonic psychophysics may be a useful domain for studying multi-quality experience. Taste is one example. Different taste qualities such as sweet, bitter, temperature, crunchiness, odor, and so forth seem well defined both physically and psychologically, alone and in various combinations. Although rather afield from social–moral phenomena, their physical manipulability and their experiential qualities in combinations are attractive for experimental analysis and could be used in tandem with social–moral qualities (see further *Hedonic Psychophysics*, Anderson, 2008, pp. 291f; McBride, 1989, 1993; McBride & Anderson, 1991).

Taste has an additional advantage of allowing comparative studies with animals, which can employ methods not feasible with humans including extended sessions and motivation produced by deprivation. Four integration studies are reported in Anderson (1978a, 1996a, p. 104) including the notable study of food–shock motivation by Farley and Fantino (1978).

The adding-type law is considered an innate integration capability which suggests it may also be present in lower animals. One possible integration task could study response rate to obtain a plate with varied amounts of two foods of different hedonic value. Evidence from operant studies suggests that response rate may be a linear scale (Anderson, 1996a, p. 104). Perhaps a graphic rating-type response could be trained.

Note 21. One issue for profile measures concerns the relation between the separate components and the overall judgment. With ambivalent attitudes, for example, is the overall attitude any simple integration of the positive and negative components?

In general, each component quality may contain unique information that warrants separate study, despite commonality with other component qualities. Quality analysis is a prime field for psychological measurement theory.

Note 22. Goodness of Fit and Parameter Estimation.

Information Integration Theory rests on extensive experiments that have revealed algebraic models of stimulus integration in most fields of human psychology, even in young children. Two statistical issues arise with these models: goodness of fit and parameter estimation. Detailed discussion of these issues is given in Anderson (1982; see also 2001, 2002). A brief overview is given here.

**Goodness of Fit.** Does the model account for the data? This question requires statistical test whether the deviations from the model are statsig. Standard correlation analysis is invalid for testing goodness of fit as detailed in the main text.

Add–ave models imply that deviations from parallelism in a factorial integration design are not statsig. This implication may be tested with the interaction term from analysis of variance (Anova).

This Anova test requires independent responses except as allowed with repeated measurements Anova. Independent responses requires care in experimental procedure. Thus, the initial practice is intended to stabilize the stimulus values and the frame of reference for the response. Influence from previous response is undesirable, one reason
for using a graphic response that does not remain visible. Presenting trials in random order can randomize out possible carryover.

Power may be markedly increased with repeated measurements design (see legend of Figure 6.1) and even more with single subject design. Cluster analysis may be generally useful.

**Parameter Estimation.** Functional measurement rests on the principle that the model uses—and provides—the stimulus values that functioned in the integration. Estimation of these functional values depends on the model. A linear response measure is assumed in what follows.

*Strict Additive Models.* The two-variable additive model, error omitted, may be written as follows:

\[ R_{jk} = C_0 + \omega_{A1} \psi_{A1} + \omega_{Bk} \psi_{Bk}. \]

The difference between rows 1 and 2 is thus the difference between two part-worths,

\[ R_{1k} - R_{2k} = \omega_{A1} \psi_{A1} - \omega_{A2} \psi_{A2}, \]

which may be averaged over the column index, k. These differences are on a proportional scale with a true zero; the same scale holds for the column part-worth differences.

*Averaging Model: Equal Weight.* The two-variable averaging model with equal weights may be written

\[ R_{jk} = (\omega_{A1} \psi_{A1} + \omega_{A2} \psi_{A2} + \omega_{Bk} \psi_{Bk}) / (\omega_{A1} + \omega_{A2} + \omega_{Bk}). \]

The denominator has the same value in every cell of the design. With equal weighting of each separate variable, therefore, the averaging model is formally an additive model and the analysis of the previous section applies.

Separate estimates of weight and value can be obtained by including the two one-way designs. This may require iterative analysis, however, as with Average.

*Averaging Model: Unequal Weights.* With unequal weighting across levels of any one variable, the averaging model is nonlinear. Parallelism analysis does not apply but the Average program may be used to estimate parameters and test goodness of fit (Zalinski & Anderson, 1989, 1991). Practice with artificial data before running the experiment is advised.

A special case arises when the weight can be expressed as a linear or quadratic function of the scale value, as with the negativity effect. This allows a fairly simple analysis, illustrated with clinical judgment in Anderson (1972).

*Multiplying Model: Linear Fan Theorem.* The multiplying model may be written

\[ R_{jk} = C_0 + \psi_{A1} \psi_{Bk}. \]

This equation implies that the row curves will form a diverging fan of straight lines if the column stimuli are spaced at their functional values on the horizontal axis. These functional values may be estimated by the column means. Analogous to the parallelism theorem, an observed linear fan supports three benefits:

- Benefit 1: support for the multiplying model.
- Benefit 2: support for response linearity.
- Benefit 3: linear scales of both stimulus variables.

Statistical analysis is straightforward. The linear × linear SS should be statsig and all other components should be nonstatsig. Weiss (2006) includes a disc with a computer program (see further Anderson, 1982, Section 2.2.1).

*Multivariable Models.* The foregoing results generalize fairly simply to integration models with three or more variables. Further discussion is given in Anderson (1982), especially for the averaging model with unequal weights which may allow simpler weight estimation.
Issues in Moral Science

Chapter 7

Twenty-eight topics in moral science are discussed briefly in this chapter. Some address moral issues that deserve systematic empirical analysis. Experimental studies of obligation and deceit, for example, are rare despite millennia-old concern. Some concern theoretical issues, including person science, conflict/compromise, and deserving theory. Others are more concerned with betterment of the moral level of society, as with family life and our educational system.

The Two Worlds: Internal and External (2)
Psychological Measurement Theory (3)
Metric Cognition (5)
Verbal Reports (6)
Science of Phenomenology (8)
Deserving Theory (12)
Conflict and Compromise (13)
Gratitude and Ingratitude (21)
Algebra of Forgiveness (24)
Lies and Deceit (34)
Crime and Human Nature (37)
Person Science and Personality (39)
Group Dynamics (46)
Positive Psychology (48)
Analytic Context Theory (51)
Goal Theory (53)
Affect Is Information (57)
Mood Is Information (58)
Emotion Integration Theory (59)
Language Algebra (60)
Attitude Integration Theories (61)
"Bias" (63)
Objections to Psychological Algebra (65)
Intuition (69)
Moral Philosophy (70)
Virtue Psychology (79)
Moral Science as Descriptive/Prescriptive (80)
Education (81)
THE TWO WORLDS:
INTERNAL AND EXTERNAL

Information Integration Theory is a science of the internal, psychological world. Relations between observable stimulus fields and observable responses reside primarily in the internal world. Psychological science must, and can, be based on structure and function of this internal world—polar opposite to behaviorism.

This internal, psychological world obeys mathematical order revealed by the psychological laws of information integration. The three-fold difficulty of establishing an integration law appears in the three operations—valuation, integration, action—of the Integration Diagram (next page). Valuation transmutes an observable stimulus informer, $S$, into a goal-oriented internal value, $\psi$. Integration unifies multiple $\psi$s into a unitary response, $\rho$. Action externalizes $\rho$ to become an observable $R$.

Three unobservables thus lie between the two observables, $S$ and $R$. Determining these three linked unobservables might seem impossible.

Almost miraculously, this problem of the three unobservables has a simple solution. Parallel integration graphs support three propositions (benefits 1, 2, and 3 of the parallelism theorem of Chapter 1):

1. integration follows an adding-type law;
2. the observable $R$ is a true measure of the unobservable $\rho$;
3. true measures of unobservable $\psi$ values are readily available.

The integration laws thus solved the long-troubling obstacle of true psychological measurement. In so doing, they showed that measurement theory was conceptually different from still-prominent preconceptions.

These three benefits are real, of course, only if the integration laws have empirical reality. Empirical reality has been demonstrated repeatedly over the last half-century by many workers in many countries in almost every field of human psychology: person science, moral cognition, social attitudes, motivation, emotion, learning/memory, language, perception, judgment—decision, and life-span development. Young children, in particular, showed algebraic laws of information integration—cognitive capabilities far higher than previously recognized.

These integration laws are *idiographic* and *nomothetic*. They hold with single persons and can measure their personal values. These laws are a foundation for unifying psychological science.
PSYCHOLOGICAL MEASUREMENT THEORY

Figure 7.1. Information integration diagram. Chain of three operators, V → I → A, leads from observable stimulus field, {S}, to observable response, R.

Valuation operator, V, transmutes stimuli, S, into subjective representations, ψ.
Integration operator, I, transforms subjective field, {ψ}, into internal response, ρ.
Action operator, A, transforms internal response, ρ, into observable response, R.

How are two or more variables, such as S_A and S_B in the above Integration Diagram, integrated to yield a unitary response R? The Axiom of Integration poses three basic problems for cognitive theory.

First problem: is our observable response, R, a faithful measure of the unobservable response, ρ? Second problem: can we measure the subjective values ψ_A and ψ_B that are integrated to yield ρ? Third problem: does any rule govern how ψ_A and ψ_B are integrated to yield ρ?

All three problems deal with unobservables in the internal world. Can it actually be possible to solve these three unobservables? We can manipulate S_A and S_B and we can observe R. We must work with these observables. Can they possibly suffice??

The answer is yes. By an inestimable blessing of Nature, many integrations follow simple adding-type laws. A pattern of parallelism in an observable integration graph solves all three unobservables of the internal world (benefits 1, 2, 3 of the parallelism theorem of Chapter 1).
These empirical laws, established by dedicated investigators in many nations, are the base and frame for functional measurement theory.

This problem of psychological measurement had resisted solution ever since Fechner made it prominent in psychophysics in 1860. One obstacle was the prevailing image of physical measurement, which was considered to rely on additive units. Thus, the physical weight of an object is measurable by adding up the number of unit weights needed to balance it on a balance scale. Fechner tried to do just this by adding up jnd’s (Note 14, Chapter 6). However, the critical issue, equality of jnd’s, remained moot. A special committee of the British Association for Advancement of Science concluded that true measurement in psychology was impossible because the condition of equal psychological units could not possibly be established (Ferguson, 1940).

The solution to this measurement problem lay in a conceptual shift from additivity in the external physical world to additivity in the internal psychological world. Such additivity was found in the integration laws: conclusion 1 of the parallelism theorem (Chapter 1). Then conclusion 2 of the parallelism theorem states that observable response R is a linear measure (equal additive units) of the unobservable response ρ. Also, linear measures of the internal stimuli, ψ_A and ψ_B, are available (benefit 3 of the parallelism theorem).

A guiding idea of functional measurement is that measurement scales are derivative from substantive theory. (Anderson, 1970, p. 153.)

Success of this functional theory of measurement rested squarely on the empirical reality of laws of information integration. These empirical laws are the base and frame for true measurement—of both response and stimulus—in the internal, psychological world.

This empiricist orientation hardly seemed attractive in the beginning. Algebraic laws had been conjectured in nearly every field of psychology but all were roadblocked by the critical problem of true psychological measurement. Success depended on experimental procedures to remove biases that can trouble the rating method (see Nature of Psychological Measurement, Chapter 6; see also Twelve Theoretical Issues, pp. 54-68 in Anderson, 2008).

The integration laws provide a new foundation for psychological science. The Axiom of Integration is universally recognized but popular methods of attack have been markedly unsuccessful. The Axiom of Purposiveness can be studied with new theory and method that are effective in every field of psychology, from psychophysics to person science.
METRIC COGNITION

The metric nature of thought and action is so common we seldom give it much attention. Metrication underlies much interaction with the external world, as with seeing and acting in local space. Metrication is a major function of senses, as with localization and intensity of sound or pain.

The same holds for much social information. We like or dislike particular traits or specific behaviors of our family members or coworkers. We judge them on various forms of deserving: praise, blame, forgiveness, and so on. Metrication is a fundamental cognitive process.

This metric nature of cognition derives in part from evolutionary adaptation to a metric physical world of distance, size, temperature, and so on. No less, metric cognition derives from goal-oriented character of living—approach/avoidance reactions in the external world (Anderson, 1996a, pp. 99ff).

A critical obstacle is that cognitive metrics are unobservable. Experienced loudness of a sound, for example, is not a linear function of its physical intensity. The obvious tack of asking the person to give a number to represent loudness must show that this number is a faithful measure of the inner experience, an obstacle that long resisted solution. With nonphysical concepts such as blame or obligation, this measurement obstacle seems even greater because physical measures do not exist.

This measurement obstacle to analyses of mental concepts was resolved by discovery of three laws of information integration. These laws showed that measured response can be a faithful function of the inner experience, $R$ and $\rho$, respectively, in the Integration Diagram (benefit 2 of the parallelism theorem; see also Verbal Reports next).

These integration laws embody the metric nature of cognition. These laws provide a base and frame for general cognitive theory.

Moral cognition exhibits these same integration laws. This was seen with fairness and unfairness in Chapter 2, with blame in Chapter 3, and with legal issues in Chapter 4. The same holds for moral judgments by young children (Chapter 5). These laws provide an effective foundation for general moral theory.

Note. In IIT, metrication is hypothesized to rest on a general metric sense that may be applied to particular qualities and concepts. Judgments of specific qualities, like/dislike, right/wrong, likelihood/unlikelihood, and others, are considered to be blended into this general metric sense to produce quantified qualities (Anderson, 1974d, 1981a, p. 10).
VERBAL REPORTS

Psychological science of humans depends heavily on verbal reports about internal feelings or processes. Validity of these verbal reports is a prime question: are they faithful representations of the internal world? Two questions are involved.

TWO QUESTIONS: TWO ANSWERS

First question: can verbal reports be faithful representations of conscious experience? Second question: is conscious experience a faithful representation of cognitive processing?

Both questions can be answered with integration experiments; one from psychophysics is shown in Figure 7.2. Participants lifted a cubical block varied in size and gram weight and judged its felt heaviness using the method of functional rating.

Figure 7.2. Parallelism supports adding-type rule for size-weight illusion. Subjects lift and judge heaviness of cubical blocks in 3 x 5, Gram Weight x Block Size design. Verbal rating in left panel, graphic rating in right panel. The slope of the curves provides a true linear measure of the nonconscious heaviness effect of visual size. (After Anderson, 1970a.)

The answer to the first question can be yes. Near-parallelism of the three curves in each panel supports an adding-type integration rule—and hence the linear veridicality of this verbal response method (benefit 2 of the parallelism theorem of Chapter 1). This response linearity, however, depends on the method of functional rating (Chapter 6). Ordinary rating responses are often not linear, only monotone (ordinal).
The answer to the second question is no. The upward slope of the curves in each panel show that the same gram weight feels heavier in a smaller object. But what people are aware of is the unitary sensation of their lifting effort, unaware of the preconscious effect of visual size, much less of its additivity. (Theoretically, the kinesthetic lifting sensation and the contrast between it and the expectancy based on the visual appearance are added preconsciously to produce conscious sensation; see further Anderson, 196, pp. 286-290.)

There is a third question: can verbal reports yield faithful representation of nonconscious experience? Yes, as this size–weight experiment illustrates. The integration laws are thus a base for Science of Phenomenology discussed in the next section (see also Self-Measurement Theory in Chapter 6; Verbal Reports, p. 346f, Anderson, 2008).

PERSON COGNITION

The same three questions arose with person cognition, especially with judgments of persons described by a set of personality trait adjectives. In these experiments also, observed parallelism supported both a simple adding-type model and a true linear rating method (e.g., Anderson, 1962a). This veridicality of the method of functional rating has been a powerful tool for general theory of cognition.

In person cognition, however, participants give detailed reports about their cognitive processes. They claim that the trait adjectives interact to change one another’s meanings during the integration process. But this claim is false; the parallelism disproves such interaction.

In person cognition, as this example shows, conscious experience can be a cognitive illusion; it can misrepresent the nonconscious process of cognitive integration. Other examples include the dissociation between attitude based on verbal materials and the recall of those materials (Figure 8.2) and the failure of moral theories based on verbal rationales (see Moral Stage Theories, Chapter 5). On the positive side, the integration law provides a penetrating method for cognitive analysis of nonconscious processing (see also Science of Phenomenology, next section).

In moral philosophy, verbal analysis is the standard mode of inquiry (see Moral Philosophy below). This mode of inquiry is not trustworthy, as shown in the cited integration experiments. For human relevance, moral philosophy needs grounding on empirical psychological science.
Has psychology thrown out the baby and busied itself with bathwater? Everyday conscious experience, of blaming or caring, say, or of a moral dilemma, seems far distant from standard concerns of experimental analysis or even of personality theory. The same applies to conscious experiences of the external world, as with music or with facial–verbal expressions of your spouse. Indeed, early investigators considered conscious experience to define psychology, a view that has retained some popularity ever since. Lack of productive method and theory, however, have been serious obstacles.

The theme of this section is that the three laws of information integration provide a base for developing a science of phenomenology.

FIVE PROBLEMS OF SCIENCE OF PHENOMENOLOGY

**Validity Problems.** Is overt report a valid measure of underlying consciousness? Inability to answer this question led to demise of the early introspectionist schools and to the behaviorist denial of the question itself. This validity problem remains an obstacle (Note 1).

In the Integration Diagram of Figure 7.1, this validity question asks whether the observable response R is a linear measure of the unobservable ρ. The answer can be yes, as indicated by benefit 2 of the parallelism theorem of Chapter 1. The evidence for the three laws of information integration in nearly every field of human psychology thus provides a base for developing a science of phenomenology.

A pertinent example of this validity problem occurred in the original study of person cognition, in which participants judged likableness of hypothetical persons described by a set of trait adjectives (Anderson 1962a). Phenomenology gives compelling evidence that the adjectives interact to change one another’s meanings. But the parallelism obtained in the integration graphs indicated otherwise, a conclusion solidly verified in subsequent work.

In itself, the phenomenal feeling was genuine. The conclusion of meaning change, however, was a phenomenal misinterpretation. Instead, the phenomenal feeling was shown to be a halo effect (Anderson, 1971b; Simpson & Ostrom, 1975; see Section 3.2, Studies of the Positive Context Effect, in Anderson 1981a). Similar views have been adopted by others (e.g., Nisbett & Wilson, 1977). This halo effect became under-
standable by virtue of the integration laws (see Figure 3.2, p. 167, Anderson, 1981a; Note 14, pp. 391f, Anderson, 1996a).

**Integration Problem.** Conscious experiences are generally integrals of multiple determinants. This integration problem remains terra incognita to virtually all approaches to phenomenology.

By a blessing of Nature, the three laws of information integration have been well-established in many areas including person cognition, attitudes, moral judgment, cognitive development, psychophysics, judgment–decision, learning/memory, and language (see Chapters 4, 5, 6, 7, 8, 9, 10, 11, and 12 in Anderson, 1996a).

**Valuation Problem.** The values that become integrated into conscious experience can help understand such experience. True measures of these values for individual persons can be available when an integration law holds (benefit 3 of the parallelism theorem). These values are goal-dependent (leftmost GOAL in the Integration Diagram), a unique aid for theory of purposiveness (see Goal Theory below). How values are constructed, however, remains an open question.

**Nonconsciousness.** Conscious experience always depends on nonconscious determinants. A simple example appears in the size-weight illusion of Figure 7.2. People experience a unitary sensation of heaviness; the influence of visual appearance remains nonconscious. Everyday examples appear in seeking a word to express your meaning.

A more complex example appeared in the blame law of Chapter 3, Blame = Responsibility + Consequences. The value of Responsibility may depend on diverse determinants such as memories of blamee’s previous behaviors that operate at semiconscious levels.

In this integrationist view, conscious and nonconscious are intimately related. There is no sharp division. Understanding conscious experience depends on understanding nonconscious and semiconscious processing. This approach recognizes the importance of affect at both conscious and preconscious levels (see Affect Is Information below; see also index entries for conscious/nonconscious in Anderson, 1996a).

**Measuring the Nonconscious.** The nonconscious can be measured with an integration law. These laws can disintegrate an overt response into its determinants—including nonconscious determinants (benefits 3 and 5 of the parallelism theorem). The size-weight illusion of Figure 7.2 just above is a simple example (see also Cognitive Unitization in Chapter 1).
FURTHER PROBLEMS OF PHENOMENOLOGY

Definition of Phenomenology. In the inductive philosophy of Information Integration Theory, definition of phenomenology is considered to arise gradually from experimental analysis. A common approach, in contrast, seeks to begin with a definition, which leads to fine verbal edifices but little agreement or progress (see e.g., Nixon, 2010; Velmans, 2000). Study of phenomenal blends, for example, has made little progress.

Phenomenal Blends. Conscious experience is often, perhaps always, a blend of several qualities. Examples include blame (Chapter 3), face perception, attitudes towards women (Anderson, 2008, p. 185), and so on. Study of blends is one task for science of phenomenology. Integration theory can help (see Response Quality, Chapter 6).

Purposiveness. Thought and action are purposive, aimed at goals, as emphasized by the threefold GOAL in the Integration Diagram. Values are not in the stimuli; instead, values are constructions that depend on individual knowledge systems and operative goals. The measurement capability of the integration laws provides a foothold for goal theory (benefits 3, 4, and 5 of parallelism theorem; see Goal Theory below).

Analytic Holism. That stimulus fields act configurally or holistically may seem obvious to naïve phenomenology, unaware of preconscious valuation and integration processes. Face cognition is a prime example. Thus, Shanteau and Nagy (1976, 1979) found that a multiplication model gave excellent accounts of females’ judgments of date attractiveness of male photographs in single-person analysis (see Figure 1.24, p. 76, in Anderson, 1981a). Truly impressive work on face cognition by Armando Oliviera and associates (2007, 2009, 2012) has found extensive support for analytic holism.

Music is another interesting example. Makris and Mullet (2003) found that pleasantness of short musical themes with four variables—rhythm, theme, pitch, timbre (violin, flute, guitar)—followed an adding-type law (see Figure 10.2, p. 290, in Anderson, 2008). In particular, rhythm and pitch, a controversial example, did not interact. Additivity held for naïve participants and advanced music students.

Cognitive Unitization and Gestalt Analysis. Some stimulus fields may be truly configural, not reducible to part-wise analysis, as Gestalt psychologists have long claimed. One contribution to gestalt analysis is exact measurement of gestalts. In the foregoing example of music, rhythm involves perception of pattern. It can be treated as a cognitive unit, how-
ever, by virtue of the principle of Cognitive Unitization (benefit 5 of the parallelism theorem). Then its functional value could be measured, regardless of which instrument it is played on, by incorporating rhythm in an integration design as in the cited study by Makris and Mullet.

**Neuroscience Information Integration.** The psychological laws provide boundary conditions that can help develop neuroscience. That physiological reality underlies conscious experience is here taken for granted. Vision science, in particular, has made important contributions to delineating diverse visual receptors and processing centers in the cortex.

Some investigators, however, present neuroscience as an all-encompassing theoretical framework. Thus, P. S. Churchland (2011, p. 7) argues that moral thought and action are matters of “constraint satisfaction.”

What exactly constraint satisfaction is in neurobiological terms we do not yet understand, but roughly speaking it involves various factors with various weights and probabilities interacting so as to produce a suitable solution to a question.

“Various factors with various weights and probabilities interacting . . .” is the theme of the psychological integration laws. The challenge to neuroscience is to explain these mathematical laws about both valuation and integration. These results provide boundary conditions that can help integrate neuroscience with cognition of everyday life.

**FIRST-PERSON SCIENCE**

First-person analysis is essential for science of phenomenology. The contrast between observer and observed that has troubled some discussions of phenomenology (see e. g., contributors to Velmans, 2000) can be partly dissolved with Information Integration Theory. First-person science is possible with the integration laws because they allow personal values of each individual. The nomothetic character of these laws provides desirable generality.

**Note 1.** Developing methods for assessing validity of conscious reports is a primary problem. The identity assumption, that conscious report is a valid measure of underlying experience, has been common in psychophysics (Anderson, 1975, p. 479) and throughout psychology (e.g., Mandler, 1984, p. 91; Marcel, 1983).

But the integration laws revealed falsity of the identity assumption, even in psychophysics. One example was the size–weight illusion of Figure 7.2 above. More important, the laws of information integration show how to obtain valid conscious reports.
DESERVING THEORY

Deserving is a unifying theme for much of everyday life. The folk axiom that people should get what they deserve underlies previous chapters: positive deserving of fairness and equity in Chapter 2 and negative deserving of blame and punishment in Chapters 3 and 4. Conscientious work deserves approval; careless and indolent persons deserve disapproval. Those who work hard on a project deserve to do well; they should be commended even if they do poorly. Understanding development of individuals’ concepts of deserving is important for social–moral theory, especially for betterment of social practice (Chapters 5 and 8).

Deserving extends far beyond the usual moral realm to include other positive-negative valuation. Deserving appears generally in the diverse status hierarchies and pecking orders so common in society.

These and other aspects of deserving pervade everyday life. How children deserve to be treated has high importance (More Praise, Less Blame). The same holds for appreciation and understanding between their parents. Development of ways to improve positive aspects of family life is basic to moral science. The one-year maternity leave available in EU countries benefits society simultaneously with infant and mother.

In education, social–moral deserving should be prominent in classrooms of primary and secondary schools. Teaching for adaptive transfer—what will be needed in later life—has basic moral importance. Adaptive transfer should inform every text and lecture—adaptive transfer is what students deserve (see Education, end of this chapter).

Deserving theory extends beyond family and schools; numerous other classes of deserving are interwoven with everyday life. One class includes rights of children, the ill, the elderly, the accused, and other subgroups. A second class includes allocation of limited resources, such as social security and expensive medical care. A third class includes responsibilities of governing agencies, as with taxation, schools, parks, police, streets, and waste disposal. To these should be added reciprocal responsibilities of citizens. Responsibilities of corporations are underscored by tobacco companies’ active role in causing cancer (e.g., Chapman, 2000). An important class concerns mutual responsibilities of employee and employer (e.g., Gardner, 2007; Ciulla, Martin, & Solomon, 2011). Another concerns our responsibilities for maintaining the environment for our descendants. Moral science needs a broad social–moral perspective grounded in social–environmental reality.
CONFLICT AND COMPROMISE

Conflict among goals is common in moral thought and action. Each of us experiences conflict between competing desires, between competing obligations, between desire and obligation. Good deeds may hardly seem worth their cost. Temptation must be balanced against conscience and possible adverse consequences. Conflict resolution should thus be a focal concern in moral theory (Note 1).

Metric cognition is central in conflict resolution. In some cases, choosing the greater good or lesser evil may require only simple comparison. In general, however, some valuation/integration process will be required to calculate, however roughly, net value of each goal.

TWO SIMPLE CONFLICT MODELS

Some situations involve degree of preference between two alternatives, A and B. A natural hypothesis is the subtraction model,

\[ \rho = \psi_A - \psi_B. \]  

(1)

Establishing this model faces the obstacle of true measurement of \( \rho \), \( \psi_A \), and \( \psi_B \). This long-standing measurement obstacle was removed with the parallelism theorem of functional measurement (e.g., Shanteau & Anderson, 1969). An application to conflict of obligation is given next.

Many conflict situations involve compromise in which some good, positive or negative, is to be divided between A and B. Such compromise may be amenable to the decision-averaging model,

\[ \rho = \frac{\psi_A}{\psi_A + \psi_B}. \]  

(2)

The relative ratio on the right gives the value of A relative to the whole. This model has done rather well in fairness theory, including the neglected problem of unfairness (Chapter 2).

A and B may be complex stimulus fields that require complex processing to construct \( \psi_A \) and \( \psi_B \). This complex processing can be finessed by virtue of Cognitive Unitization, which allows measurement of functional values of \( \psi_A \) and \( \psi_B \) when either model holds. More detailed analysis of the stimulus fields could be obtained by using systematic integration designs for A and/or for B (Note 2).
ALGEBRA OF OBLIGATION

Obligation is a basic social phenomenon. We have obligations to family members, friends, our job, social groups, and so on. Such obligations may conflict with one another. Even more, they may conflict with self-interest. This latter form of conflict was considered in the following study, in which the story protagonist failed an obligation to another person in preference to self-interest. Metric analysis allowed a test for algebra of obligation.

How bad is failure to fulfill your duties and obligations? Unforeseen circumstances or other forces may partly extenuate such failure. In his first experiment, John Verdi presented participants with brief paragraphs about an actor who had failed to repay a loan from another person. The main integration design included:

- two levels of actor’s obligation to repay;
- three levels of actor’s need not to repay;
- three levels of other’s need to get repaid.

Participants judged goodness of actor’s failure to repay (Verdi, 1979; Anderson, 1996a, pp. 218-221).

How are the two needs integrated? A natural hypothesis is that actor’s need is extenuating, specifically by subtracting from other’s need. Indeed, a subtractive averaging rule was found. The parallelism of the solid curves in the left panel of Figure 7.3 supports an adding-type rule. The opposite effects crossover of the dashed curve, for which other’s need was not specified, infirms adding and affirms averaging.

Surprisingly, actor’s need had over twice the effect of other’s need. In the left panel of Figure 7.3, effect of actor’s need is measured by the vertical spread of each solid curve; effect of other’s need is measured by the spread between top and bottom curves. This counterintuitive contrast appears even though the nominal range of actor’s need was actually less than other’s need.

What might account for this counterintuitive need comparison? Other had done a good deed and actor was always at fault. Perhaps participants implicitly adopted the role of the actor. Such implicit role play may have been induced by the definition of the response as goodness of failure to repay; judgment of badness might yield different results. Replication with participants instructed to role-play other, actor, or some third-party, might illuminate this matter. Fair division of actor’s available funds between the two would have special interest.
Also curious is that although other’s need is averaged with actor’s need, it seems to add to actor’s obligation. This additivity appears in the right panel of Figure 7.3, in which the dashed curve parallels the solid curves. Strict addition rules are infrequent yet here it appears conjoined with an averaging rule. This pair of results is hard to believe, yet it was obtained in all three stimulus scenarios noted in the next paragraph. If this result can be replicated, it may throw light on the question of adding versus averaging, about which little is known.

Stimulus generality is always a problem in studying moral cognition. One’s results may be peculiar to particular choice of stimulus materials. This concern was amplified by the joint appearance of averaging and adding rules just noted. Very similar results, however, were obtained in a replication by Verdi that included two additional scenarios, one scenario with obligation based on kinship and another scenario with obligation based on gratitude.
WIFE–HUSBAND INTERACTION

The many results on attitude interaction in marriage obtained by Armstrong (1984) in her remarkable thesis studies included one study of wife–husband discussion of conflict of obligation.

In the first phase, both spouses received a common scenario in which a third person had failed an obligation. Each made a private judgment of badness of this failure. Next, wife and husband received added private information, one item slightly negative for one spouse, and three items moderately extenuating for the other. They then discussed their own attitude and their added information with each other, following which they made a revised, private judgment of badness.

Four different scenarios were used to assess generality. One is illustrated in the following quotations from Armstrong (1984, pp. 216f). Participants received Obligation and Need information in a $3 \times 4$ design, only one item of each of which is listed here (Note 3).

Background Information:
Joan had promised to pay a visit to an elderly aunt. When the time came for the visit, however, Joan decided she had better things to do.

Obligation Information:
Her aunt had always taken a kindly interest in Joan, helping her out whenever she needed financial assistance or moral support.

Need Information:
Joan’s aunt was very lonely, being physically incapacitated and unable to get out on her own. Family relationships were very important to her aunt, and Joan was her only living relative.

New Information:
Joan had also not sent her aunt a note to explain why she wasn’t going to be able to visit. (slightly negative item)
Joan had just visited her aunt two days before this incident. (extenuating)

Obligation and need were integrated by an adding-type law. This was shown by the parallelism in Figure 10 of Armstrong (1984, p. 137). An opposite effects test supported averaging (her Figure 11, p. 139).

No less important, spouse’s information was also integrated by averaging. The graphs of the revised judgments in Armstrong’s Figure 10 are parallel but closer together than the initial judgments—exactly what averaging predicts (see similarly Figure 3.2).

This result illustrates the power of simple integration laws for exact analysis of marital dynamics. Each spouse’s added information is transmitted to their partner through verbal discussion. This discussion is a
complex stimulus field that depends on each individual’s understanding and valuation of their given information, on their communication abilities, and on spouse’s interpretation of this communication. This information transmission is unique to each couple, beyond detailed analysis. Yet all this can be treated as a functional unit by virtue of Cognitive Unitization. The integration laws thus give analytical capability to study marital interaction for individual couples (see also *Studies of Marriage*, pp. 224-231 in Anderson, 2008; Troutman & Shanteau, 1989).

DIVISION OF GOODS

Conflict is implicit, if not explicit, in any division of goods. The decision averaging law did well in Chapter 2 on the traditional problem of third-party judgments of equity in two-person groups. This law was extended to begin analysis of multiple determinants of deserving, multiple goods to be divided, and multiple claimants. These preliminary experiments showed promise. This decision averaging law also made sense of controversies about over/underpayment and negative input.

Extensions were made to study *unfairness*, a basic social motivation neglected in the usual approaches to equity theory. Unfairness recognizes the social importance of first-person judgments in place of the usual third-person judgments. Development of realistic experiments, however, presents challenges.

MORAL DILEMMAS

Resolving conflict must be a central issue in moral theory. Moral dilemmas have been popular since ancient times because they are stark examples of conflicting considerations. Moral dilemmas should thus have catalyzed analysis of conflict. Instead, they obscured the problem. The dominant philosophical approach was to deny that conflict was morally real (see *Moral Philosophy*, this chapter). In psychology, the popular theories of moral stages suffered fatally because they followed the method of choice and verbal justification thereof (see *Moral Stage Theories* in Chapter 5).

In principle, resolving a moral dilemma merely requires standard cost–benefit analysis: add up the pros and cons for each horn of the dilemma and choose the horn with the least bad total. In practice, as each of us knows, resolving a moral dilemma is often difficult. Integration laws can help entrain dilemma psychology to social betterment.
AMBIVALENCE

Ambivalence, conflicting feelings about some issue, is common in moral cognition. Examples include the foregoing studies of conflict of obligation, studies of forgiveness (see Algebra of Forgiveness below), and studies of attitudes about euthanasia and abortion in France (e.g., Frileaux, Lelièvre, Muñoz Sastre, Mullet, & Sorum, 2003) and in India (Kamble, Sorum, & Mullet, 2012). It may thus be advisable to get separate judgments of pros and cons. The overall judgment may follow one of the two simple conflict models discussed in the first section.

WOMEN

A woman’s life is one conflict after another. To men, women look so attractive and smile so winningly that men think they must be serenely happy inside. But effort and heartache are involved to keep looking attractive, especially by those less attractive and those growing older.

A man may dress like a slob but not a woman. A man may be fat without much cost in social status, but not a woman. A man may use obscene language but not a woman.

To a mother who must contend with diverse demands of her husband, her children’s everyday needs, squabbling, and growing-up crises, with unending housework, and perhaps holding down a job, life is a continual conflict of too much to do, too little time. Then, as she goes, fatigued, through the supermarket checkout line with food for her slightly appreciative family, she sees the women’s magazines with slim, smiling models and red-letter headlines shouting “no more belly fat!” and “Six Sex Secrets You Must Know!” (Note 4).

Women’s lives offer a fine field for conflict theory, with motivational depth and high social worth. Some work on cognitive analysis has been done with IIT (see Studies of Marriage, pp. 224-231 in Anderson, 2008). The numerous recent articles and books on feminist theory have been largely concerned with social betterment. Gilligan’s (1982) emphasis on caring led to realization that the traditional focus on justice was flagrantly narrow as a base for moral theory.

SELF-INTEREST: PERSON AND SOCIETY

The existence of large, complex civilizations is remarkable given that each one of us is necessarily guided by self-interest. In some important ways, however, self-interest concedes to other-interest, notably in
marriage and parenting, as well as in friendship and group belonging. To these should be added the moral power of the world’s religions.

Such prosocial forces are far from sufficient, however, as shown by the many laws needed to define what is unacceptable and to help reduce antisocial behavior.

Self-interest may lead to conflict owing to inevitable individual differences. The unfairness paradox of Chapter 2 (that two persons who make equal objective contributions may both feel equal shares unfair) illustrates a general issue: different persons have different values, different attitudes, different knowledge systems. Theodore Roosevelt’s “vested interests” are alive and well, as with industries that exploit natural resources and with Eisenhower’s “military–industrial complex.”

These obstacles can be overcome to remarkable extent as shown by existing societies that have passed through intense wars, civil as well as foreign. Much remains to be done.

The family is a primary locus for social betterment. Remedial action has resulted from increasing social–legal equality for women and from child labor laws and protective agencies. Preventive action is more important, of course, as with education for positive family interaction, a direction pursued by some persons.

Schools are a second locus for social betterment, one that could be greatly improved. It is astonishing that instruction on marriage and parenting is virtually unknown in our educational system (see Education, end of this chapter). More generally, the moral domain offers a promising core for unifying psychological science (Chapter 8).

These brief comments on self-interest as an integral characteristic of life may help as an antidote to philosophers’ claims that self-interest must be essentially identical with absolute moral law (see Moral Philosophy, this chapter). On the contrary, self-interest poses basic difficulties that society and social science must continually address.

CONJOINT EXPERIMENTAL–FIELD WORK

Realistic study of interpersonal conflict requires primary attention to field situations. Among these are marriage, parenting, friendship, teams, and work, as well as educational and legal systems.

It seems desirable, accordingly, to begin by gaining familiarity with a chosen field situation. This can be invaluable for revealing attitudes and goals of conflicting parties as well as openings for useful results and obstacles thereto. Helpful books are available for parenting, marital therapy, counseling, work, and labor–management negotiations (Note 5).
Experimental analysis can help by embedment in the field situation. Embedded designs can provide needed capability with multiple determination. Realistic context variables can thus be taken into account, as through their influence on valuation of experimental variables.

Note 1. Conflict is an issue in many areas of psychology. Judgment–decision theory has been much concerned with choice of best among several alternatives as well as allocation of resources across alternatives. Conflict theory needs a shift in emphasis from normative to cognitive (Functional Theory of Judgment–Decision, Chapter 8).

Ambiguity—conflict between alternative interpretations—is the norm in language communication, as in She was looking for a boy with a pair of binoculars (Oden, 1974, 1983). Oden found good support for his ambiguity model, which has the same relative ratio form as the decision averaging model (see also Functional Approach to Language, pp. 284-288 in Anderson, 2008).

Ambiguity pervades perception of the external world. Size constancy, despite the ambiguity in size of the retinal image, is the classic example. Figure-ground perception is another, as with the well-known ambiguous geometrical figures in introductory texts.

Note 2. Conflict with more than two alternatives may require new models. Extending the compromise model of Equation 2 to three alternatives can be done in more than one way (Anderson, 1982, Section 3.5). Further extension will need to allow for subgroups, a central problem in group dynamics (Friedkin & Johnsen, 1999; Graesser, 1991).

Note 3. Armstrong’s (1984) landmark thesis on marital interaction includes 81 pages that list the many ingenious stories she used in her several experiments.

Note 4. When I was doing some very modest studies of marriage around 1980, I attended an APA lecture on couples therapy. The lecturer, whose name I regret I have not retained, began by saying that the first task of couples therapists was to throw away everything they had learned in clinical training. Such training placed primary emphasis on uncovering the source of the client’s problem, with the Freudian belief that uncovering such repressed material would allow it to dissipate. But in couples therapy, said the speaker, that would reheat old disagreements and make matters worse. Instead, the therapist should work for joint movement toward new goals.

Family therapy is now more common. One would expect clinical psychologists to place the greatest emphasis on teaching about marriage and parenting. Such courses could contribute more by improving family life for many persons, children especially, than by trying to ameliorate disturbances in single persons after they have become strong (see similarly Positive Psychology below).

Note 5. Labor negotiators recommend some useful rules, including “Always exploit the inevitable” and “Never get between the dog and the lamp post.”
GRATITUDE AND INGRATITUDE

Gratitude deserves much greater role in society. Our personal development, who we are, owes much to parents, siblings, teachers, and friends, to whom we should in principle be grateful. In actuality, gratitude is often muted or absent, in sharp contrast to the ubiquity of blame.

Gratitude is here considered within judgment–decision theory: gratitude depends on valuation and integration of multiple determinants. Integration laws for gratitude, if they can be established, would help study cognitive processes that underlie feelings and expressions of gratitude. Such laws could also help develop ways to improve self and society by increasing feelings and expressions of gratitude.

Algebra of Gratitude. Gratitude for a benefit is expected to depend on the value of that benefit and the intent of the benefactor. One may feel thankful for an unintended benefit but, it would seem, no more grateful than for a fine spring day. A multiplication rule, Intent \times Benefit, thus seemed plausible.

Contrary to expectation, experimental analysis revealed averaging:

\[
\text{Gratitude} = \text{Intent} + \text{Benefit}.
\]

This outcome is shown in the integration graphs of Figure 7.4 (Lane & Anderson, 1976). The parallelism of the solid curves supports an adding-type model, either adding or averaging. The crossover of the dashed curve in the left (right) panel for judgments based on Intent (Benefit) alone rules out adding and supports averaging (see Opposite Effects, Chapter 1).

That gratitude was nonzero with zero intent seems puzzling. Possibly participants conflated appreciation for the benefit with gratitude to the benefactor.

Similar results were obtained with six-sentence stories and with simple assertions of intent and benefit. Conceptually, this agreement shows similar processing for bare phrases and complex verbal stimuli, a result that deserves further study. Methodologically, this agreement is useful because simple phrases are easy to construct whereas the stories required considerable pilot work.

A linear integration rule had been reported in an innovative study by Tesser, Gatewood, and Driver (1968), who included the important third variable of cost to the benefactor of providing the benefit. The crossovers of Figure 7.4, however, reveal a decidedly nonlinear rule (Note 1).
Figure 7.4. Left panel shows judged normative gratitude (“how much gratitude the average person would feel”) for a benefit as a function of the value of the benefit (curve parameter) and the intent of the benefactor. Parallelism of solid curves and crossover of dashed curve for judgments based on intent alone support the averaging law. Solid curves in right panel show alternative view of solid curves in left panel; crossover of the dashed curve based on benefit alone further supports averaging. (After Lane & Anderson, 1976.)

What Is Gratitude? Gratitude has different meanings for different investigators. The cited study of Tesser, et al. (1968) analyzed the average of two responses, gratitude and indebtedness, which seem rather different in quality. Contributors to The psychology of gratitude (Emmons & McCullough, 2004) showed little agreement as noted in the review by Anderson (2005). Some conflate gratitude with obligation in their discussion of gift-giving as a base for social cohesion. Gift-giving can be important but, as other writers have pointed out, it can create an onerous sense of obligation, quite different from gratitude.

How do participants interpret instructions to judge gratitude? If we researchers differ, so will they. Appreciation may have advantages with, for example, judgment of influence of the benefit in one’s own life. Appreciation for a benefit seems readily separable from appreciation of the benefactor, as in some persons’ attitudes toward their parents.

In view of the disagreements among researchers over meanings of gratitude (e.g., Anderson, 2005; McCullough, Kilpatrick, Emmons, & Larson, 2001), naïve participants cannot be expected to be precise, perhaps not even with careful instruction. It may be preferable to seek gen-
eral agreement on some profile of measures among investigators at different institutions (see Profile Measures, Chapter 6).

Emmons and McCullough (1992) showed that participants randomly assigned to keeping journals of experiences showed more positive affect from recording gratitude experiences than from recording hassles. The claim by Emmons and McCullough (2003) that focusing on positive aspects of one’s life has causal effects on one’s feeling state is inconclusive because feeling states and positive focus were measured at the same time and may have been confounded. Their result may thus be merely a halo effect (see Chapter 6). Their goal is certainly desirable and deserves further work, especially work designed to test for lasting effects (see also Affleck & Tennen, 1991, pp. 385-389).

Ingratitude. Failure to make fitting recompense for benefits received may evoke a feeling of ingratitude by the benefactor. “How sharper than a serpent’s tooth it is to have a thankless child” (King Lear).

An obvious model is suggested by the blame law of Chapter 3:

\[
\text{Ingratitude} = \text{Obligation} - \text{Extenuation}.
\]

The extenuation term can allow for obstacles to fulfilling the obligation for which the blamee should not be unduly faulted (see Figure 7.3 in the previous section on failure to fulfill an obligation).

Looking Forward. Cognitive process has been the main concern of IIT. Substantial evidence has been obtained for a general moral algebra, illustrated in this and previous chapters. This moral algebra can aid deeper analysis of moral cognition, especially with individual persons.

The main societal problem, of course, is to increase gratitude and related feelings in everyday life. Express your appreciation of your spouse and your children. Be ready to compliment your friends and coworkers on achievement, good spirit, appearance, or what you will. Seek to internalize the Golden Rule: More Praise; Less Blame.

How to amplify this Golden Rule in everyday life needs experimental study at every age. An overview of work on this problem is given by Emmons and McCullough (2002).

Note 1. The claim for a linear integration rule by Tesser, et al. (1968) is not warranted. Multiple regression, on which they relied, is not a valid test because, among other reasons, it fails to test the deviations from prediction. Functional measurement, used by Lane and Anderson (1976), does provide a valid test (see Goodness of Fit in Chapter 6). Functional measurement showed a nonlinear averaging rule in Figure 7.4, contrary to Tesser, et al.
ALGEBRA OF FORGIVENESS

Fractures in social relationships are common; healing processes are needed to keep society functioning. Apology can be an effective healing process as shown in Chapter 3. A complementary healing process is forgiveness, recently studied by a number of workers. Many variables that influence these two healing processes have been delineated: intent of the offender, harm caused by the offense, remorse of the offender, various aspects of social context, and others (see contributors to McCullough, Pargament, & Thoresen, 2000, and to Worthington, 2005).

How these multiple variables are valuated and integrated to arrive at overall forgiveness is a fundamental problem, one that might seem too complex and context-dependent to allow any simple analysis. It is remarkable, therefore, that substantial evidence for a simple algebraic model has been found in landmark work by Etienne Mullet and his many associates on which this section is mainly based. Cross-cultural generality of this algebra of forgiveness is promising. So also is its applicability even in aftermath of the extended civil wars in Lebanon.

This forgiveness algebra has far-reaching implications. The support for a simple adding-type integration law illustrated by the parallelism in Figure 7.6 emphasizes that plausible conjectures about interactions among causal variables require definite evidence. A useful grip on the context problem is provided by Cognition Unitization (benefit 5 of the parallelism theorem of Chapter 1), which can treat context effects, however complex, as exact units.

This law of forgiveness is considered to hold for individuals—an idiographic–nomothetic law. This is possible in principle because values, which may vary markedly across individuals, are independent of the integration operation. Indeed, an integration law can actually measure individual values (benefit 3 of the parallelism theorem of Chapter 1). This idiographic–nomothetic character may be generally helpful for studying healing processes in marriage and family.

FORGIVENESS IN CIVIL WAR

Forgiveness, unlike blame, is not an everyday reaction. The hypothetical situations that are useful in blame theory may induce anemic realization of pain and resentment felt by those who are victims of real offenses.

The work by Azar and Mullet (2001) thus has exceptional significance for it studied forgiveness during a lull in the extended civil wars in Lebanon, first between Christian and Muslim and then between
Christian and Christian. These harrowing experiences in this small country led to substantial readiness to forgive.

Their experimental scenario concerned a gunman who had shot a child during the civil wars and whose identity was known. Each scenario specified four variables: whether the gunman had shot the child on purpose or by accidental ricochet; how much the child had recovered; faith of the gunman (Christian or Muslim); and apology—whether he had come to the child’s family to ask forgiveness. Participants were from three Christian faiths and three Muslim faiths listed on the horizontal axis of Figure 7.5. For each scenario, they judged how appropriate it would be to forgive the gunman.

**Empirical Results.** Remarkably, Muslims and Christians both showed nearly equal forgiveness for Christian and Muslim gunmen. This appears in the near-identity of the two curves in the upper left panel of Figure 7.5. This equal level of forgiveness for gunmen of a different religion with long past hostility is the most remarkable result in forgiveness research. It says much for the human potential for social–moral harmony. It is a terrible pity that the Lebanese people have been trapped in the Arab–Israeli conflict, which has since rekindled.

Apology has remarkably substantial effects shown in the lower left panel. This is a striking extension of studies of effects of apology on blame in Chapter 3. This large effect of apology, as Azar and Mullet point out, can help heal serious conflicts.

Apology has much larger effects than intent in Figure 7.5 (Note 1). This is a socially dramatic affirmation of the large effects of apology found with abstract scenarios (Hommers & Anderson, 1985, 1991; see Chapter 3). This apology–intent difference remains a puzzle.

How forgiveness depends on consequences to the child is shown in the lower right panel of the figure (still severe or completely recovered). Even the still severe curve shows substantial willingness to forgive. The similar levels of the pairs of curves in the two lower panels is striking. This result, together with the large effects of apology found with blame in Chapter 3, suggests an innate healing process to pardon past harm or at least for resentment to be diluted by later experiences (Note 2).

**ALGEBRA OF FORGIVENESS**

Forgiveness appears to follow an adding-type law. This law is notable in the Lebanese study just considered. Evidence appears in the uniform parallelism of the integration graphs of Figure 7.6. The left panel shows
that Intent had nearly equal effect for a gunman of similar or dissimilar religious faith; these two variables did not interact. The right panel shows no interaction between apology and amount of recovery experienced by the child.

It deserves emphasis that this evidence for noninteraction additivity depends squarely on having a linear scale of response (Premise 2 of parallelism theorem). Fortunately, the method of functional rating yields

![Figure 7.5. “Appropriateness of forgiveness” of a gunman who had shot a child in the civil wars by six religious communities in Lebanon (horizontal axis). Vertical scale re-numbered so that 0 = “Definitely NO” and 50 = “Definitely YES.” Upper left panel shows equal forgiveness for gunmen of same or different religion as participant (Christian or Muslim). The other three panels show main effects of intent to shoot the child, apology, and whether the child had completely recovered. (After Azar & Mullet, 2001.)](image-url)
linear response scales. This linearity can help with analysis of situations that do not follow any simple integration law (see Response Generality in Chapter 6).

Supportive Results. Supportive results were obtained in two related studies that used the same task and stimulus materials. One was a preliminary study of the three Christian faiths in Lebanon (Azar, Mullet, & Vinsonneau, 1999). The other studied Kuwaiti adolescents and adults (Ahmed, Azar, & Mullet, 2007). Results were very similar. The only difference was a small effect of the gunman’s religion in the Kuwait study (see also Individual Differences below).

The adding-type forgiveness schema, together with the importance of apology, was also reaffirmed by Vinsonneau and Mullet (2001) with 14–16-year-olds living in Paris. Half were of Mughrabi origin (mostly Muslim) and half European (mostly Christian). A severe street fight was used as being realistic for this age group. Interestingly, forgiveness was higher when offender and victim had different national origins.

Adding Versus Averaging. An averaging law might be expected for forgiveness on the ground that forgiving involves a giving up of blame, for which averaging theory has done well (Chapter 3). Indeed, integration graphs for forgiveness have nearly all exhibited parallelism, as in
Figure 7.6 (Note 3). Parallelism, however, can also result from a strict addition rule as well as averaging.

This adding–averaging issue was studied by Girard, Mullet, and Callahan (2002) with good concern for the methodological problems. Their evidence favored adding rather than averaging as does the noncrossover of the dashed curve in the right panel of Figure 7.6 (but see Note 4; see also Conflict and Compromise, second previous section).

INDIVIDUAL DIFFERENCES

Extreme individual differences in forgiveness were revealed with the ingenious cluster analysis of Girard and Mullet (1997). They found two extreme clusters: Always Forgivers, who insisted it was always better to forgive than to harbor resentment, and Never Forgivers, who insisted that getting even or revenge was the only proper reaction.

Participants were 236 French citizens equally spaced across age from 15 to 96 years. They judged propensity to forgive for 64 scenarios from an integration design in which the offender had caused loss of job promotion for the victim. Intent and apology of the offender were both important variables, a result confirmed in the subsequent experiments already discussed.

Cluster analysis was used to delineate participants with similar patterns of main effects of the experimental variables. The Never Forgive cluster comprised 5% of the sample, somewhat more frequent at younger ages. The Always Forgive cluster comprised 14% of the sample, mostly elderly people (see Cluster Analysis in Chapter 6). All these experiments yielded uniform support for an adding-type law; analyses based on main effects were thus faithful to the data.

This experiment was replicated with 517 Kuwait citizens by Ahmed, Azar, and Mullet (2007), who used the same gunman scenario as Azar and Mullet (2001). Results were similar.

Basic problems for forgiveness theory are raised by these large individual differences. Can general theory be expected to account for numerous variables, only some of which were represented here? And in the face of such large individual differences? The integration laws offer a cautious yes for they apply to each individual, and they can measure functional values of each individual. Single person design and analysis (Chapter 6) might also be useful with a spectrum of persons selected on the basis of an initial group cluster analysis. Nomothetic and idiographic theory can thus go hand in hand.
DEFINING AND MEASURING FORGIVENESS

The multiplicity of definitions of forgiveness in the literature might seem to embody Worthington’s (2005, p. 3) dictum: “Definitions are the fountainhead of knowledge.” But there is much disagreement among these definitions. This complicates cross-study comparison.

This disagreement among definitions also suggests this dictum is inappropriate. Some definitions impose personal opinions such as forgiveness is a “gift” to which the offender has no “right.” Such prejudgments may distort the phenomena they seek to study. Inductive theory argues against Worthington’s dictum—definitions should develop inductively from empirical inquiry.

**Functional Theory of Forgiveness.** Functional theory focuses on the functions of forgiveness and nonforgiveness in an individual’s psychodynamics. The functional approach of Mullet, Girard, and Bakhshi (2004) found evidence for four functions that forgiveness can perform. These include Change of Heart (replacement of negative feelings by positive) and Forgiveness Is Good (forgiving an offender will encourage better future behavior). Understanding what people think to accomplish by forgiveness, or nonforgiveness, should be generally useful.

A functional approach to elucidating the nature of forgiveness by Mullet, Riviere, and Muñoz Sastre (2007) reported that willingness to blame, to avenge, or to prosecute a medical error were cognitively close constructs. Different and less close were resentment, forgiveness, and reconciliation. Their approach, based on comparing patterns in integration graphs, has advantages over other such comparisons in related articles that they cite (see also Response Quality in Chapter 6).

Fincham, Hall, and Beach (2005, p. 208) point out that forgiveness may be partial, coexisting with nonforgiveness; both need to be measured. They also emphasize that investigators need to find out what participants themselves mean by forgiveness and related words. Other discussion of this critical problem of definition is given by Pargament, McCullough, and Thoreson (2000, pp. 301-305).

One approach to understand what people mean by forgiving and related cognitions is to ask them. This approach was used by Enright and others (e.g., 1991), who attempted to force people’s verbal responses into developmental stages analogous to those of Kohlberg. But Kohlberg’s stage theory is misleading and moribund (see Moral Stage Theories in Chapter 5). Such verbal responses can be useful clues, of course, and Enright’s approach could be combined with the valuation–integration analyses used by the Mullet group.
Nonforgiveness. Should a clinical psychologist who learns that her husband has been sexually abusing their daughter forgive him? Should scientists who systematically fake their data be forgiven (e.g., Empirical Direction, pp. 241, 242f, 511f)? Should U. S. president G. W. Bush be forgiven for the 2003 Iraq war (Note 5)?

Forgiveness entails reducing the social responsibility component of the blame law of Chapter 3. This is desirable in many cases, both morally and for social harmony. Even so, some nonforgiveness may generally remain. What people mean by forgiveness can hardly be understood without measuring nonforgiveness (Fincham, et al., 2005).

Moreover, nonforgiveness may be a proper moral reaction as suggested by the three cited examples. Murphy (2005) argues that resentment is appropriate moral behavior in some situations, proper to maintain one’s personal integrity, a view also found in Aristotle. Related reactions include getting even and retribution.

Profile Measures. The preceding subsections indicate need for systematic development of profile measures of forgiveness and related qualities. Healing after civil strife may rest on tolerance and societal cooperation even though substantial nonforgiveness may remain, as in the American south after the War Between the States. Healing after marital infidelity may involve suppression and adaptation as well as elimination of a complex of negative feelings (see further Profile Measures, Chapter 6).

Confounding. Attrition is a plaguey confound. A treatment may falsely appear effective because more serious cases tend to drop out earlier. This is just one of several confounds that vitiate the claim of Worthington, Sandage, and Berry (2000) that longer time spent in group sessions had substantially greater beneficial effects, a claim based on their compilation of 13 such studies (their Table 11.1), which includes a number of unpublished PhD theses. Besides differential attrition, other confounds include lack of randomized control group. Unfortunately, their presentation is silent on how such confounding issues were handled.

A pernicious confound consists of interpreting a correlate as a cause. This confound is illustrated in Kachadurian, Fincham, and Davila (2005), who argue that a spouse who ruminates about a transgression will increase the negative component of forgiveness and thus cause less forgiveness. But such rumination is part of the (non)forgiveness, not necessarily a cause thereof.

This example illustrates the practice of many who work with correlational data to measure one component of a concept and interpret it as a cause (see further Illusion of “Statistical Control” in Chapter 6). This
correlation–causation confound is emphasized in the cogent discussion of forgiveness in marriage by Fincham, Hall, and Beach (2005, p. 218):

The paucity of longitudinal or experimental research on marital forgiveness renders it difficult to draw any conclusions about the causal relationships between forgiveness and its correlates in marriage. For example, although there is a robust association between forgiveness and marital satisfaction in cross-sectional studies, forgiveness may enhance marital satisfaction, marital satisfaction may enhance forgiveness, or these concepts may be reciprocally related.

LOOKING FORWARD

Two directions for future work on forgiveness stand out: social reality and cognitive theory.

Real Life. The importance of forgiveness and related phenomena is emphasized by studies of real life. The cited work on forgiveness in civil war in Lebanon by Azar and Mullet is striking in revealing a simple cognitive algebra of complex socio-psychological processes. Other work on civil conflict has been done by Cairns, Tam, Hewstone, and Niems (2005) and by Staub (2005). An algebraic model for acceptability of amnesties (which have been at issue in upwards of 40 countries to help heal effects of oppressive regimes) was studied in Togo by Kpanake and Mullet (2011) and in Columbia by López-López, et al. (2012); Note 6.

Forgiveness has been studied in marriage (Fincham, et al., 2005; Gordon, Baucom, & Snyder, 2000), close relationships (Rusbult, Hannon, Stocker, & Finkel, 2005; Temoshuk & Chandra, 2000) and family therapy (Battle & Miller, 2005). Marriage and family have foremost social–cognitive importance and social reality, and they offer feasibility for experimental analysis.

Case studies and nonrandomized experiments can be useful if explicitly planned as pilot work for randomized design. Random assignment to different therapeutic regimens, now common in the medical field and becoming common in clinical psychology (Kazdin, 2011), is essential for developing effective instruction about improving family life and school programs for character education (see Education in this chapter). Cooperative work across different institutions, also common in the medical field, is important to ensure use of comparable method, comparable response measures, and hence comparable results and generality.

The importance of design and analysis for individual persons is indicated by the cluster analyses of the Mullet group. Individualized experi-
ments should also be useful in family therapy, an important application (see *Personal Design* in Chapter 6).

**Unified Research.** Research on forgiveness needs to be integrated with general social–moral theory. Moral attitudes, including attitudes about forgiveness and nonforgiveness, are part of general social attitudes, the major subfield of social psychology. Judgment–decision theory is no less relevant, for judgment and decision are basic in moral conflict, forgiveness in particular; see similarly seven directions for future work discussed by Pargament, McCullough, and Thoresen (2000). These areas have seen little interaction. Moral theory provides a fertile field for conjoint study that will enrich all three areas (Chapter 8).

Important steps in this direction have been taken with the algebraic law established by Etienne Mullet and his associates. They used rigorous experimental methods to reveal moral law. This same law was found in the real context of civil war and in abstract contexts of typical laboratory experiments, evidence for its generality.

**Note 1.** This claim that apology has larger effect than intent seems justified because the yes-no levels of each variable covered the main range likely in practice (see *Measuring Importance* in Chapter 6).

**Note 2.** A methodological problem is illustrated by comparison of levels of forgiveness across Muslim and Christian in Figure 7.5. These differences may arise simply from differences in the meaning of “forgiveness” in the two religions and between sects within each religion (*Comparing Persons and Groups*, Chapter 6).

**Note 3.** Almost the only exception to additivity appeared with the love breakup scenario of Gauché and Mullet (2008, Figure 1, p. 612). Their integration graph showed a divergence consistent with averaging in which failure to remedy the breakup carries greater weight.

**Note 4.** This adding–averaging issue was studied by Girard, Mullet, and Callahan (2002) with two methods. One was to include stimulus sets in which one variable, such as intention, is not specified. Addition implies that this curve will be parallel to those curves for which intention is specified; averaging implies nonparallelism. Their integration graphs were clearly parallel.

But this missing information test fails, as Girard, et al. recognized, if participants impute some value to the missing information and average that imputation. Such imputations seem likely because harmful acts usually have some intent. Given imputations, averaging theory can also predict parallelism (Anderson, 1991a, pp. 73-84).

Evidence for such imputations appears in Figure 3 of Girard, et al. If no imputation is made, addition implies the curve for unspecified intent will be identical to the curve for talkativeness that unintentionally gave harmful information. Instead, it lies some distance below, which suggests an imputation of somewhat culpable intent.

A method that might avoid this problem of imputations was also used by Girard, et
al.: vary the credibility of the intent information. No variable is then missing so the imputation problem does not arise. This credibility manipulation was intended to influence the importance weight of intent without changing its value.

The results, however, may not agree with the addition model. Adding low credibility intent to apology should add less than adding high credibility intent. Their Figure 6 (bottom panel), however, shows a small difference in the opposite direction. This same trend appears in the middle panel for recovery from harm.

The averaging law may account for the observed results. If the high and low levels of intent have the same values as the high and low levels of apology, averaging of intent will cause no change, regardless of credibility. A complete analysis would have to take account of the factorial structure of the design and would depend on the values of the variables (as well as prior state). The one numerical example I tried gave results similar to those in the bottom panel of their Figure 6, even the slight direction crossover.

A simpler method would compare effects of one and two pieces of information about, say, intent. This avoids any concern about the imputation problem as well as uncertainty about the weight manipulation.

For many purposes, of course, this adding versus averaging issue has little relevance. It is a curious issue, however, about what causes use of which integration process.

Note 5. The ostensible reason for starting the 2003 Iraq war was that Iraq possessed “Weapons of mass destruction.” None were found, and it seems clear that there was little prior evidence for them. Besides the personal suffering and the expense in money that could have been used to improve children’s lives, the overt religious–political differences are now worse than under Saddam Hussein. And the concomitant neglect of the Afghan–war allowed resurgence of the Taliban and insurgence of al Qaeda.

Note 6. Problems of amnesty have arisen in upwards of 40 countries that try to rebuild after periods of severe oppression or civil war. In Kpanake and Mullet (2011), judgments of acceptability of amnesty for hypothetical applicants by Togolese citizens followed an approximate algebraic model:

$$\text{Acceptability} = (A \times T) (P + D + R)$$

where

- $A =$ sincere apology/remorse (vs. no apology/remorse);
- $T =$ cooperation with truth commission;
- $P =$ procedural justice;
- $D =$ distributive justice;
- $R =$ retributive justice.

The multiplicative $A$ term dominated the judgments; unless it had the higher of the two listed values, the other variables had little effect. This model is a good example of a qualitative integration model (Chapter 6). A related forgiveness study in Columbia is given by López-López, Mullet, Pineda Marín, Murcia León, and Perila Garzón, 2012.

Analysis of variance may have limited usefulness with this and other qualitative models. One reason is that interactions from the additive analysis of variance may not be meaningful with a multiplicative model (Empirical Direction, p. 198; see also Chapter 6). Another reason is that different variables may not be independent, as with $A$ and $T$ in the above equation.
LIES AND DECEIT

The endless lies in society range from white lies to relatives and friends and gray lies in letters of recommendation or in excuses to black lies by scam artists and in offices of heads of state. Social–moral problems presented by lies and deceit have been discussed by innumerable writers over the ages. One extreme is Kant’s imperative that lying is never justified; another is a simple cost–benefit analysis.

ALGEBRA OF DECEIT

How bad is a lie? Such judgments often depend on many context variables that vary in degree and may occur in complex combinations. Definite judgments might thus seem impossible. Once some lies are admitted as justifiable, where can one draw a line? This slippery slope may be why some writers (e.g., Augustine, Kant) make blanket condemnation of all lies. Some lies are less bad than others, however, as Augustine observed, so degree of badness deserves investigation.

The basic blame law of Chapter 3 may be expected to apply also to lies and deceit:

Badness of Deceit = Responsibility + Consequences.

Responsibility refers to the responsibility of the person not to lie in the given situation. Consequences depends on some cost–benefit analysis, often partial, but perhaps including moral value of deception per se.

Qualitative Implications. Qualitative implications of this deceit schema may be instructive regardless of algebraic form. To illustrate, consider Bok’s (1999, p. 248) concluding questions about lying.

We need to consider, for example, in the context of working life, why it has been thought worse to plan to lie than to do so on the spur of the moment; worse to induce others to lie (and thus to teach deception, whether in families, work places or schools) than to do so oneself; worse to lie to those with a right to truthful information than to others; worse to lie to those who have entrusted you with their confidence about matters important to them than to your enemies.

These four conclusions follow naturally from the deceit schema. First, to plan to lie implies a stronger negative motivation and hence greater Responsibility than to lie on the spur of the moment. Second, to induce another to lie makes Consequences worse.
Third, lying to someone with a right to truthful information violates that right, adding a negative term to Consequences. Fourth, an analogous argument holds for violation of confidence.

**Integration Analysis.** The long tradition of black-white arguments about deceit has obscured important problems, both cognitive and social. Metric judgments of badness deserve systematic study, especially with respect to individual differences. Contextual factors such as conflicting demands and extenuating circumstances also require metric analysis. Integration designs seem essential because deceit generally involves joint action of multiple variables.

Validity of the deceit schema would aid further analysis. Such tests would be straightforward: apply the parallelism theorem of Chapter 1. This seems not yet to have been done but prospects are hopeful in view of successes of the blame law in Chapter 3.

**SOCIAL BETTERMENT**

The continued concern with lies since ancient times has produced ample expression of opinion but remarkably little evidence on how to improve the social–moral level of society. Bok (1999, p. xxxiii) focuses on the “vexing dilemmas of ordinary life,” especially those in which “many see good reasons to lie.” This focus appears in her perceptive discussions of everyday domains, including white lies, paternalistic lies, lies for the public good, lying to enemies, deceptive social science research, and excuses and justification for lying (Note 1).

Other writers emphasize the ambiguities and conflicts that surround truthfulness and deceit, from close relationships to business organizations, regulatory agencies, and politics. *Lying and deception in everyday life*, edited by Lewis and Saarni (1993, p. vi), aimed to “examine duplicity not as the bane of existence, but rather as an example of how remarkably resourceful people are in their adaptation to the demands of living with others.” Their emphasis is well taken and it may help illuminate the harmful aspects of deceit which they recognize.

Barnes (1994) takes a sociological view and offers some suggestions for improvement while concluding (pp. 265f):

The evidence I have presented demonstrates that for the last two thousand years and more the same assorted comments and evaluations have been repeated over and over again by philosophers, theologians, moralists and others without achieving any significant steps towards agreement. The writings of social scientists are more explicitly directed towards the achievement of consensus, but as yet these inquiries . . . serve to highlight the extent of our ignorance.
Empirical inquiry is needed, directed toward greater clarity about dealing with the inevitable conflicts of everyday life. Bok advocates publicity about ethical challenges, certainly desirable in view of past cover-ups in business and government (see also Bok, 1982). Contributors to *Local justice* (Elster, 1992) present instructive discussions of diverse social situations that required decisions about relative deservingness of persons competing for access to scarce resources.

Conflict of interest is a basic issue of social morality. The American Psychological Association maintains an active ethics committee that publishes a detailed annual report in *American Psychologist* (e.g., July-August, 2010). Each year between 2002 and 2009, about 12 members were expelled or resigned under investigation. Codes of ethics developed for professions and sciences from engineering to law are discussed by contributors to Rest and Narváez (1994), Bennion (1969), and in *New ethical challenges in science and technology* (Sigma Xi, 2001). Ethical issues involving life and death are common in the medical field and some schools give courses on such issues. *Making ethical guidelines matter* (Zig mond, 2011) has special significance.

Although morality is central to social personality, moral instruction is largely haphazard. Our educational systems should give major attention to moral values and knowledge systems in everyday life. Especially educating for marriage/parenting and for self-fulfillment. Opinions abound but little is known. Sound experimental–field research is needed to develop instruction that will translate to later life (Notes 2 and 3).

**Note 1.** Bok takes a strong, well-argued stand against lying. Her criticism of placebos, however, fails to recognize that they can have real therapeutic value (see Note 8.1.1a, p. 251, in *Empirical Direction*).

**Note 2.** Scenario construction for experimental integration studies of lies and deceit faces difficulties. One approach would follow Verdi’s study of obligation (Figure 7.3), varying costs and benefits for the two parties.

An alternative approach would ask for net badness of a set of, say, two lies varied in badness in an integration design. Success of an integration model would allow true measurement of lies of different character.

**Note 3.** Heyman, Hsu, Fu, and Lee (in press) found that parental lying to children was common in China and the U.S., a novel, most desirable study of family life. However, lies such as the tooth fairy, praising a child’s poor performance, and white lies, imply that “lie” compounds factual truth-untruth with moral right-wrong that deserve separate analysis (see *Response Quality*, Chapter 6).
CRIME AND HUMAN NATURE

*Crime and human nature* by Wilson and Herrnstein (1985) emphasizes the individual in understanding criminal behavior. This differs from sociological approaches that begin with group concepts such as social class or level of education and obscure the individual. Wilson and Herrnstein recognize the importance of social groupings, which are one of their main concerns. But they emphasize that crimes are committed by individuals; hence understanding must be grounded on psychology.

Their book gives detailed summaries of literature on many correlates and causes of crime: constitutional factors (e.g., body build, genes), gender and age, intelligence, personality, family, social context (e.g., labor market, drugs), and culture. Their discussion of “formidable methodological problems” involved in studying relations between crime and unemployment (pp. 312ff) is illuminating.

Their literature summaries are invaluable. They discredit many simplistic, one-cause theories and remedies that have been proposed. They expose methodological problems that must be solved to obtain meaningful results. They give some idea of multiple, coacting causes of crime as well as difficulties of changing them. In these and other ways, they help clarify paths for future work.

**Cost–Benefit Analysis.** Wilson and Herrnstein begin their book with a conception of crime as choice. When faced with choice among alternatives, a person calculates, often very roughly, net cost–benefit value of various alternatives. Such calculations include psychological considerations such as momentary need, conscience, thrill from danger, fears and consequences of failure, and satisfactions of success. That alternative with highest net value is to be chosen.

Such cost–benefit analysis is common in modern judgment–decision theory. But science of cost–benefit analysis faces critical problems: measurement of personal values of diverse costs and benefits in common terms; integration of these component values into a net value for each alternative (see *Functional Theory of Judgment–Decision*, Chapter 8).

**Reinforcement Theory.** To make their choice analysis concrete, Wilson and Herrnstein assert that reinforcement determines value. Primary reinforcements, such as taste and warmth, are unlearned. Secondary reinforcements yield values learned through classical conditioning (Pavlov) or instrumental conditioning (Thorndike, Skinner).
This reinforcement position reflects the enormous influence of learning theory in the first half of the 20th century, when it was widely seen as the foundation of scientific psychology, caricatured in Aldous Huxley’s *Brave new world*. But despite its importance, conditioning is far from sufficient. Valuation often depends on knowledge systems that involve more complex processes than envisaged in conditioning theories. Also, only one simple kind of integration is considered (see *Functional Theory of Learning*, Chapter 8).

**Equity Theory.** Equity theory is invoked as a second base for Wilson–Herrnstein theory. One reason is that valuation of costs and benefits may involve equity comparisons with other persons that require cognitive processes outside the scope of reinforcement theory (Chapter 2).

The other reason given for including equity theory is that legal codes in all societies include some conception of fairness. Equity theory refers to distributive justice, of course, as in Aristotle’s model (their p. 57). Retributive justice, in contrast, is prominent in legal codes.

Wilson and Herrnstein seek to justify retributive justice in terms of equity theory. A criminal act, however, would be a negative input. This tack had been seen unworkable in previous attempts to include negative input in the equity equations (Anderson, 1976; see Chapter 2).

**Deserving Theory.** Deserving theory, not equity theory, is needed for general theory of criminal justice. Equity theory is concerned with fair division among two or more claimants; deserving theory also applies to single persons. In addition, deserving theory includes inequity as well as negative deserving (see further Chapter 3 and bail setting in Chapter 4).

If punishment should be proportional to seriousness of crime, the proportionality coefficient should depend on comparison with crimes by others, not by equity comparison with a reified society.

**Improving Society.** The societal problem is how to reduce prevalence of criminal behavior. Wilson and Herrnstein’s discussion of the many correlates of criminal behavior and the difficulties of remedial action is an invaluable contribution. One direction of effort would follow their major conclusion (p. 509) that “the facts summarized in the preceding chapters rivet our attention on the earliest stages of the life cycle.” A similar opinion is given by Wrightsman, et al. (2002, p. 136).

Family should thus be one primary focus. But how can parenting be improved? One beginning would include courses on family life in high school and college. The general lack of such courses is a crime of our educational system (Anderson, 1991c, p. 231, 2008, pp. 230f).
PERSON SCIENCE AND PERSONALITY

FUNCTIONAL THEORY OF PERSONALITY

Person science requires a functional framework: how persons function in everyday living should be the focus of inquiry. Functional theory of personality differs from standard personality theory in three respects.

*Function versus trait* is the first difference. Personality trait theories arise from and try to make scientific the common trait words people use to describe others. Trait theories have been continuously attractive; they keep promising to reveal simple order and structure underlying the large individual differences among different persons. But these promises have been continually disappointing; trait–behavior correlations, the standard measure of success, remain distressingly low. The so-called “Big Five” are really the “Little Five”.

In functional theory, understanding goal-oriented thought and action is the focal concern. *Knowledge systems and goals* thus replace traits. Knowledge systems include values and attitudes that function in every aspect of daily life. They also include goal-oriented motivations.

A number of workers recognized that trait theories were weak because they ignored context. Person \times \ Situation extensions were accordingly considered; thought and action depend not just on traits of the person, but also on the contextual situation. This makes good sense, a form of Lewin’s *Behavior = f(Person, Environment)*. This approach ran aground, however, seeking to extend the trait-typological approach to typology of situations (Note 1).

*Single person psychology* is a second difference. Personality trait theory rests mainly on group questionnaires. Carlson’s (1971) “Where is the person in personality research?” was echoed in Lopes’ (1976a) study of level of aspiration and in Shoda and Lee-Tiernan’s (2002) criticism that the person is just one anonymous point in a group scatterplot.

A conceptually different approach is available with the integration laws—idiographic as well as nomothetic. This approach has analytic power with both person and situation (see Analytic Context Theory, third following section).

*Unified theory* is the third difference. Person science has a solid empirico-theoretical foundation of three mathematical laws of information integration. These laws have shown promise in most areas of human psychology: person cognition, social attitudes, developmental psycholo-
Chapter 7

40

gy, cross-cultural studies, motivation and emotion, memory, learning, judgment–decision, and language. All these areas can be unified in person science and personality (Chapter 8).

PERSON COGNITION

The foundation for Information Integration Theory was a series of experiments on person cognition that asked for judgments about a hypothetical person described by a set of trait adjectives (Anderson, 1962a). Multiple difficulties arose, some discussed in Chapter 1. These difficulties were assiduously resolved to reveal a simple theoretical framework based on mathematical laws of information integration (Anderson, 1981a).

Person cognition pervades everyday life. Other instances include the Hoag bigamy trial of Chapter 4 (Figure 4.3), attitudes toward U.S. presidents (e.g., Figure 6.1), wife–husband interaction studied by Armstrong (e.g., Figure 3.2), and forgiveness after civil war (Figures 7.5 and 7.6). Deserving and equity (Chapter 2), blame (Chapter 3), and legal judgment (Chapter 4) represent diverse aspects of person cognition. These same three laws of person cognition have done well in all these areas. Persons in other cultures including Europe, the Near East, India, and Taiwan, also follow these same laws, at least in work to date.

ATTITUDES ARE PERSONALITY

Attitudes are primary components of personality. Attitudes underlie our social interactions in family and friendship, at work, and as citizens. Attitudes constitute much of our self and goal striving.

A dynamic, constructionist approach to attitude function is shown in the Integration Diagram (Figure 7.1). Attitude proper is considered a knowledge system (AKS). AKSs function in setting goals and in constructing values of stimulus informers. These values then function in the integration process of constructing attitudinal response (AR).

This constructionist, situation-sensitive view was the theme in Anderson (1974b), which concluded (p. 89) “People do not know their own minds. Instead, they are continually making them up.” This constructionist view was called “nontraditional” by Tesser (1978), who contrasted it with the traditional view of attitude as an enduring property of the person. This traditional view of attitude as a stable reaction on a good-bad dimension still predominates, as illustrated with quotes from eminent writers in Anderson (2008, pp. 109ff).
Similar “nontraditional” views have now been adopted by some writers. Thus, Wilson and Hodges (1992) entitled their article “Attitudes as temporary constructions.” This rightly refers only to attitudinal responses (ARs), however, not to underlying attitudinal knowledge systems (AKSs). AKS and AR are conceptually distinct in Information Integration Theory, which has revealed that construction of ARs follows mathematical law (see also Functional Theory of Attitudes, Chapter 8).

MORAL THOUGHT AND ACTION

Moral thought and action are basic functions of personality: friendship, fairness, unfairness, love, resentment, spite, getting even, grief, regret, deserving, obligation, beneficence, dominance/submission, blame, deceit, and much else. Personality is immanent in such functioning.

Moral knowledge systems are ubiquitous in personality. Some of these moral systems involve personal goals, without reference to other persons, as with Henry David Thoreau and Emily Dickinson. Most, however, relate to other persons, either directly as with parenting and teaching, or indirectly, as with civic duties. Morality should thus be a major concern of person science.

In fact, morality is largely ignored in current personality theory; concepts such as deserving, obligation, unfairness, blame and forgiveness/unforgiveness are notably absent. This incompleteness is reemphasized by similar absence of attitudes. This fragmentation is mutual; Eagly and Chaiken’s (1993) scholarly review of attitude theory contains no index entry to personality. Unification will be beneficial to all (see Functional Theory of Attitudes, Chapter 8).

CLINICAL JUDGMENT

Clinical judgment is person cognition. Clinical judgment rests on information integration in which clinical expertise claims a special role for detection and valuation of signs and symptoms. Clinical judgment, however, has long been criticized for low predictive power as well as for a naïve conceptual framework that ignores relevant research (e.g., Meehl, 1954; Mischel, 1968; Grove & Meehl, 1996; Dawes, 1994).

Functional theory is less concerned with prediction of behavior, more with understanding the person. How do minds of patients function? What are the knowledge systems of these minds? How do minds of clinicians function? What are their knowledge systems? Such questions are
part of person science. Also, of course, studies of these questions can help improve clinical training and practice.

Clinicians claim that clinical judgment is a complex, configural process, which requires sensitivity to specifics of each individual and especially to configural interactions among these specifics. This is what clinical training is intended to produce. Are these claims valid?

Similar claims of complex configurality were made for the personality adjective task studied in IIT. These claims rested on compelling feelings about such configural interaction. But these feelings and these claims were quite mistaken. These person judgments were found to obey simple mathematical laws in numerous experiments by many investigators (see e.g., Anderson, 1981a, 1996a, 2008).

This same integration-theoretical approach may be applied to clinical judgment. The search for configurality with clinical stimuli in Anderson (1972) revealed nonconfigural integration. Although this experiment used naïve participants, the same approach may be applied with clinical psychologists and counselors, especially in training.

The nomothetic–idiographic laws of information integration can uncover the actual values that an individual clinician attaches to complex fields of information by virtue of Cognitive Unitization. This clinical measurement can serve as a criterion for validating or improving clinical judgment. This seems essential for developing clinical science.

SINGLE PERSON PSYCHOLOGY

Person science needs grounding on experiments with single persons. The simplest class of single person experiments uses similar design and informer stimuli with different persons but analyzes each person separately. Such design was used in the cited 1962 study of person cognition with 12 participants, each of whom served for 5 sessions.

Personal design (Chapter 6) represents a second class of single person experiments. In personal design, stimulus informers are chosen from each person’s life space for use in the experiment. Personal design was used in a study of marriage satisfaction in which divorced women recalled incidents of varied value from their marriage. These results supported the averaging law with negativity weighting (see Figure 4.21, p. 319 in Anderson, 1981a).

Single person design is essential in person science. Each of us has our own personal goals, attitudes, and values. The integration laws allow for and can measure values for each person in each situation.
PERSON SCIENCE AND SOCIAL PSYCHOLOGY ARE ONE

The inherent unity of person science and social psychology is explicit in the foregoing section on attitudes. This unity appears also in others areas, especially family life and morality, a view in harmony with Mead’s (1930) Mind, self, and society. In practice, however, these fields are fragmented not only from one another but within themselves.

Desirability of unifying person science and social psychology was urged by Snyder and Cantor (1998, p. 667) in the fourth edition of the Handbook of social psychology:

For, if the intellectual evolution that we envision actually comes to pass, and there does come a time when there is the unified and integrated discipline of personality and social psychology that we envision . . . then the answer to the question . . . “Why is there a chapter on personality and social behavior in the Handbook of Social Psychology?” eventually may be that there is no longer a need for a distinct chapter on personality and social behavior in the Handbook.

The dynamic approach advocated by Snyder and Cantor echoes the Axiom of Purposiveness, expressed by the threefold GOAL in the Integration Diagram. Effective analysis is available with the three laws of information integration (Note 2).

In the fifth edition of this Handbook, Funder and Fast (2010, p. 692) place even greater emphasis on desirability of unification (Note 3):

[M]apping the interactions between personality and situational variables, will also be necessary but difficult. Interactions only get the variance left after the main effects of people and situations have had their way . . . This enterprise may offer the best hope of at last reuniting the long-estranged siblings of personality and social psychology in a way that would have made their parents proud.

The person–situation interactionist strategy advocated by Funder and Fast is a relic of the traditional trait-typological framework of the personality field. The idiographic valuation capability of the psychological laws can yield exact analysis of person–situation interaction. Personality and social psychology are unified in IIT.

CROSS-CULTURAL PSYCHOLOGY

A new conceptual framework for cross-cultural psychology is available with the laws of information integration. These laws are jointly nomothetic and idiographic, the same across cultures while allowing for personal values of each individual (see Analytic Context Theory below).

This framework agrees with the importance of cultural effects emphasized by Cheung, van de Vijver, and Leong (2011). But it disagrees
with their attempts to extend the traditional trait-typological framework across cultures (see foregoing discussion). Instead, it calls for focus on situations and contexts universal across cultures.

One such focus concerns moral attitudes which pervade everyday life, especially interpersonal relations in all cultures. A second focus concerns family life, discussed next.

FAMILY LIFE

Person science and social psychology should both place major emphasis on family life. Much of our personality, especially its social nature, develops in family life. This begins in the earliest years and continues through diverse social situations into old age.

Some work in this direction has been done by workers on Information Integration Theory. The same integration laws found with adults are also found with children, not only with social–moral judgment (Chapter 5) but more generally, especially with judgment–decision (e.g., Anderson, 1980, 1983; Schlottman 2000, 2001; Wilkening & Anderson, 1991). Marriage studies have also shown promise (see Family Life and Personal Design, Anderson, 1991f; Studies of Marriage, Anderson, 2008, pp. 224ff; Anderson & Armstrong, 1989; Armstrong, 1984; Shanteau, Pringle, & Andrews, 2007; Troutman & Shanteau, 1989). Effective analysis of multiple determination, which is fundamental in both person science and social psychology, becomes possible with these laws. These laws of information integration may be used to study single families. These laws of information integration open a working path to unification of person science and social psychology (Note 4).

Family life, however, is almost invisible in personality theory or in social psychology. The page index to the 1999 Handbook of personality (Pervin & John) contains a single page citation to each of marriage and parenting. The few citations to children are mainly concerned with pathology. There is not a single citation for attitudes, which are major components of personality.

The 2010 Handbook of social psychology does better for it includes a full chapter, Personality in Social Psychology (Funder & Fast). But this chapter suffers from the moribund trait-typological framework that undercuts their hope for unification quoted above.

Family life presents golden opportunities for both person science and social psychology, especially for betterment of self and society. Life-span development of social personality will be easier to guide the earlier the effort is applied.
Note 1. McAdams (1990, p. 284) records his experience as a first-year graduate student in personality courses.

I encountered a “villain”. . . . I never met the villain face to face. But I read a lot about him, and I listened with strong emotions, ranging from outrage to despair, as my professors in personality psychology discussed, often with strong emotions of their own, the villain’s controversial claims.

This villain was Walter Mischel, whose 1968 article documented the fact that numerous studies had shown that personality traits accounted for only about 9% of the variance in behavior. Unfortunately, the shift to person × situation approaches, although certainly desirable, remained fixated on typological analysis and so did not get very far.

A new direction is available with the cognitive laws of information integration. Personality functioning can be studied with mathematical law.

Note 2. Baumeister (1999, p. 377) concludes his chapter in the *Handbook of personality* on the interface between personality and social psychology by saying that “personality has become a small field.” This “interface” is an artifact of the narrow conception of personality as traits rather than as knowledge systems, attitude knowledge systems especially.

Unification of person science and social psychology is explicit in Information Integration Theory. Social attitudes, in particular, are recognized as integral to personality and personality function.

Note 3. The reference to interaction in this quotation reflects prevalent misconception about analysis of variance. Person–situation interactions have little or nothing to do with statistical interactions. Statistical interactions are deviations from an additive model, Person + Situation, which has little psychological meaning (see *Understanding “Interactions,”* Chapter 6).

Substantive person–situation interaction consists mainly of individual differences in values of stimulus informers. The integration laws give a base for measuring such personal values and hence a base for studying real person–situation interaction.

Note 4. One would expect psychologists to place the greatest emphasis on teaching courses about marriage and parenting, not merely to reduce need for therapy, but even more to increase quality and value of family life. Such courses could contribute far more by improving family life for many persons, children especially, than by trying to ameliorate disturbances in single persons after they have become entrenched.
GROUP DYNAMICS

Groups are ubiquitous in social life. Interpersonal interaction in a group can be extremely complex, however, which might seem to preclude mathematical analysis. Integration laws, however, can quantify complex interpersonal interaction by virtue of Cognitive Unitization.

MARITAL DYNAMICS

Ingenious methods used by Armstrong (1984) allowed comparison of spouse influence in individual student couples at UCSD. First, each spouse independently judged seriousness of 40 dilemmas for each of three family areas: family finance, child rearing, and social obligation. Next, each dilemma was presented a second time, now accompanied by four possible solutions and each spouse independently checked which solution seemed best. Finally, each dilemma was presented a third time, half accompanied by the solution checked by the wife, half by the husband. Each spouse made separate judgments of the seriousness of the dilemma, assuming that the given solution had been put into effect.

Self influence and spouse influence could be compared separately for wife and husband. The differences between initial and final judgments measure the effect of the specified solution. For family finance, wives considered their solutions better than their husbands’, 5.42 versus 4.79. Husbands concurred, 5.00 versus 3.89. This result may reflect that wives were the main wage earners in most of these student couples.

For child rearing, wife and husband both considered spouse’s solutions better than their own, perhaps because few couples had children. Social obligation showed small differences. “Marital power” is thus not unitary, as sociologists have assumed. Most important, Armstrong showed how family dynamics can be subject to experimental analysis.

Relative power of wife and husband has nearly always been studied by requiring mutual agreement. Single-couple analysis, moreover, has rarely if ever been possible. Both limitations were overcome in another experiment in Armstrong’s landmark thesis. Wife and husband received separate information about 36 possible prospective next door neighbors, mainly positive for one spouse, mainly negative for the other, balanced across spouse. Each made separate judgments of neighbor desirability, exchanged their information in discussion, and again made separate desirability judgments. Wife had substantially larger influence in 5 couples while 5 showed small differences. This experimental paradigm has general usefulness for within couple analysis (see further Armstrong, 1984;
GROUP DECISION: SOCIAL AVERAGING THEOREM

Compromise is essential for a group to reach a common decision, whether in marriage or the U. S. Congress. Mathematical analysis faces two severe difficulties: complexity of group interaction and large individual differences in bargaining power. Both difficulties can be addressed with the social averaging theorem which states that the group decision equals the average of the preferred position of each member weighted by that member’s social power.

Graesser (1978, 1991), showed that the social averaging theorem gave good accounts of a task used in several experiments by Davis (1973). In contrast, Davis’ theory of social decision schemes did extremely poorly (see Anderson, 1996a, Figures 5.9 and 5.10).

A wife–husband joint decision paradigm was used by Trouman and Shanteau (1989) in which couples were recruited from childbirth preparation courses. They received an integration design with several dimensions of obstetrical care, made separate judgments of quality, then discussed the information and reached a joint judgment. The averaging law was verified so the Average program could be used to estimate weight and value parameters for both separate and joint judgments.

GROUP ATTITUDES

Averaging theory may be similarly applied to attitudes and other judgments formed in group discussion. Participants in groups of 2 or 3 were given biographical paragraphs about some U. S. president and judged him on statesmanship based on their own information. Next they exchanged information in group discussion and then revised their initial judgments. Finally, they made self-estimates of weight and value of the information provided by each group member, including their own. These self-measures were used in the averaging law and gave good accounts of each member’s final attitude (Anderson, 1996a, Figure 5.11).

These predictions from averaging theory agreed well with the criterial attitudes across several different experimental conditions. It deserves emphasis that exact tests of goodness of fit were available. If this experiment can be replicated, it would help establish exact method for dealing with the complexities of judgments formed in group interaction.
POSITIVE PSYCHOLOGY

Positive psychology was central in the virtue philosophies of the ancient Greeks, a concern that continues to the present day but that has made little contact with experimental analysis (see Moral Philosophy below). Instead, a negative pall was infused by the Judeo–Christian doctrine of inherent depravity of man (e.g., Hunter, 1965, pp. 243f). Negative outlook was reinforced by Freudian theory and sustained by the focus on personality disorders that continues to dominate clinical psychology. Positive psychology, as emphasized by recent writers, has opposite goals—improving the lives of the many rather than the few who have serious disorders. This positive focus makes societal sense—one ounce of prevention can be worth more than pounds of cure.

The term “positive psychology” is a useful organizer for the diverse approaches illustrated in the 65 chapters of the second edition of the Oxford handbook of positive psychology (2009). Empirical analysis remains weak, however, despite work on self-efficacy (e.g., Bandura, 1997), on close relationships (e.g., Hendrick & Hendrick, 2000; Kelley, et al., 1983), and on deserving and forgiveness discussed above. Indeed, personality traits remain the dominating conceptual framework, despite the long-known inadequacies of trait theories to deal with situation and context and hence with living itself (see Person Science and Personality, second previous section). This trait framework also pervades the Oxford handbook of methods in positive psychology (2007) despite important efforts to study individuals over time.

EXPERIMENTAL ANALYSIS

Positive psychology needs to be liberated from the prevailing conceptual framework of personality traits. Experimental analysis of deserving is one promising area. What persons deserve depends not merely on actual accomplishment but also on effort, perseverance, and other variables (Chapter 2). Positive psychology could seek to increase values of such variables. Development of effective methods could begin with integration analysis of parents’ and children’s judgments of feelings of story children under various conditions.

Blame (Chapter 3) also deserves consideration. One concern is to ameliorate its negative effects. A related concern is to increase its positive effects. One positive result is the great healing power of apology, which extends even to forgiveness after civil war (Figure 7.5).
Positive psychology should seek to instill the Golden Rule:  

*More praise, less blame.*

### MEASUREMENT

Research on positive psychology involves diverse measurement issues, a number of which are thoughtfully discussed by Isen and Erez (2007). Information integration is fundamental, as already noted, and points to important measurement problems not considered by Isen and Erez. One problem is whether the measured response is a faithful image of the underlying entity (see also *Response Generality* in Chapter 6). A second problem is to obtain faithful measures of underlying causal variables, such as accomplishment, effort, and need as determinants of deserving. Both problems are solvable when an adding-type law can be established—benefits 2 and 3 of the parallelism theorem of Chapter 1.

A third problem is comparing importance of different variables. Comparing importance is a frequent goal, but suffers pitfalls that undercut nearly all published attempts. The integration laws give effective ways to conceptualize and solve this surprisingly treacherous problem (see *Measuring Importance*, Chapter 6).

Comparison of positive and negative affect is tricky, as Isen and Erez emphasize. Remarkably, this problem can be solved in some cases with functional measurement based on Information Integration Theory. A notable demonstration is given by Oliveira, Fonseca, Teixeira, and Simões (2005).

The idiographic character of the integration laws deserves emphasis. These laws can give unique aid for measuring changes in individual values over time, especially with programs oriented to increase the positive. Such experimental programs can add a new dimension to current efforts based on trait formulations given in Snyder and Lopez (2007).

### EFFECTIVENESS

Positive psychology makes many enthusiastic recommendations: think positively; set positive, realistic goals; have hope; and so on (see Snyder & Lopez, 2007). Are such recommendations any better than the self-help books on every bookstand? Snyder and Lopez (2007, p. 6) advocate “positive psychology that is based on the latest and most stringent experimental methods. In short, an enduring positive psychology must be based on scientific principles.”
Such evidence is in short supply. A pertinent example is the gross shortcomings in Seligman’s (1995) claim for effectiveness of psychotherapy based on mail questionnaires obtained through Consumer Reports. Fatal flaws were pointed out by Hunt (1996) and especially the well-known regression artifact by Brock, Green, Reich, and Evans (1996). Seligman’s (1996) further analysis to deny this regression artifact boomeranged—instead demonstrating its reality (Brock, Green, & Evans, 1998; see Regression Artifact, discussed in Empirical Direction, Section 18.4.5).

Nevertheless, Seligman (2006, p. 6) cited his original article as glowing evidence that psychotherapy is “so robustly effective” with no indication of the criticism—a negative blot on positive psychology.

FAMILY AND SCHOOLS

Family and schools should be a primary focus for positive psychology. Neither gets much attention in either of the two handbooks. Feminist ethics and caring, certainly fundamental for positive psychology, are barely mentioned. The same holds for school programs on character education (see Values and Character Education below; see also Studies of Marriage in Anderson, 2008, pp. 224-231).

Positive psychology, to fulfill its name, should give first consideration to family and schools. These are where effort is most needed—and where it can be most effective.

MORAL SCIENCE

Moral systems are quintessentially positive psychology. They have a positive record that goes back to the religions of the ancient world. Moral science can provide a unifying framework for the scattered domain of positive psychology. Much of everyday life is concerned with positive deserving (Chapter 2) and negative deserving (Chapters 3 and 4), further illustrated with the issues of this chapter. Moral science can help unify the scattered domain of positive psychology.
ISSUES IN MORAL SCIENCE

ANALYTIC CONTEXT THEORY

Context effects are ubiquitous in moral science. However, abstract principles of right–wrong have been the main concern in ethical theory, seeking some universal base for moral thought and action. Much experimental analysis has similarly focused on moral ideals, as in equity theory (Chapter 2) and in moral stage theory (Chapter 5). This neglect of context is little help with moral judgment in real life.

Context capability is essential in person science. Facial expression, tone of voice, and choice of words may all influence meaning of a verbal communication (Note 1). Context is ever-present in the family. Children soon learn that in lying to their parents, they need to take account of multiple aspects of context to make their lies credible and effective. In disagreement with your spouse, contextual factors may bid you hold your tongue no matter how damn right you are.

This context problem may be illustrated with the basic blame law, Blame = Responsibility + Consequences. Responsibility is not an objective variable but a subjective attribution by the blamer. This attribution will depend on context variables such as previous knowledge about blamee and on diverse details of the present situation. Also, of course, it depends on moral attitudes and knowledge systems of the blamer. Most of this will be unknown. Exact theory may thus seem quite impossible. Many writers have so argued, beginning with early Gestalt psychologists and continuing to the present (e.g., Rosnow & Georgoudi, 1986).

Fortunately, exact analysis of context effects is sometimes possible. Cognitive Unitization is one aid. Success of the blame law just cited implies that Responsibility functions as a cognitive unit whose value can be exactly measured. The valuation operation for Responsibility is undoubtedly complex but, however complex, this valuation yields a single, measurable number—the functional value of Responsibility.

Cognitive Unitization also holds for extended wife–husband interaction in Armstrong’s work (Figure 3.2), for witness testimony in the Hoag bigamy trial (see testimony of Catherine Conklin, Hoag’s bigamous wife, quoted in Chapter 4), and for attitudes toward U. S. presidents based on biographical paragraphs (see e.g., two paragraphs on Theodore Roosevelt quoted in Batteries of Stimulus Materials, Chapter 6). Such complex stimulus fields may thus function as measurable units (see also Analytic Gestalt Theory, pp. 309-312 in Anderson, 2008).
Deeper analysis seems possible through experimental manipulation of context components that require implicit preliminary integration. With Blame = Responsibility + Consequences, for example, Responsibility could be determined by two context variables in an integration design. The person judges only blame, but this requires an implicit preliminary integration for valuation of Responsibility. These integrated values are available by benefit 3 of the parallelism theorem. These values may be used to construct an integration graph for the manipulated context variables. This graph may reveal a simple context integration law. Or it may reveal interaction/configurality of the context components.

Holistic views rightly emphasize that phenomenal experiences, such as person cognition and moral attitudes, differ qualitatively from what can be expected from standard experimental analysis. What is needed are method and theory that can study phenomenal experience. Primary reliance has been placed on introspection but introspective reports can be obstinately untrustworthy, as with meaning invariance in person cognition, Chapter 1 (Note 2).

The algebraic laws provide a base for functional holism that has analytic capability with context effects. Foremost are the integration laws themselves. Second is capability for true idiographic measurement of values constructed for complex contexts by virtue of Cognitive Unitization. Third is the method of functional rating as a generally valid response measure (see Response Generality, Chapter 6). Fourth is some capability for assessing multiple components of a holistic response (see Response Quality, Chapter 6). Fifth is capability with the often-subtle task of assessing configurality (see Interaction and Configurality, pp. 357-364 in Anderson, 2008; see also Science of Phenomenology above).

Note 1. Face cognition has been much studied but is widely considered a holistic emergent from facial features. However, exact integration laws have been obtained in impressive studies by Oliveira and associates (e.g., 2012, overview in press), who have developed sound theory and solid experiments to replace previous confusion about the concept of holism. They also point out that their approach can be extended to include verbal interaction and other social variables.

Note 2. Context effects operate in every field of psychology, as recognized in the Axiom of Integration. In psychophysics/perception, context effects are ubiquitous, but have often been treated as “biases” that obscure focal phenomena, sensation especially. A wider framework is available with IIT (Anderson, 1975). An integration law can utilize the “bias” to obtain true measures of sensation—even nonconscious sensation as in Figure 7.2 (see also Verbal Reports above). The “bias”, moreover, can be interesting in its own right (see “Bias” below). Context capability is needed in every field of psychology, especially in moral science.
GOAL THEORY

The self-evident Axiom of Purposiveness has been attractive to many writers as a foundation for psychology. Purposiveness has rightly been criticized, however, because it tends to be used as an explanation for what needs to be explained. A more analytical approach is desirable.

INFORMATION INTEGRATION THEORY

The Axiom of Purposiveness is represented in the threefold appearance of GOAL in the Integration Diagram, repeated here from Chapter 1. Each operation represents a component goal of an overall operating goal. Algebraic integration laws provide an analytic base to study all three component goals: valuation—integration—action.

Figure 7.7. Information integration diagram. Chain of three operators, V – I – A, leads from observable stimulus field, {S}, to observable response, R.

Valuation operator, V, transmutes stimuli, S, into subjective representations, ψ.

Integration operator, I, transmutes subjective field, {ψ}, into implicit response, ρ.

Action operator, A, transforms implicit response, ρ, into observable response, R.


Valuation. Valuation is fundamental: valuation bridges the internal world of living with the external world in which the organism seeks to live. How far valuation processes have evolved from primitive pain and
food motivations was indicated with fairness division in Chapter 2. Each of multiple inputs (accomplishment, effort, need, . . .) was to be valuated in comparable terms for each of two persons (see also Figure 2.5).

**Integration.** Multiple variables are the rule. This was seen in the discussions of fairness/unfairness (Chapter 2) and blame (Chapter 3). Multiple variables are also important in biological motivations as with food, the value of which may depend on four or five taste senses as well as temperature and texture (see Note 20 in Chapter 6).

**Dis-integration.** Adding-type laws can dis-integrate an integrated response to measure functional goal values of each of multiple determinants (parallelism theorem, benefit 3). These goal values are not properties of stimuli per se, as in current goal control theories. Instead, they are subjective values constructed by goal-oriented valuation processes. Measurement of subjective goal values is necessary for analytic theory of purposiveness.

**Action.** The root function of action is adjustment to the external world. Some theorists take the external world as their criterion. Perceptual-motor skills such as tracking a moving target or driving a car in traffic have been studied in terms of goal-error feedback (Note 1).

Most actions, however, remain largely internal, as in resolving a conflict of obligation or reacting to one’s spouse. Understanding how internal action sequences are constructed is a basic problem. A foothold for internal analysis is given by the psychological laws (see *Action Theory*, pp. 344f in Anderson, 2008).

**Assemblage Theory and Executive Goal.** The three operations of the Integration Diagram represent different subgoals of an overall goal. To specify these subgoals and assemble them into an operating whole involves an operating goal or central executive (e.g., Baddeley, 1996; Pashler, 1998). This assemblage problem has been considered by various writers but experimental tasks and theory remain limited. Naïve physics has advantages (see *Assemblage Theory* in Anderson, 1982, pp. 344ff, 1983, 1996a, pp. 272f; Anderson & Wilkening, 1991).

**MOTIVATION**

The concept of motivation underlies all three GOALS of the Integration Diagram. Foremost is valuation, which constructs situation-sensitive values for multiple aspects of a goal.
Multiple determination is a basic problem in motivation theory, poorly recognized in standard typologies of drives and needs. A quantitative foundation for motivation theory is thus available with the three laws of information integration. These laws solve the problem of multiple variables. Moreover, they can yield true measures of the separate values that were integrated—including nonconscious values (Note 2).

GOAL FIELDS

Multiple goals and subgoals are the norm. Even the simple Integration Diagram of Figure 7.7 lists three subgoals, one for each operation.

Conflict, as in moral dilemmas, is a prototypical case of multiple goals. In the fair shares studies of Chapter 2, each person corresponds to a subgoal that may involve initial, individual valuation to determine deserving. Each individual valuation will involve its own goal field of such variables as effort, need, and contribution. This flow of information processing was found to differ from plausible assumptions previously taken for granted but not previously testable (e.g., Input Integration Versus Fairness Integration, Chapter 2).

Temporal evolution is common in which the goal field includes a sequence of subgoals that involve stepwise information processing. The juror learning curves of Figure 4.3, for example, represent a homogeneous sequence of valuation/integrations of witness testimony, organized by the goal of judging the prisoner at the bar. More generally, heterogeneous sequences may involve contingent subgoals at each successive step (see Extended Integration Diagram, Chapter 6).

OTHER GOAL THEORIES

The Axiom of Purposiveness is universally recognized in psychology, explicitly by early writers such as James (1885), McDougall (1923), and Tolman (see 1959), and implicitly in behaviorist concepts of motivation and drive. The main problem is to find an observational base for theory.

Goal concepts have been basic in behaviorism, as in Skinner’s functional, goal-oriented conception of behavior. This functional view was criticized as too narrow by Rachlin (1994), who argues it must be extended to include mentalistic concepts. Cognitive psychologists might welcome Rachlin’s view except for his simple solution: “Overt behavior does not just reveal the mind, it is the mind. Each mental term stands for a pattern of overt behavior” (p. 15). This view cannot recognize the three functions of the above Integration Diagram. This view cannot recognize
the central operation of valuation because values are not generally observable in an integrated overt behavior. This view has no capability with the Axiom of Integration. This view does not recognize the important role or even the meaning of response linearity. Nor does it recognize that the averaging law depends on extra-behaviorist conceptions.

Schwartz (1995, p. 237) criticizes Rachlin for failure to distinguish between Skinner’s behaviorist functional view (the why of behavior) and teleology or purposiveness:

Treating the distinction as significant might lead to a cognitive psychology of goals of final causes. It would be quite different from the cognitive psychology that actually exists, because of its focus on goals rather than mechanisms. But it would also be quite different from teleological behaviorism, because of its focus on mental states and processes rather than, or in addition to, behavior.

Such joint focus on mental states and processes as well as on behavior is the heart and soul of IIT.

Contributors to Frese and Sabini (1985, p. xviii) seek to ground goal theory on feedback from the external world. This externalist base is reemphasized by Sabini, Frese, and Kossman (1985) who assert it for person cognition. They do, however, recognize that information integration is essential (p. 255): “The question we need to answer is . . . How do we combine information derived from different sources . . .?” Respectable progress has been made on this question of information integration by the many workers on IIT.

Discussions of goal issues in recent edited books (e.g., von Cranach & Harré, 1982; Frese & Sabini, 1985; Morsella, et al., 2009; Moskowitz & Grant, 2009; Pervin, 1985) have pursued treatments too extensive and diverse to be discussed here, especially for analyzing conflict situations which are central to goal theory, such as fair division (Chapter 2), legal judgment (Chapter 4), and moral dilemmas (see also Conflict and Compromise above). None, however, has solved the problem of finding an effective theory of integration, which is necessary for general goal theory.

Note 1. Progress has been made with cybernetic-type control theories (e.g., Rosenbaum, 2005; Vancouver & Zawidski, 2007). Control theories, however, seem limited by reliance on measurement in the external world. Measurement in the internal world, the main locus of purposiveness, is essential for goal theory, especially for social goals.

Note 2. Typologizing has been a frequent approach to motivation, as with biological “drives,” emotional “dimensions,” and social “needs.” These stopgap solutions can be useful but they shortchange the phenomena. The integration laws embody a more inductive approach (Anderson 1981a, 1984b).
AFFECT IS INFORMATION

Affect is information in IIT—integral to cognition. This affective–cognitive unification differs from once-common views in both cognitive and social psychology.

Affect was treated as information in the initial integration studies of person cognition; person judgment was a cognitive integral of affective values of personality trait adjectives. This affect-is-information conception is reemphasized in the moral laws of Chapters 2-5.

Integration laws can unify affective and nonaffective. One example appears in the multiplication law for Subjective Expected Value, in which value may be affective but expectancy nonaffective.

This unity of affect and cognition would hardly need mention except that some authors have asserted that the two are distinct. This segregation of affect from cognition stemmed from an old quasi-philosophical tri-chotomy of cognition, affect, and volition, also embraced by some social psychologists (e.g., Berscheid, 1982; Fiske, 1982, 1986; Zajonc, 1980, 1998; see Anderson, 1996a, pp. 135f, Taylor, 1998, p. 72).

This affect–cognition segregation was reemphasized by nearly all contributors to Lau and Sears (1986). A review of this book (Anderson, 1987, p. 297) concluded: “Social-political cognition requires a more social conception of information processing, one that gives primary place to affect, values, and social goals. . . . By being true to itself, social psychology could be more true to its sister disciplines.”

Similarly, Taylor (1998, p. 72) comments that social psychologists lived with a fundamentally cognitive view of the social being—to the relative exclusion of motivational, affective, and behavioral processes.

This sundering of affect and cognition seriously distorted theory and experiment. Affect is integral to cognition throughout everyday life. Cognitive theory must be able to treat affect and motivation in conjunction with nonaffective variables (Note 1).

Note 1. A curious denial of affect occurs in Gibson’s (e.g., 1979; Neisser, 1993) ecological psychology. Neisser’s “ecological self” strictly disallows affect although pleasure and pain are surely basic for ecological survival. Gibson’s theory itself rests squarely on an assumed veridicality of perception of the external world. Thus it cannot recognize nonveridical perception in illusions such as the size-weight illusion of Figure 7.2.
MOOD IS INFORMATION

Mood comes in many varieties: good, bad, hope, dismay, satisfaction, and so on. Each mood reflects our current state and constitutes information that is used in our ongoing continuum of thought and action. A natural hypothesis is that mood will exhibit the three laws of information integration.

This view of mood as information was proposed by Martin Kaplan (1971a,b,c, 1975) as part of his integration-theoretical approach to personality. Kaplan found that mood was integrated as an independent informer (prior state) in parallel with external stimuli, in accord with the averaging law. Kaplan’s mood law was replicated in his work on juror psychology (Chapter 4).

Novel mood processes were predicted by integration theory. Previous theories assumed mood operates through memory, at encoding or at retrieval (e.g., Bower, 1981; Isen, Shalker, Clark, & Karp, 1978). As one example, Isen, et al. (1978) found that people who received a small gift thought better of their cars and TVs. This was interpreted to mean that the good mood induced by the gift caused retrieval of positive affective memories from long-term memory. However, care is needed to avoid confounding such memory effects with the direct effect demonstrated by Kaplan. Few workers seem aware of this confound or how to avoid it. Heit’s (1993) ingenious analysis of three theories of stereotypes supports Information Integration Theory.

Kaplan’s law of mood is a high point in mood theory because of its analytic power. IIT provided a natural place for mood in terms of prior state as Kaplan showed (Notes 1 and 2).

Note 1. Vigorous disagreement with Kaplan’s mood theory by Clore (e.g., Clore & Byrne, 1974) made the sharpest distinction between mood and information (see Information Integration Theory vs. Reinforcement–Affect Theory, Chapter 4).

Since then, Clore (e.g., 1992) has made a complete about-face, now treating mood as information as Kaplan had originally done. A cordial invitation is given Clore to utilize the analytic power of Information Integration Theory in his studies of mood. These laws allow true measurement of mood and of its causal variables, including nonconscious variables.
EMOTION INTEGRATION THEORY

Integration laws can liberate the traditional typologies of emotion theory by studying integration of multiple variables. These laws can resolve two basic measurement issues. One is to obtain true linear measures of underlying emotion. Such capability for response measurement is provided by benefit 2 of the parallelism theorem.

The other measurement issue is to dis-integrate the response to obtain true measures of the functional values of each stimulus variable—including nonconscious values. A number of experimental applications are summarized in Anderson (1989b, 2008).

Phobias. Phobias offer interesting opportunities for studying emotion, both for theory and for therapeutic applications. An expectancy × valence model was found in Klitzner’s 1977 PhD thesis (see Figure 6.2, p. 137, in Anderson, 1989b). Adding-type integration tasks could allow simpler experimental applications.

Relative Importance. One integration question has been studied by a number of investigators: what is the relative importance of different variables? “Perhaps without exception, these studies rest on invalid methods of measurement” of importance (Anderson, 1989b, p. 166). Valid methods have been developed in penetrating work by Armando Oliveira and his associates, also notable for clarifying the long perplexity of holistic analysis (see Oliveira, et al., 2012).

Pain. Pioneering application of functional measurement by Algom, Raphaeli, and Cohen-Raz (1986) found an algebraic model for cross-modal integration of painful noise and electric shock. Impressive studies of perception of pain from facial expression have been done by Armando Oliveira and associates (see Note 10 in Chapter 6).

Cerebral Organization. The separate roles of the two hemispheres can be quantified with bi-hemispheric integration designs, as with the predominance of the right hemisphere in emotional reactions. Similar methods may be applied with the two eyes. Metric responses from integration tasks can be more meaningful than the common threshold identification tasks (Anderson, 1989b, pp. 177ff).

Social Emotion. Integration theory embodies a more social approach to emotions than the common biologically-oriented framework. Examples are unfairness (Chapter 2), blame (chapter 3), retribution (Chapter 4), and forgiveness (Chapter 7), all of which have followed algebraic laws.
LANGUAGE ALGEBRA

Algebraic laws of language have been found in a number of applications of Information Integration Theory (see Algebraic Language Processing, Chapter 12 in Anderson, 1996a). A brief overview is given here.

Continuous Language Concepts and Oden's Fuzzy Logic. Many language expressions have a range of possible meaning. Traditional syntax and semantics, however, rely on accuracy measures and cannot deal with much language function. The laws of information integration, in contrast, provide a base for pragmatic language concepts that allow true measurement of meaning as a continuous function.

A notable example is Gregg Oden's extension of fuzzy set theory from normative to descriptive status. Applications include his fuzzy models for disambiguation, class membership, and quantifiers (e.g., Oden, 1974, 1978a,b, 1979, Oden & Massaro, 1978).

Prototype Algebra. That words have fixed lexical meanings, independent of context, has been argued by various writers but evidence has been lacking. Indeed, fixed meaning has been denied by some who have presented seeming counterexamples. Thus, a few crumbs are more numerous than a few cookies. Definite evidence for reality of prototypes was given in Shu-Hong Zhu's PhD thesis, which yielded a weighted average integration for probability quantifiers:

\[
\text{Judged likelihood} = \omega_p \times \text{Prototypical likelihood} + \omega_b \times \text{Base rate}.
\]

Prototypical likelihood was a fixed constant in each of three different scenarios (see Figure 12.11 and Table 12.4 in Anderson, 1996a). This model was extended to include confidence expressed by the speaker.

Context. Meaning arises from purposiveness and hence depends on context, both for communicator and for recipient. Oden (1974, 1978b) manipulated both contexts in his pioneering extension of fuzzy set theory to continuous language concepts (see Figure 12.7 and Table 12.2 in Anderson, 1996a). Capability with context is essential in language pragmatics (see Analytic Context Theory above).

True Measurement of Language Parameters. True measurement of language parameters becomes possible, not only for overt response, but also for stimuli, including preconscious stimuli (e.g., benefits 2 and 3 of the parallelism theorem). This functional measurement can be applied to single persons.
ATTITUDE INTEGRATION THEORIES

Besides IIT, attitude integration models have been presented by other investigators, a few of which are briefly noted here.

PROBABILITY MODELS

McGuire (1960) sought to combine syllogistic reasoning and probability as joint determinants of attitudinal judgment, A. A more general model appears in mathematical statistics that may be written:

$$\text{Prob} (A) = \text{Prob} (X) \text{Prob} (A|X) + \text{Prob} (\text{not}−X) \text{Prob} (A|\text{not}−X).$$

McGuire’s model was extended in this way and tested in several experiments by Wyer (1970; Wyer & Hartwick, 1982). A valid model test was available in only two of these experiments but the model did very poorly in both. This poor showing may have resulted from faulty method. With functional measurement theory, the model did quite well in Anderson (1975; 1981a, Figure 1.23, p. 72) and Wyer (1975).

FISHBEIN–AJZEN THEORY

Classical conditioning was used by Fishbein (1967) as the base for his model about attitudes toward behaviors:

$$A = \Sigma b_i e_i.$$

Here $b_i$ is the subjective probability that the behavior has attribute $i$, and $e_i$ is the value of the behavior on attribute $i$. The sum is to be taken over over a complete set of independent attributes, as in multiattribute theory. Classical conditioning later transmuted into “Information Integration” (Fishbein & Ajzen, 1975, p. 235), but without using analytic power of IIT. Fishbein–Ajzen theory pretends to solve the problem of information integration but it cannot; it lacks capability for true measurement of $b_i$ and $e_i$. Moreover, Fishbein–Ajzen theory denies the averaging law so prominent in attitudinal judgments (Anderson, 2008, pp. 127ff).

JACCARD’S ATTITUDE DECISION THEORY

James Jaccard has presented a multiattribute decision model for attitudes that has solid advantages over Fishbein–Ajzen theory (e.g., Jaccard & Becker, 1985). These include
1. Inclusion of nonattitudinal variables (e.g., subjective norms).
2. General applicability, not just to attitudes about behaviors.
3. Valid methods for analyzing attribute integration based on functional measurement.

The work of Jaccard and his colleagues is a model of scientific inquiry.

DUAL-PROCESS THEORIES

Recently popular dual-process attitude theories (Chaiken & Chen, 1999) consider that people use two kinds of informer variables in processing an attitude message. These correspond, roughly, with message content and with noncontent informers such as source reliability. Both processes have straightforward representation in IIT: message content corresponds to $\psi$, the polarity value of the message; source reliability corresponds to $\omega$, the importance weight.

In heuristic–systematic theory (e.g., Chen & Chaiken, 1999), a heuristic determines reliance to be placed on the position advocated by a message, independent of message content. Their illustrative heuristic, “Experts can be trusted,” is an example of such source reliability.

Integration experiments (Himmelfarb & Anderson, 1975; Birnbaum, Wong, & Wong, 1976) had shown that source reliability acted as an importance weight that multiplied the polarity value of the message:

$$\text{heuristic} \times \text{systematic} = \text{source reliability} \times \text{polarity value} = \omega \times \psi.$$ 

Integration of two such messages followed the averaging law.

Chen and Chaiken presented two qualitative hypotheses, attenuation and additivity, to illustrate predictability of integrating heuristic and systematic information. Both follow simply from the present functional theory (Anderson, 2008, p. 116). IIT can go further to provide quantitative analysis as in the two cited experiments.

Peripheral–central theory also presented two qualitative integration assumptions, tradeoff and strength (e.g., Petty & Cacioppo, 1986; Petty & Wegener, 1999). Both follow from IIT (Anderson, 2008, pp. 116f).

Valuation and integration of information are both fundamental in attitude theory. Multiple stimulus variables, including context, must be valued and integrated. These long-standing obstacles can be resolved in some important cases, illustrated with attitudes toward U.S. presidents (Anderson, 1973, 1974b; see Figure 6.1 in Chapter 6). An effective foundation for attitude theory has been provided by these mathematical laws of information integration (see further Anderson, 2004, 2008).
“BIAS”

_Bias_ refers to a deviation from some standard of accuracy or correctness. Not a few writers misuse the term by referring to a standard that is inappropriate or even nonexistent. Thus the _negativity effect_ (greater importance weight of stimuli with more negative value) is popularly referred to as “bias.” But often, perhaps typically, more negative stimuli carry more information and so _should_ have greater importance weight (e.g., Anderson, 1972b). This is not bias but a sensible effect.

“Bias” is often misused in the attitude literature. The scholarly volume of Eagly and Chaiken (1993, p. 680) echoes a common view in saying that “Individuals resist influence through multiple cognitive processes that are _biased_ in favor of their initial attitude” (italics added). Functional theory, in sharpest contrast, conceptualizes attitudes as knowledge systems that have a proper function of utilizing past learning in present thought and action.

To illustrate, consider the carefully designed experiment of Lord, Ross, and Lepper (1979). Participants received a matched pair of alleged research reports, one arguing that capital punishment acted to deter murder, the other arguing the opposite. Participants judged the research report that supported their prior attitude as more convincing and better conducted. This outcome was interpreted as “biased processing” and is widely cited as a definitive demonstration.

This “bias” interpretation fails to understand the functional nature of attitudes. They are knowledge systems that help us get along in an uncertain world of limited information and personal goals. The widespread acceptance of “bias” interpretations reflects basic misconceptions about nature and function of cognition.


- The “bias” orientation misunderstands attitude function . . . AKSs [attitude knowledge systems] are memory stores that help a person utilize past experience in present action. We all differ in cultural, family, and genetic background so we naturally differ in our AKSs. And we differ in our motivation and goals. By the Axiom of Purposiveness, therefore, we are bound to differ in our value judgments, our attitudinal judgments, in particular. _Much “bias” is normal functioning of prior attitude._

“Bias” interpretations rest on some assumption, often implicit, of some “correct” response. In the above example, the pro and anti research reports were carefully constructed to be equal and opposite in face value.
To a person with neutral prior attitude, the pro and anti messages would seem equally well done and equally convincing. But the proper function of prior attitudes is to aid present judgment. This is a vital function even though it will usually rest on insufficient information and often be controversial. Thus, the perpetual political disagreements between conservatives and liberals stem from different attitudes that often have a sensible base not recognized by the other side (see also *Juror Bias*, Chapter 4).

Often a correct standard is simply assumed, as in many studies of ethnic prejudice or social stereotypes. Rightly speaking, the “bias” is in this assumption. Most who study such questions agree that such beliefs are socially undesirable. But to call them “biased” is a claim for being a God of truth.

Misuse of “bias” also pervades judgment–decision. Much such “bias” represents deviations from optimal behavior prescribed by normative models. Once it is realized that normative framework is largely foreign to cognitive process, the “bias” vanishes (e.g., Anderson, 1968b, p. 392, 1982, pp. 335f; 1991a, pp. 123-133, 1991b, pp. 210-217, 1996a, pp. 344-351; Shanteau, 1978). The once-much-studied “conservatism bias,” which arose from mispressing normative Bayesian theory into a descriptive, psychological mode, is a prime example (Anderson, 1982, p. 333). Once the cognitive irrelevance of the normative Bayesian model is realized, conservatism is seen to be a “noneffect.”

Treating conservatism as a psychological phenomenon was a mistake. The behavior called conservatism invalidates the Bayesian model as a description of human cognition. But conservatism only exists by reference to this Bayesian standard. Once that standard is seen to be invalid, conservatism loses claim to psychological reality. Conservatism is not a cognitive illusion; it is a cognitive noneffect. (Anderson, 1996a, p. 345.)

Why is “bias” so popular? One answer is that it attributes psychological reality to the “bias,” making it seem that the data mean something, that they reflect operation of real cognitive processes, as in the above quotation from Eagly and Chaiken and with the conservatism “bias.” As concluded in Anderson (1982, p. 336): “such terms as . . . *bias* . . . are attractive because they invoke the image of dynamic, interactive psychological processes. At present, however, they are largely free-floating theory.” Indeed, they obfuscate the real problem of understanding the phenomena.
OBJECTIONS TO PSYCHOLOGICAL ALGEBRA

Human thought and action generally involve information integration. Psychological algebra thus provides a useful base for psychological science. Some writers, however, object to psychological algebra.

MEANING INVARIANCE

This still-seductive objection asserts that stimulus informers commonly interact to change one another’s meanings and values. The value of any given informer would not be constant for any given goal, therefore, but depend on which other informers accompanied it.

Invalidity of this objection has been shown repeatedly by empirical successes of the parallelism theorem (benefit 4). The phenomenal feeling of meaning change was instead shown to be a halo effect.

Some situations do involve change of meaning (or weight). Redundancy and inconsistency are important cognitive processes about which little is known (see index entries in Anderson, 1981a, 1996a). The psychological laws can help study these and other interactions.

COMPLEX STIMULUS FIELDS AS COGNITIVE UNITS

Some writers object that mathematical laws simply cannot hold with complex stimulus fields. This objection seems reasonable at face value. But this objection is nullified by the many successes of the integration laws with complex stimulus fields (benefit 5 of parallelism theorem).

Observed parallelism implies that the valuation process has reduced the complex field to a single, goal-oriented value (Anderson, 1981a). This Cognitive Unitization implies that complex stimulus fields can be exactly measured for individuals, a unique tool for cognitive science.

CONTEXTUAL EFFECTS

Contextual theorists argue that values are not constant but depend on situational context. This is not a proper objection—Information Integration Theory insists that values depend on context (see Analytic Context Theory above).

This contextualist objection also fails to appreciate the distinction between valuation and integration in the Integration Diagram. Valuation
may be very complex but contextual value may be exactly measurable by virtue of Cognitive Unitization (benefit 5 of parallelism theorem).

JUST AN EQUATION

This objection is that the algebraic laws are just equations, somehow lacking cognitive reality or phenomenal relevance. Quite the contrary; these laws clear up some prevalent confusions and provide conceptual clarity. Meaning invariance, discussed above, is the classic example; it was discovered by success of an equation (benefit 4 of parallelism theorem). The same applies to the treacherous problem of “assessing the relative importance of several variables” in the quote below (see Measuring Importance, Chapter 6). Other examples that require an equation for conceptual clarity include “bias” (preceding section), treating complex stimulus fields as cognitive units by virtue of Cognitive Unitization, as well as opposite effects and halo theory (see Chapter 1).

In attitude theory, these equations exposed the fixation on “nonattitudes.” These laws went further to ground an effective revival of functional theory of attitudes (Functional Theory of Attitudes, Chapter 8).

In developmental psychology, these equations showed that young children have high cognitive capabilities previously denied. Moreover, they revealed conceptual failure of popular stage theories of moral development (see Moral Stage Theories, Chapter 5).

In person science, these equations provide analytic capability for single person, idiographic analysis (see Person Science above).

In learning/memory, integration equations can liberate this field from its narrow historical concentration on rote learning and conditioned reflexes to study functioning vital in everyday life (Figures 8.2 and 8.3).

In judgment–decision, the integration equations facilitate the conceptual shift from normative to cognitive framework.

These equations make unification of psychological science feasible.

NOMOTHETIC–IDIOPHORIC LAWS

Search for general laws has long been a guiding hope in psychological science. This nomothetic theme, as it is called, envisages something analogous to the laws of physics. Much work in perception and psychophysics is guided by this theme (Anderson, 1974a; Masin, 2003).

Person sciences, however, require a very different idiographic theme that focuses on individuals. Can general laws be expected in moral
judgment, which exhibits such large individual differences? This same question holds throughout person science.

Independence of valuation and integration in the Integration Diagram is a key. Valuation is certainly idiographic; people differ markedly in values in every realm. Much integration, however, is nomothetic—the three integration laws have done well with individuals in many fields of psychology. These integration laws allow idiographic measurement. Effective nomothetic–idiographic theory is thus possible.

**MULTIPLE VARIABLES**

All thought and action depend on multiple variables. Multiple regression is remarkably useful for practical prediction but inept for conceptual understanding (Chapter 6). Analysis of variance does better but statistical interactions are treacherous because they rely on an arbitrary, Procrustean additive equation (see Understanding “Interactions” in Chapter 6; Note 3 under Person Science and Personality above).

Correct analysis of multiple variables is provided by the psychological laws. These laws can also solve the treacherous problem of measuring relative importance in some cases (Chapter 6).

**MODES OF THOUGHT**

The two problems represented in the Integration Diagram, namely, *valuation* and *integration*, are basic in every area of psychology. Lacking methods to solve these two problems, other approaches were perforce adopted. The resultant modes of thought developed conceptual fixedness that severely constricted the field of inquiry.

Many examples illustrate this conceptual fixedness in social–personality. Among these is the typological mode of thought that pervades personality theory. Another is the fixation on “nonattitudes” that continues dominant in attitude theory (Anderson, 2008, pp. 109f).

In the fifth edition of the *Handbook of social psychology*, Wilson, Aronson, and Carlsmith (2010, p. 79) call for a new synthesis:

> An emphasis on assessing the relative importance of several variables, which all influence an aspect of multiply-determined behavior, rather than on testing to see if a particular variable has a “significant” impact.

Such a new synthesis had been flourishing for nearly a half-century. “Multiply-determined behavior” is the essence of the Integration Dia-
gram. Much such behavior follows algebraic laws of information integration, as shown by many investigators in many countries.

These integration equations made two related contributions. First, they made clear the invalidity of most common methods of assessing “relative importance.” Second, they provided valid methods (see Measuring Importance, Chapter 6).

INDUCTIVE THEORY

The inductive mode of inquiry followed in Information Integration Theory places primary emphasis on phenomena. Inductive theory seems formless and uncertain to many workers who favor a deductive mode. They wish to begin with theoretical formulation to be tested by deductive implications. But the Axiom of Integration only emphasizes the universal phenomena of multiple determination; the three psychological integration laws emerged from inductive inquiry (see index entries to inductive theory in Anderson, 1981a).

These three laws illustrate advantages of the inductive mode; they led to new conceptual outlooks in several fields of psychology. One was revival of functional theory of social attitudes. Another was the functional, goal-oriented conception of memory/learning. And these laws solved the problem of true psychological measurement, a long-standing roadblock in fields as far apart as psychophysics, judgment-decision, language, and person science (see further Chapter 8).

GENERALITY

Generality is a problem everywhere in science. Any set of data must be gathered under specific conditions. Results may lack generality. One problem concerns generality across people. The integration laws have shown some promise across age and culture because they allow for idio- graphic values. Cross-cultural analyses can help understand the nature of morality by comparative analysis of cultural systems of moral values.

A second problem is that only a few moral issues have been considered. Integration studies of friendship, love, self-fulfillment, self-blame, regret, jealousy, envy, admiration, respect, honesty/dishonesty, beneficence, lying, spiting, getting even, obligation, and many other moral concepts are rare. The generality of the three integration laws is thus uncertain. Integration experiments, however, can hardly fail to be useful.
INTUITION

A contrast between intuitive and analytic modes of thought is currently popular. Different writers take different views but the main sense is that intuitive thinking is nonconscious and effortless whereas analytic thinking involves conscious deliberation. Intuition is considered to have explanatory power as a unique mode of thinking.

Such ideas of intuition fail to recognize the conceptual structure of the Integration Diagram. The valuation operation has fundamental importance; it transmutes an external stimulus into an internal, goal-oriented value. Valuation may be nonconscious and seem effortless but to call it intuitive obstructs analysis of this goal-directed processing. Blaming your spouse often seems intuitive, but that merely obscures the underlying social-cognitive processing.

The nature of the valuation operation is largely unstudied, having been finessed with functional measurement of stimulus values. Valuation processes have basic importance, however, and deserve systematic study.

Intuitive formulations also ignore the fundamental importance of integration. Integration processes may become habitual and no longer need conscious attention, as with judgments of blame (Chapter 3). Indeed, intuitive and analytic integration often follow the same laws.

In the moral realm, Haidt’s (2001) intuitionist approach had already been obsoleted by the many empirical demonstrations of moral algebra over the previous 30-odd years (Chapter 2-5). Moral algebra is not some mysterious intuition; it follows definite cognitive processes.

An interpenetrating mix of nonconscious and conscious processing is the rule. Some degree of conscious analysis is often needed when multiple determinants are to be valued and integrated. This may be expected in conflict situations in which each of two alternative actions has both pros and cons. Examples appear above in Conflict and Compromise and in Forgiveness/Nonforgiveness. Algebraic integration laws appear in both areas. These laws allow deeper analysis of conjoined nonconscious/conscious deliberation (see Science of Phenomenology, above).

Other examples appear in developing rules for allocating scarce resources (e.g., Elster, 1992) in deciding about whistle blowing (Bok, 1982), or in developing codes of ethics. The superficiality of intuitionist views stems from simplistic ignoral of basic processes of valuation and integration.
MORAL PHILOSOPHY

Moral philosophy has been dominated by the idea that moral law exists and is the same for all persons and all times. Social scientists, however, especially historians and anthropologists, have emphasized the diversity of moral systems in different cultures, past and present. These observations suggest that morality is not culturally invariant (Note 0).

Most philosophers anathematize moral relativism. It denies the very idea of moral law. If anything can be right or wrong, their basis for morality vanishes. To set this issue straight, they apply their sovereign remedy—philosophic reason. Here is one example:

It is so very obvious that moral ideas differ from country to country and from age to age. And it is so very easy, if you are mentally lazy, to suppose that to say this means the same as to say that no universal moral standard exists—or in other words that it implies ethical relativity. We fail to see that the word “standard” is used in two different senses . . . [The relative sense] means what people think right, whether as a matter of fact it is right or not. On the other hand when the absolutist asserts that there exists a single universal moral “standard,” he is not using the word in this sense at all. He means by “standard” what is right as distinct from what people merely think right. His point is that although what people think right varies in different countries and periods, yet what actually is right is everywhere and always the same. And it follows that when the ethical relativist disputes the position of the absolutist and denies that any universal moral standard exists he too means by “standard” what actually is right. (Stace, as excerpted in Feinberg, 1985, p. 474)

The force of reason, according to Stace, thus compels the relativist to admit the existence of a universal moral standard. This is Stace’s strong argument; rationally it should suffice. Stace apparently feels, however, that rational argument may not convince some people and goes on to overthrow simplistic views of moral relativism (Note 1).

This quotation is from Feinberg’s (1985) sixth edition of a book of readings in philosophy. Feinberg (p. 462) comments that “if the conclusions of Stace are rejected, there may be little point in trying to settle the ethical issues debated in the other articles” on moral theory.

Another denier of moral relativism is W. D. Ross (1930, p. 15) who says “there are not merely so many moral codes . . . whose vagaries can be traced to historical causes; there is a system of moral truth, as objective as all truth must be.” Similarly, Larmore (1987, p. 131), who insists that morality is complex, not unitary, as previous philosophers had typically assumed, nevertheless maintains that “we have no good reason to deny objectivity to morals in just the sense that we affirm it of science.”
SELF-INTEREST

To a nonphilosopher, it seems obvious that self-interest often conflicts with moral principles in everyday life. Most philosophers resolve this problem by denial. As Feinberg (1985, p. 467) says:

Plato’s *Republic* is prototypical of much of the classical literature of moral philosophy in that it consists largely of arguments designed to show that there is a necessary and invariant connection between duty and self-interest.

It seems refreshing, therefore, to read in *The morality of self-interest* (Olson, 1965, p. 8):

A man is entitled to moral commendation for performing an act only if he has good reason to regard that act as conducive to his own best long-range interests.

But 100 pages later (p. 108), we read:

For if I am right, the rational pursuit of one’s own best long-range interests can rarely if ever be regarded as detrimental to the best long-range interests of society as a whole.

The ambiguity of the phrases “rational pursuit” and “best long-range interests” make this argument proof against disproof.

Amalgamating individual self-interests with general social interests is a fundamental problem for moral theory. At this biosocial level of human life must moral theory be developed.

HUME

Hume (1751/1983) departed sharply from standard moral philosophy by insisting on the first importance of “sentiments” [feelings or values]. Reason was only an aid, not a foundation for morality (Note 2). Hume claimed a foundation in repeated assertions that everyone possesses some “general benevolence, or humanity, or sympathy . . . and I assume it as real, from general experience, without any other proof” (p. 90).

But Hume hardly recognizes two critical issues. One concerns the conflict between self-interest and benevolence (see *Conflict and Compromise* above). The other is how this “general benevolence” functions to develop our moral system. He relies on a general claim that moral actions are socially beneficial in the long run, a forerunner of utilitarianism, which skims past problems of self-interest and interpersonal conflict. Hume says virtually nothing about how children learn moral principles. About women, he says “yet such are the insinuation, address, and charms of their [men’s] fair companions, that women are commonly able to break the male confederacy, and share with the other sex in all the rights and privileges of society” (p. 26). Pretty embarrassing.
CONTRACTARIAN THEORIES

Contractarian theories attempt to avoid the traditional appeal to higher moral law. Instead, they postulate that society rests on some imaginary agreement that people enter into as a preliminary to deciding on their form of government. The term social contract throws a rational–legalistic sheen on what has usually been some assumption of equalitarianism. The originals of Hobbes, Rousseau, and Locke were in line with growing sentiments about rights of individuals and helped overcome the prevailing doctrine of divine right of kings, which at that time could have made the base for a contract at least as cogent, perhaps more.

The modern version by Rawls (1971) postulates an imaginary “veil of ignorance” in making the contract. Hence each person will agree to equality for fear of coming out less than equal. But, as others have pointed out, persons beyond Rawls’ imaginary “veil of ignorance,” as all of us are, may well prefer personal self-interest above Rawls’ equality.

Contractarian morality is rationalist fantasy, wishing away the pervasive reality of moral conflict. Moral theory must be grounded on social reality, not some socially unreal “contract” (Note 3).

UTILITARIANISM

The utilitarianism of Bentham and Mill made a historic advance by treating social good as a base for morality, a theme that remains prominent in later discussion. Moreover, the utilitarian slogan, “greatest good for the greatest number,” in spite its long-known mathematical incoherence, was influential in the English reform movement of the 1800s. This goal was in tune with the equalitarianism of the American and French revolutions. Utilitarianism represents a radical shift from the long belief in transcendent moral law to a social–moral base.

Despite these virtues, utilitarianism has been severely criticized by later writers. One criticism is that classical utilitarianism rests on the principle of equality: “each person counts as one.” This equality is inconsistent with the meritarian principle that people should be rewarded in proportion to their deserving. Indolent persons would be delighted to contribute to the “greatest good” by greatly enjoying their indolence.

Measurement problems constitute a major group of criticisms. Utilitarianism assumes that “good” is ultimately one-dimensional and comparable across persons. But how can the good man Y gets from teaching in middle school be compared to the good woman X gets from being school principal? And how can the good they contribute to society be measured
and compared? More generally, the meritarian principle requires valuation, integration, and comparison of multiple variables between different individual persons, capabilities quite neglected in utilitarianism, which seems willfully blind to the prominent issue of dealing with the between-person conflicts that pervade society.

“Greatest good” depends squarely on psychological measurement. True measurement for individuals is possible in some cases with the functional theory of measurement. Cross-person comparisons, however, seem possible only in a limited, pragmatic sense. Everyone needs food, shelter, and personal dignity, but value comparison of many goods (e.g., children, friends, music, self-fulfillment) is problematic.

Utilitarianism imposes a rigid amalgamation of individual and society. Functional theory recognizes individual–social symbiosis but emphasizes that individuals have some independent moral status.

VIRTUE THEORY

Virtue theory, which has enjoyed recent popularity, differs from contractarianism and utilitarianism in allowing greater emphasis on individual morality. Virtue theory goes back to Aristotle, who differs from most moral philosophers in some recognition of social reality. His basic proposition is that the good life consists of human flourishing in accord with reason and virtue (eudaimonia). Reason and virtue are central to Aristotle’s discussion, which makes two practical points.

First, moral virtue is not given by nature but comes from education and habit. This is good psychology, emphasized also by Benjamin Franklin, William James, John Dewey, and others in modern times. Aristotle (pp. 281ff), however, says that virtue must come from laws of the state for both young and old, following “the principle that we can be made good by laws.” Aristotle considered that the laws were rightly directed in Sparta but in few if any other places, apparently including Athens. Only glancing attention is given formal schooling, or the family, emphasized in recent feminist reconstruction of the idea of morality.

Second, virtuous action in any situation depends on context:

It is possible, for example, to experience fear, boldness, desire, anger, pity, and pleasures and pains generally, too much or too little or in the right amount. If we feel them too much or too little, we are wrong. But to have these feelings at the right times on the right occasions towards the right people for the right motive and in the right way is to have them in the right measure, that is somewhere between the extremes; and this is what characterizes goodness.

[p. 51, italics added. Notes 4 and 5]
“True, but not very illuminating” as Aristotle later allows (p. 150).

Aristotle seems to take for granted that the virtues are known. The moral world of the ancient Greeks was quite different from ours, however, and they had a different array of virtues. That woman is best, said Pericles in his funeral oration, who remains out of public notice.

The *Iliad*, considered a bible in the Greek world, propounded an ethic of warrior honor of killing, especially killing those of higher honor. Aristotle more than once personifies cowardice as the soldier who throws away his shield to flee the battlefield faster. Courage was pertinent because of endemic hostility among the Greek city-states.

The Greek world rested on slavery. Aristotle’s “natural slaves,” which seem to have included most non-Greeks, were outside his moral horizon. A master cannot be unjust to a slave because a slave is property, part of one’s self, so to speak, and no one deliberately injures himself (p. 137). A free man who actually works for another man is also largely outside Aristotle’s moral horizon, which included mainly the well-off few. Today, in contrast, doing our job well is an important virtue.

**MORAL PARADOX**

From the standpoint of traditional moral philosophy, social morality represents a paradox. A simple case appeared with the unfairness paradox of Chapter 2: two persons who make equal objective contributions to a mutual project will both tend to feel that they rightly deserve more than a half-share of the outcome. This unfairness paradox has moral generality, being accentuated by kind and amount of contributions and especially by differences in moral values. Moral philosophy, to be useful, must re-ground itself on the social sciences, including anthropology, history, law, psychology, sociology, especially education and family life. Reason, as Hume recognized, should subserve the passions.

**CONFLICT AND MORALITY**

Moral theory must focus on conflict and conflict resolution; these are central in moral thought and action. Intrapersonal examples include dealing with temptation, balancing self-interest with obligation, and overcoming obstacles to self-fulfillment (see Benjamin Franklin in Note 6).

A natural way to deal with such within-person conflict is cost-benefit analysis: valuate and integrate relevant factors for each alternative and choose that with the best overall value. This of course is what we do in conflict situations. But our calculations suffer multiple difficulties:
overweighting of self-interest or temptation, inadequate balance of present moment and later life, and of course insufficient information.

Between-person conflict involves a higher level of difficulty. Different people inevitably have different values. The many cases include wife–husband differences over parental discipline, housework, or money, the liberal–conservative axis in politics, and religious wars, as formerly in the Christian world and currently in the Islamic world. Societies exist by virtue of social–moral systems that exert some control over such divisive tendencies. The historical development of these social–moral systems is a remarkable sign of societal potential.

Moral science has the dual goals of understanding and improving moral systems. Moral algebra can help. As one example, moral algebra can reveal and quantify different weighting of effort, need, and actual contribution by different persons in judgments of deserving (see Chapters 2-5). Nonconscious influences can be brought to light.

Primary emphasis of moral science, however, should be on education: in family, schools, social groups, work, and so on, where social morality is learned and practiced. It is astonishing that this fundamental problem of moral education is so left to haphazard (Education below). The historical sterility of moral philosophy resulted from vain attempts to provide normative systems. The social reality of conflict and of conflict resolution requires descriptive–prescriptive conceptualization.

Although utilitarians recognized the importance of cost-benefit analysis, they did not recognize the necessity of meritorianism in place of equalitarianism. Nor could they deal with the biosocial reality of interpersonal conflict.

IMPROVING PERSONS AND SOCIETY

Moral theory should aim to understand and improve persons and societies. To this endeavor, moral philosophy has contributed little. Two-plus millennia of earnest, subtle disquisitions have mostly obfuscated the real problems of understanding and improving social–moral reality.

Telling indictments of moral philosophy’s lack of contact with social reality appear in discussions of caring by Gilligan (1982) and of mothering by Held (1993, 1995) and others. Mothering is fundamental in moral development, but unheard of in moral philosophy. Harlow’s studies of mother love in monkeys have been confirmed with human children under the Communist dictatorship in Romania (Nelson, Furtado, Fox, & Zeenah, 2009; Nelson, Fox, & Zeenah, 2013). Extended discussion of the importance of mother–child attachment is given by Bowlby (1969).
Useful discussions were given by Benjamin Franklin (see Note 6) and by John Dewey (Human nature and conduct, 1930, p. 295), who asserts: “Since morals is concerned with conduct, it grows out of specific empirical tasks . . . . [M]orals is ineradicably empirical.” Functional theory follows Dewey’s empirical theme, extending it to experimental analysis which Dewey hardly recognized.

Moral science requires grounding in the social sciences, especially education, which was a major concern of Dewey. Far more, it requires empirical grounding in family life and interpersonal relations as emphasized in recent feminist conceptions of morality.

Note 0. I have spent considerable time on some of the innumerable philosophical discussions of morality with small benefit. Someone has surely pointed out that Hitler is a grand exemplar of Kant’s categorical imperative that one should act in ways that all persons should follow. Thus, Hitler was totally dedicated to an ideal Aryan world state and would have been delighted to universalize this idea. As indeed he strove to do by systematic killing non-Aryans. He narrowly missed success, partly from initial over-optimism, mainly because of British dedication and incredibly heroic Russian resistance.

Philosophy’s lack of contact with social reality was recognized in Bok’s (1999, p. xxxi) Lying: “Since I was trained in philosophy, it is natural for me to look to moral philosophers for guidance. . . . Once again, the paucity of what I found was astounding . . . . The index to the 1967 eight-volume Encyclopedia of Philosophy contains not one reference to lying or to deception.”

Some recent philosophers have given attention to practical morality (e.g., Churchland, 2011; Flanagan & Rorty, 1993; Hampshire, 2000; MacIntyre, 1984; Stausborg, 2009; Stocker, 1996; Williams, 1985). But few of these writers have much appreciation of empirical morality. Thus, Flanagan and Rorty say in their introduction that “[M]orality simply demands that we deliberate rationally” (p. 11). But such rational deliberation slurs over basic problems of individual differences involving self-interest and interpersonal conflict as well as differences in value.

Note 1. By Stace’s reasoning, when I deny that a golden mountain exists, it follows that what I mean actually is a golden mountain (see Bertrand Russell, 1945, p. 831).

Note 2. Hume made a revolutionary contribution to philosophy by showing “that induction is an independent logical principle, incapable of being inferred either from experience or from other logical principles” (Russell, 1945, p. 674).

In moral theory, Hume made a notable conceptual break from the idea of universal moral law, then unquestioned and still dominant today, as was illustrated in the introductory quote from Stace. Instead, Hume appealed to the social benefit of moral behavior, an early form of utilitarianism (Schneewind, 1983, p. 9), although also inadequate to deal with the fundamental motivation of self-interest.

Note 3. “Rationalist fantasy” well describes Rawls’ (1971) theory of justice, which assumes that “reasonable” persons will reach agreement behind the “veil of ignorance”—and will persevere in these agreements in actual life. The Catholic-Protestant and Sunni-Shiite wars illustrate the falsity of Rawls’ basic premise. Conflict and compromise are
ubiquitous in society. To achieve social betterment, theory of justice must be empirically grounded on history, religion, sociology, anthropology, and psychology.

Justice is deserving, not merely fairness as Rawls posits. Deserving depends on integration of merit variables, which seem outside Rawls’ framework. Moreover, deserving may be negative as in blame and legal judgment (Chapters 3 and 4).

Note 4. Aristotle is well known for his claim that a mean level is best for nearly all virtues. Thus, courage is a mean between cowardice and foolhardy rashness. Similarly, the superior man who claims his superior due strikes a proper mean between the vain man and the poor-spirited. More important is that Aristotle recognized the importance of context, as in the quotation in the text.

Aristotle’s neglect of moral roles of the family may stem from different family structure in ancient Greece, especially in Sparta in which the laws required young children to be raised in a group, separate from their families. Despite such limitations, Aristotle showed common sense that sets him apart from other philosophers.

Note 5. I have followed Thompson’s (1953) translation of Aristotle’s *Nicomachean Ethics*, which aims to be intelligible to nonphilosophers. Aristotle’s Greek term *eudaimonia* means flourishing in accord with the best life for man. It is often translated as happiness which seems inappropriate to me. Doing one’s duty can be unpleasant. Seeking self-fulfillment may be an arduous failure (see *Virtue Psychology* below).

Note 6. Benjamin Franklin (1793/1982) developed a practical method that may suggest ways to improve teaching of morality in family and schools.

It was about this time I conceived the bold and arduous project of arriving at moral perfection. I wished to live without committing any fault at any time; I would conquer all that either natural inclination, custom, or company might lead me into. As I knew, or thought I knew, what was right and wrong, I did not see why I might not always do the one and avoid the other. But I soon found I had undertaken a task of more difficulty than I had imagined. While my care was employed in guarding against one fault, I was often surprised by another; habit took the advantage of inattention; inclination was sometimes too strong for reason. I concluded, at length, that the mere speculative conviction that it was our interest to be completely virtuous was not sufficient to prevent our slipping; and that the contrary habits must be broken, and good ones acquired and established, before we can have any dependence on a steady, uniform rectitude of conduct. For this purpose, I therefore contrived the following method. (p. 75.)

Franklin listed 13 virtues that were important to him, including *Industry*, *Sincerity*, *Moderation*, *Cleanliness*, and *Humility* (“Imitate Jesus and Socrates”). These he wrote as 13 rows in a book with 7 columns, one for each day. He focused on one virtue each week, marking down his infractions each evening, resolving to do better the next day.

I entered upon the execution of this plan for self-examination, and continued it with occasional intermissions for some time. I was surprised to find myself so much fuller of faults than I had imagined; but I had the satisfaction of seeing them diminish. (p. 81.)

Franklin’s discussion illustrates that different virtues may be appropriate for different persons. Aristotle would have considered Franklin’s Christian virtue of humility a mark of an inferior, poor-spirited man. Franklin agrees with Aristotle on the importance of habit but goes beyond to give a practical means for instilling habit for each individual—rare achievement in moral science.
VIRTUE PSYCHOLOGY

Virtues give a useful categorization of the complex moral terrain and have been much discussed over the ages, beginning with the four cardinal virtues of Plato and Aristotle (prudence, temperance, justice, fortitude) to which the Catholic church added three theological virtues (faith, hope, and charity) and the modern feminist movement has added the virtue of caring. Tolerance deserves explicit inclusion as a foundation for society. Tolerance can help conflicting beliefs coexist, as with Protestant–Catholic faiths and, eventually, with Sunni–Shiite faiths. Also, tolerance recognizes partial independence of person and society.

Virtues are the problem, not an answer. Virtue theory must be grounded on experimental study of moral cognition, especially on developing effective, practical methods to improve moral thought and action. Some directions for virtue psychology are noted in Positive Psychology above and in Education below. Discussions of virtue that slide by such empirical problems of education are worth little.

VIRTUE AND CONFLICT

Conflict is a central problem for virtue theory. Intrapersonal conflict between different values and goals for a single person can, in principle, be handled with cost-benefit analysis. This is often troubled, of course, by limited knowledge as well as self-interest fueled by rationalization.

Interpersonal conflict presents more difficult problems. Different values are inevitable, as shown with the unfairness paradox (Chapter 2). Other difficult examples appear with moral–political issues such as the liberal–conservative differences in relative importance of need and merit of welfare applicants or in conflict between environmentalists and industry over natural resources (see Conflict and Compromise above).

SELF-FULFILLMENT AS VIRTUE

Self-fulfillment is a fundamental moral virtue. Self-fulfillment may be developed in diverse ways that benefit society: parenting, teaching, nursing, doing one’s job well, local politics, community service, preserving the environment for future generations (see biographical paragraphs for Theodore Roosevelt quoted in Chapter 6), and many other ways. Finding how to increase prosocial self-fulfillment should be a major concern of social–moral science.
Self-fulfillment, however, is basically personal. It is conditioned by obligations of avoiding harm, obligations of family, duties as citizens and earning one’s keep in society. Personal self-fulfillment, however, goes beyond social obligation.

Self-fulfillment may be found in music, history, outdoor life, sports, amateur astronomy, gardening, and other ways that lack general social value. If not moral in a societal sense, they are moral in a spiritual sense (see also Chapter 23, Life-long Learning in Empirical Direction).

Self-fulfillment is an old idea. It was propounded by Aristotle and by Nietzsche, but only for the few. Instead, self-fulfillment should be for each of us as a universal personal need. Something of this kind has been advocated by personality psychologists including Adler, Horney, Kelly, Maslow, and Rogers. It has some similarity with recent virtue psychologies except that self-fulfillment is a virtue in itself that need have no relation to any of the usual virtues (Note 1).

Note 1. Self-fulfillment as virtue is illustrated by many people, including Henry David Thoreau, Emily Dickinson, John Muir, and Helen Keller.

When Thoreau did die in his mid-40s, his good friend Emerson lamented that he had not amounted to much. Today, Walden is an inspiration to many and Emerson’s turgid prose is being forgotten.

Dickinson wrote her poetry for self-fulfillment. She published nothing herself and the one opinion she sought was put off by her strange rhyme.

John Muir began as a lover of Nature, discovered the correct geological origin of Yosemite Valley (by glacial action, contrary to then-expert belief in sudden subsidence), and developed into an effective environmental activist.

Helen Keller, blind and deaf at 1½ years, learned to read and write, an incredible achievement. She became a social activist, not only as an advocate for the blind, but more generally, which was not popular.

Perhaps these four should not be held up as models. Self-fulfillment need not have any social benefit. Those who wish to “march to a different drummer” should be encouraged. Few of the hard-struggled contributions to the magazine Poetry, for example, have much social or even literary value. It is enough if these contributors are performing their social obligations, avoiding harm-doing, and fulfilling themselves.
MORAL SCIENCE AS DESCRIPTIVE/PRESCRIPTIVE

Functional theory leads to a conjoint is/ought, descriptive/prescriptive framework. Need for is/ought unification is clear in moral science, which emphasizes the dual goals: cognitive theory of moral knowledge systems as they now are, coupled with progress toward social betterment.

A common view, derived from physical science, is that science is descriptive of reality—science of what is. In contrast to physics, however, thought and action are functional, goal-directed. The Axiom of Purposiveness embodies a teleological conception of human science.

Teleology is explicit in the valuation operation of the Integration Diagram; the functional $\psi$ value of any stimulus informer is not a property of the stimulus per se, but rather a construction that depends on the individual’s knowledge systems and goals. Analytical grip is available with the functional measurement capability of the three laws of information integration.

The numerous attempts to present general moral systems are typically subtle paper solutions with blissful ignoring of social reality (see e.g., Moral Philosophy above). Moral science must use what is as a base to develop what ought to be. What ought to be is not fixed, of course, but depends on situation-specific compromises as in women’s rights, child labor laws, and in developing codes of ethics. What ought to be may also depend on social values not yet developed, as history illustrates. Analogous is/ought unification is sorely needed in education, which ought to focus on its much-neglected proper goal of adaptive transfer (see Education next).

Moral science should emphasize experimental–field investigations, especially in families and schools. Education for marriage and parenting are almost nonexistent. In primary and secondary schools, moral education should be woven seamlessly into every course.

Is and ought are represented in the two goals that underlie this book: cognitive theory and social betterment. There is more than enough need for social betterment. And there is more than enough need for scientific analysis to pursue social betterment to which every field of psychology can contribute (Note 1).

Note 1. My realization of the primary role of moral science in society arose gradually. I hope, however, that what my inestimable colleagues and I have done will be useful in furthering social betterment.
EDUCATION

Education in its many forms is the foundation of civilization. Education occurs in the family, schools, peer groups, at work, and through the media. A few comments on this fundamental issue are noted here.

MORAL EDUCATION IN THE SCHOOLS

Implications for moral development appear in every school subject. History has a primary moral function to help citizens understand and appreciate present social-political systems, their virtues, flaws, and inertias. U.S. history has many positive examples besides Washington and Lincoln: Truman’s executive order desegregating the armed forces, Eisenhower’s sending U.S. troops to Little Rock, John F. Kennedy’s Profiles in Courage, and Life Magazine’s Remarkable American women (1976).

Negative presidential examples are not lacking: Andrew Jackson’s nullifying the Supreme Court to expel the Cherokee Indians from their ancestral forests and force them on the wintry “Trail of Tears” to treeless western prairie, Woodrow Wilson’s using the wartime sedition act to imprison American women who objected to American entrance into WWI and having them force fed when they went on hunger strikes, Franklin Roosevelt’s internment prisons for Japanese-Americans in World War II, and George Bush’s senseless 2003 Iraq war.

Courses in citizenship and government are essential for development of social-moral knowledge systems. These courses can convey appreciation of local, state, and federal entities from school boards and city mayors’ offices to Congress and the Supreme Court. Democratic government depends on evolution of peaceful ways to settle the unending conflicts of society. Citizenship courses should be central in our schools.

Every course in our schools has relevance for moral development. Biology and chemistry give understanding of the human body and the place of humans in nature, both of moral relevance. Psychology courses can convey social-moral understanding at every school level. Literature is dominated by moral conflicts which the teacher can make socially real. The daffodils of Herrick and Wordsworth can contribute to moral-spiritual enlightenment. Physics and astronomy can lead to pride in human ability to appreciate natural law and grandeur of the universe. Mathematics can be integrated with moral theory as in Chapters 2-5. Thus, high school students could use the parallelism theorem to study their
own and others’ concepts of deserving and blame while also demonstrating how simply the mind can become open to scientific study.

In these and other ways, moral education should be infused with every academic course. Textbooks should be rewritten to expand insular views common in academic disciplines. This should not be forced preachiness, of course, simply recognition that moral concepts have integral relations with every field of knowledge.

VALUES AND CHARACTER EDUCATION

The importance of integrating morality with standard school courses need not be debated. But how can present efforts be improved? Efforts by groups of teachers and students are essential beginnings. Value and character education have been enthusiastically pursued by many persons. But how effective is such instruction?

There is simply a lack of hard research evidence to support the positive experience of on-site education. One of the most important elements in the continuation of the character education movement is the critical need for systematic research in this area. (Brooks & Goble, 1998, p. 80.)

This “critical need” for hard research evidence is clear in their summary of 25 Los Angeles schools, mostly elementary, that had participated in a Character Education Project over the school year, 1990-1991. Brooks and Goble cite selected figures and teachers’ comments to suggest substantial success. But all these claims are invalidated by obvious confounds, one of which is that the same results could reasonably result from normal adjustment over the school year. Failure to use the rudimentary tactic of a randomized group of schools as controls for normal development (which could also control for student dropout) vitiates most of the potential value of this and other such efforts.

Some values may be controversial, as with parental authority and spouses’ duties. But there are more than enough noncontroversial values, such as friendship, fairness, caring, tolerance, perseverance, fortitude, and self-fulfillment that have high importance.

Systematic research on character education has high importance, but past approaches typically rely on enthusiastic hope with little understanding of the difficulties, both conceptual and methodological. Such programs can be vital as part of the pilot work needed to assess specific tactics and to get important preliminary indication of what does or does not seem effective. But without elementary understanding of what hard research requires, and how to prepare for it, such programs may accomplish little, even as pilot work (Empirical Direction, pp. 471, 473ff, 480).
MORAL EDUCATION IN THE FAMILY

Much moral education occurs in the family. Few parents, however, have been educated in teaching ability. And not a few have ambiguous ideas about tolerance, honesty, pride in work, and other virtues. Progress requires incremental effort over generations, especially in our schools.

In a large lower-division course on personality, I assigned a midterm paper: “How I would raise an average male child.” Three women objected strongly to this assignment—“I’m not going to have an average male child.” I felt silently sorry for any average child they might have. Few of these students had much understanding of marriage or parenting. Our educational system is blind and dumb to this central social need.

The social need for such courses on marriage and parenting is readily clear from the near-total lack of informed social preparation for marriage and parenting, the most important part of life. What do psychology departments teach that is more important for quality of everyday life? (Anderson, 1991g, p. 231.)

MORALITY OF OUR UNIVERSITY SYSTEM

Universities have moral responsibility for teaching. How well are they fulfilling these responsibilities? Here is one answer.

Serve the Professor underlies the orientation of major research universities, not Serve the Student. This orientation had some justification in a previous era, when professors subsidized the educational system by working long hours for low pay. Today, however, university professors get handsome salaries, together with extremely attractive working conditions.

The root cause of the present orientation is simple. The prestige scale for major universities is research: How much grant money do their professors receive? How prominent are they in the status hierarchy in their field? How much scholarly research have they published? These are central questions for the university administration in decisions about hiring, promotion, and salary.

This prestige scale distorts and obscures the social responsibility of the universities for systematic study of learning and teaching. With this orientation, Serve the Student gets mainly lip service.

Two litmus tests provide stark evidence of this disorientation of the universities. First, if the universities were oriented toward serving the student, research on education would have top priority . . . .

Second, all Ph.D.s hired for teaching positions would be required to have systematic training for teaching . . . .

Universities operate to Serve the Professor—Serve the Student comes hindmost. (Empirical Direction, p. 781.)
Most instructors are sincere and put in dedicated hours preparing lectures in their beginning years. But few have serious training or natural ability with communication skills; some are pathetically inadequate. Yet universities give lip service to quality of teaching. Adaptive transfer, moreover, is virtually unheard of. Zuckerman’s (2006) op-ed in *U.S. News and World Report* holds for many universities:

Research, not teaching, has become Harvard’s core purpose . . . More and more undergraduates are taught by graduate assistants and part-time faculty . . . the real issue—the inverse relation between the privileges and perks of academic life and the quality of undergraduate teaching . . . . keeping students happy by giving them high grades. An absurd 91 percent of Harvard graduates gain honors.

Is reform of the universities possible?

**ADAPTIVE TRANSFER**

*Adaptive transfer* is the proper goal of education: teach what students will need to know in later life. Three problems are involved:

1. What will students need to know in later life?
2. What do they transfer from their current teaching?
3. How can we develop ways to teach for better adaptive transfer?

The problem of transfer once had a simple answer: teach logic and Latin: these two disciplines are the foundation of thought. But this belief failed miserably when subjected to experimental analysis around 1900 by Thorndike, which indicated that transfer was task-specific.

Remarkably little progress on transfer was made in the following century. The field of learning/memory fixated on conditioned reflexes and rote learning, which have slight relation to adaptive transfer (e.g., Haskell, 2001; Anderson, 1973b, 1996a, *Functional Memory*, Chapter 11; see also Chapter 8). Attitude theory, which would be expected to have primary concern with adaptive function, instead became fixated on “nonattitudes” (*Functional Theory of Attitudes*, Chapter 8).

Many dedicated teachers have been concerned with adaptive transfer. Progressive education, Headstart programs, courses on creative thinking, character education, community service, and other efforts must surely have some value. But surely they can be improved. This requires field experiments focused on issues of adaptive transfer (see also Betts & Atkinson, 2012; D. Bok, *Our underachieving colleges*, 2006).
SELF-FULFILLMENT

For each and all of us, self-fulfillment should be a personal, life-long goal in learning. Education has moral obligation to promote self-fulfillment of students (p. 779 of *Empirical Direction*):

We all strive for accomplishment. We pursue action and knowledge, in part for pleasure in exercising our abilities, in part to gain personal recognition, and in part to benefit society. We dream that, when our life has reached its summing up, what we leave behind us will have had some value.

An ideal road to accomplishment is through self-fulfillment. Develop a way of life that matches your interests and abilities. Some people are good with animals, some with children, some with perception of the external world, some with linguistic concepts, some with mathematical analysis, and some with social issues and interpersonal skills. By capitalizing on your strengths, you will accomplish more and be happier.

A major obstacle to self-fulfillment is the great overemphasis on academic research that pervades Ph.D. training, derivative from *Serve the Professor*. Even before arriving in graduate school, students are immersed in the view that the one ideal is scientific research, and that the only worthwhile goal is an academic job in a research university. But most Ph.D.s get nonacademic jobs or teaching jobs in nonresearch institutions. As a consequence, they often experience feelings of disappointment and failure. Their adjustment is additionally handicapped because the modal Ph.D. program quite ignores applied psychology and gives lip service to teaching.

Of special significance is the growth of practical applications of psychological knowledge. These include not only such fields as education, health psychology, tests, man-machine systems, and family counseling, but also research units in business and government. Psychologists are in demand because psychology is the basic social science and because psychologists have better scientific training than other social scientists. Practical applications have the added appeal that they can make a real difference in society. Indeed, contemporary American society offers historically unparalleled opportunities for self-fulfillment.

There is a place for each of us. No other field is as broad and variegated as psychology. Many different ways of thinking are needed, even within a single area. The history of psychology is a continuing demonstration of the narrowness of our successive conceptual frameworks. Progress has been impressive, but in large part it consists of continually uncovering unsuspected new richness in the phenomena we study. Our time has unique potential as new phenomena are opened to investigation and old phenomena come under new scrutiny. Future generations will never have such opportunities as lie before us today. Future workers will look back on our era of boundless opportunity as

THE GOLDEN AGE OF PSYCHOLOGY.
Moral science is the basic human science, important for self, society, and their symbiotic relationship. Discussions of morality have been unending but only in recent times have methods of science been brought to bear.

Moral cognition, its nature and its functions in person and society, has been the main concern of this book. The three laws of information integration have shown promise in the moral realm. Applications have been made to fairness/unfairness and equity (Chapter 2), blame (Chapter 3), legal issues (Chapter 4), and moral development (Chapter 5). Chapter 7 gives brief discussions of 20-some issues in moral science.

This work also showed that moral cognition is intimately related to traditional areas of psychology, including person science, social attitudes, learning/memory, judgment–decision, and life-span development. Unification of these areas with one another and with moral science can liberate them from their narrow historical origins to become fruitful collaborators on basic problems of self and society. This unification is the main concern of this chapter.

COGNITIVE THEORY OF INFORMATION INTEGRATION (2)
UNIFIED MORAL SCIENCE (4)
PERSON SCIENCE (5)
FUNCTIONAL THEORY OF ATTITUDES (6)
MORAL ATTITUDES (11)
FUNCTIONAL THEORY OF MEMORY (12)
FUNCTIONAL THEORY OF LEARNING (14)
FUNCTIONAL THEORY OF JUDGMENT–DECISION (19)
FOUNDATIONS OF SOCIAL MORALITY (21)
TOWARD UNIFICATION OF PSYCHOLOGY (23)
NOTES (25)
Chapter 8

UNIFIED SCIENCE OF PSYCHOLOGY

Copyright © Norman Henry Anderson
May 29, 2013
Comments are most welcome. nanderson@ucsd.edu

Moral science has two basic goals: one theoretical—understanding moral thought and action of individuals and societies; the other practical—improving present moral levels. To achieve these two goals requires unification of moral science with other fields of psychology: person science, attitude theory, learning/memory, and judgment–decision. Moral science provides an empirical base for unification.

COGNITIVE THEORY OF INFORMATION INTEGRATION

Two axioms are basic in psychological science. The Axiom of Purposiveness recognizes that thought and action are directed toward goals—and hence that each stimulus informer must be valuated to construct its functional values relative to what particular goal is operative. The Axiom of Integration recognizes that multiple values must generally be integrated to determine thought and action.

This functional framework is shown in the Integration Diagram, Figure 8.1 on the next page. The Axiom of Purposiveness, represented by the threefold GOAL in the Integration Diagram, has a fundamental function in valuation, namely, construction of goal-relevant values of stimulus informers. Goal-relevance implies that values are not constants, as implicitly assumed in much research and theory. Quite the contrary; the same stimulus may have different values relative to different goals.

The progressive fragmentation of psychology, of which many have complained, is due in good part to lack of capability with integration of multiple variables and with goal-relevant measurement. Hope for reversing this fragmentation into unification is presented in this chapter.

The Integration Diagram is centered on the Axiom of Integration—thought and action depend on multiple determinants. This axiom is universally recognized but analysis has been handicapped by lack of methods for true psychological measurement. To illustrate, consider the blame law from Chapter 3:
Figure 8.1. Information integration diagram. Chain of three operators, $V - I - A$, leads from observable stimulus field, $\{S\}$, to observable response, $R$.

*Valuation operator, $V$, transmutes stimuli, $S$, into subjective representations, $\psi$.*

*Integration operator, $I$, transforms subjective field, $\{\psi\}$, into internal response, $\rho$.*


Blame = Responsibility + Consequences.

All three terms in this equation represent subjective values of the person who judges blame. In terms of the Integration Diagram, therefore, this blame law should be written.

$$\rho_{\text{Blame}} = \psi_{\text{Responsibility}} + \psi_{\text{Consequences}}$$

To establish this blame law thus depended on capability to measure personal values for all three terms (see *The Two Worlds: Internal and External*, Chapter 7).

Two universal measurement obstacles are shown in this blame law. *Response:* the observable response, $R$, is a stand-in for the subjective response, $\rho$. *Stimulus:* what is integrated is not a physical stimulus, $S$, but its subjective value $\psi$—as constructed for the operative goal.

This twofold measurement obstacle might seem impassible; neither $\psi$ nor $\rho$ is observable. This obstacle can be overcome: the parallelism theorem for adding-type models in Chapter 1 shows how this is possible in principle. The empirical virtue of the three laws of information integration makes this possible in practice, indeed simple.
Moral science may be unified around the basic theme of information integration, schematized in the Integration Diagram on the previous page. Moral thought and action typically result from integrated operation of two or more stimulus informers. This problem of integrating multiple informers is well recognized, but previous attempts to develop theories of integration made little progress.

A new horizon opened with the three laws of information integration, especially adding-type laws analyzable with parallelism theorem. These laws resolved the problem of true psychological measurement, which had roadblocked previous work. These laws confer analytic power in simple ways across several moral domains.

*Fairness* is a common principle in social life, but assessing the integration models proposed by Aristotle and modern writers was not possible without true psychological measurement. Application of functional measurement showed that most people followed a different model for integration, namely, the decision averaging model. This work also opened new ground with an algebraic model for *unfairness*, an important moral motivation, largely neglected in equity theory (Chapter 2).

*Blame* and *criticism* are ubiquitous at every social level, from family to national politics. The basic blame law, \( \text{Blame} = \text{Responsibility} + \text{Consequences} \), has shown substantial generality across age and culture. This blame law has been extended to include healing processes of apology and recompense (Chapters 3 and 5) and forgiveness (Chapter 7).

*Legal judgment* involves numerous issues of information integration, a few of which are reviewed in Chapter 4. Legal psychology has twofold potential—for decreasing injustice and for increasing justice. Legal psychology can help build a better society.

*Moral development* has been much studied but progress was led astray by stage-type theories. Very different conclusions were reached in the initial applications of IIT. Indeed, young children showed far higher cognitive capabilities than previously allowed (Chapter 5).

Moral science involves much that is not specifically moral. Person cognition, for example, involves nonmoral and moral variables that may be jointly operative. The same is true of social attitudes. Learning, memory, and judgment–decision are also central in moral theory. The present fragmentation within and mutual neglect between these areas can be replaced by mutual interaction with benefit for all.
PERSON SCIENCE

Person science, grounded on the Axiom of Purposiveness, should be the primary concern of psychology. People are fundamentally goal-oriented, as many writers have observed, continually seeking goals, whether by approach or by avoidance (Anderson, 2008, pp. 323ff).

Purposiveness functions at all three stages of the Integration Diagram of Figure 8.1. The valuation stage has special importance for construction of goal-relevant values from informer stimuli. Measurement of these values is central for understanding cognition. True measurement is possible by virtue of the algebraic laws of information integration. These laws have provided an effective base for person science.

Person science can unify disparate areas of psychology that now go separate ways. Proposals for unification have been presented by various writers but not with much effect (e.g., Note 2, p. 421, Anderson, 2008). A functional approach, based on the laws of information integration, has unifying power because these laws have been found in most areas of human psychology (Person Science and Personality, Chapter 7).

Attitudes are fundamental in personality. Their special function lies in goal-directed valuation of stimulus informers. Strong attitudes are most important, of course, but strong attitudes have been neglected owing to historical emphasis on changing attitudes. An analytic base is available with functional measurement of the goal-directed valuation function of strong attitudes. Moral attitudes provide a substantive base for unified theory because of their ubiquity in everyday life and because of their interrelations with most areas of human psychology.

Learning and memory make us the persons we are. Functional theory of learning and memory focuses on their use in everyday thought and action. Functional theory thus led to a nontraditional conception of learning/memory, illustrated by the dissociation of Figure 8.2 below. Study of moral learning can liberate the learning/memory field from its historical narrowness to flourish with basic issues of person science.

The judgment–decision field has pervasive concern with integration models. Study of these integration models has been stunted, however, lacking psychological theory of measurement. The common reliance on objective or makeshift measures misrepresents cognitive processing. True subjective measurement goes hand in hand with the three laws of information integration, which have done well with several issues of judgment–decision, illustrated in the moral field in Chapters 2-5.
FUNCTIONAL THEORY OF ATTITUDES

The functions that attitudes perform in everyday life should be a primary concern of attitude theory. Functional views of attitudes go back a half-century and their good sense is generally recognized. They lacked analytical power, however, and made little progress beyond the original typologies of Smith, Bruner, and White (1956) and Katz (1960).

FUNCTIONAL THEORY

*Valuation of stimulus informers is a primary function of attitudes.* This functional nature of attitudes is clear in the Axiom of Purposiveness, represented by GOAL in the Integration Diagram of Figure 8.1. Valuation is goal-directed—functional. Goal-directed valuation includes the object-appraisal function of Smith, et al., for example, and the utilitarian function of Katz.

**Attitudes and “Nonattitudes.”** Attitude change and persuasion have been dominating concerns in the attitude field. These concerns originated in historical focus on changing social prejudice (Allport, 1935; Thurstone & Chave, 1929), which remains a basic social problem, especially in the moral realm. But attitudes about many social issues, women’s roles, for example, or euthanasia, are strong and resist change. To get results, the field insensibly gravitated to studying issues on which people held weak opinions easily changed, sometimes called “nonattitudes” (Eagly & Chaiken, 1993, pp. 152, 219; Anderson, 2008, pp. 100, 112).

Functional theory entails a conceptual shift to study strong attitudes. Strong attitude knowledge systems (AKSs) underlie the valuation operation in the Integration Diagram which constructs goal-directed values. Measurement of these values can help study function and structure of AKSs. This becomes straightforward in some useful cases with theory of functional measurement.

**Constructionist Theory.** Attitude theory must be constructionist, as the Integration Diagram shows. The *valuation* operation in the Integration Diagram constructs goal-relevant meanings of stimulus informers. The *integration* operation constructs a unified response from multiple stimulus meanings. And the *action* operation constructs an overt response. All three modes of construction can be quantified with laws of information integration (benefits 3, 1, and 2 of the parallelism theorem, Chapter 1).
IMPLICATIONS OF FUNCTIONAL ATTITUDE THEORY

The discovery that many attitudinal judgments follow the averaging law opened a road to an effective functional theory of attitudes. Strong social attitudes can thus be studied in terms of their main function—constructing goal-oriented values of stimulus informers. Psychological laws of information integration are thus a foundation for functional theory of attitudes as knowledge systems.

The efficacy of this approach was illustrated with moral attitudes in Chapters 2-5. Four general comments are added here.

“Nontraditional” Definition of Attitude. Attitudes are considered functional knowledge systems (AKSs) in IIT. In sharp contrast, most other approaches continue the classical definition of attitude as a one-dimensional evaluative response on a good-bad dimension. (A sample of such one-dimensional definitions, quoted from eminent authorities, is given in Anderson, 2008, Note 2, p. 109.) These are only attitudinal responses (ARs) in IIT—situation-specific, goal–context-oriented manifestations of underlying AKSs (Notes 1, 2).

Treatment of attitudes as functional knowledge systems embodies a “nontraditional” conception of attitudes (Tesser, 1978, p. 297; see Anderson 2008, p. 151). Attitudes are not enduring one-dimensional propensities, as in the traditional view; instead, attitudes are AKSs that function in construction of goal-oriented attitudinal responses, ARs.

In a very real sense, therefore, people do not know their own minds. Instead, they are continually making them up. (Anderson, 1974b, p. 89; 1981a, pp. 93f.)

Single Person Theory. Single person design and theory are desirable in attitude research. One reason is that cognition is personal; it occurs separately within each of us. A related reason is that attitudes often differ widely across persons. Traditional attitude theory was hobbled because it relied on group design and shunned single person design, a consequence of historical fixation on persuasion and changing attitudes. Traditional attitude experiments treat real individual differences as error variance.

Functional theory, in contrast, puts major emphasis on studying attitude function in everyday life. For this purpose, it is generally desirable to test each participant under multiple conditions, as in standard integration designs. Batteries of stimulus materials have been developed for this purpose, including the list of 555 personality trait adjectives (see e.g., Figure 8.2) and the president paragraphs (e.g., Figure 6.1) cited in Batteries of Stimulus Materials in Chapter 6.
**Basal–Surface Structure.** Attitudinal judgments have two components: an enduring *basal component* and a labile *surface component* (see discussions of Figures 4.3 and 8.3). Published experiments that have not separated out these two components may be hard to interpret. Their attitude change may be largely surface component that evaporates as their participants depart the experimental room.

Experimental procedures to eliminate surface component before measurement may possibly be as simple as ending with a neutral informer or irrelevant task. On this vital issue, almost nothing is known. The additive law has been extended to quantify basal–surface structure as illustrated in Figure 8.3. However, experimental elimination of surface component may be generally preferable.

**Measurement of Attitudes.** One-dimensional measures of attitude are widely used and widely useful. It is important, however, to distinguish between such attitudinal response and the underlying AKS that generated that AR.

Virtually all other approaches treat attitudes as enduring, one-dimensional properties of persons. These approaches are one reason for simplistic definitions of attitudes, even by some who recognize that attitudes are not one-dimensional. This conception begins by misunderstanding attitudes, which are *knowledge systems*, more complex than an evaluative response on a good-bad dimension. This simplistic conception has impoverished the attitude field (see also *Nonarbitrary Metrics With Functional Measurement*, Chapter 6).

A partial remedy is to recognize that an attitude may have multiple qualities (see *Response Quality* in Chapter 6). Multi-quality analysis is an open field for attitude theory.

A second conceptual problem is whether observed ARs are true measures of underlying feeling, that is, whether AR = ρ in the Integration Diagram. Typical studies rely on ratings but common rating methods suffer well-known biases as Thurstone showed. These biases, fortunately, can be eliminated with the method of functional rating (Chapter 6).

Choice methods, including Thurstone’s paired comparisons, cannot measure attitudes (*Measurement Theory*, Chapter 6, Appendix). The method of functional rating, in contrast, has been successful across diverse areas of person science, including attitudes (Anderson, 1974a,b,c, 1981a, 1996a, 2004, 2008; see Chapters 1-5 in this book). Functional measurement theory provides a base for developing functional theory of attitudes.
PERSON VERSUS PERSUASION

Functional attitude theory is person-centered. This contrasts with the traditional persuasion-centered framework which goes hand-in-hand with the focus on attitude change noted above. As Kruglanski and Thompson (1999, p. 83) say, “From a social psychological standpoint, the 20th century may well be dubbed the age of persuasion.” This persuasion-centered framework is widely accepted (Anderson, 2008, p. 109). Person and persuasion lead to very different conceptions of attitude.

The most obvious person–persuasion difference appears in the valuation operation of the Integration Diagram. Valuation of stimulus informers is a primary function of attitudes. This valuation function is neglected, even denied, in typical persuasion-centered theories.

Functional theory—what functions attitudes perform for a person—had made little progress beyond the typologies of the functional theories of the 1950s. The psychological laws allow systematic progress on functional analysis (see Anderson, 1974b, 2008, Chapters 4-6).

This person–persuasion difference is reflected in experimental design. Most attitude research uses between person design, a consequence of the emphasis on persuasion and changing social attitudes. The functional approach of IIT, in contrast, emphasizes within person design, a consequence of the emphasis on cognition. The large individual differences in attitudes are error noise in between person design; they are real phenomena in within person design (Anderson, 2001, 2002; see Cluster Analysis and Batteries of Stimulus Materials, Chapter 6).

Person-centered theory seeks new approaches to person science—away from group-derived typologies of traditional personality traits to embrace the individual. This idea is not new. It goes back to Allport (see 1968) and the single person studies of attitudes by Smith, Bruner, and White (1956), to which IIT contributes a base of psychological law.

UNIFIED THEORY

The attitude field and the rest of psychology should be unified. Because of their precision and generality, the three laws of information integration can contribute to unification.

Personality. Attitudes are basic components of personality. The traditional one-dimensional conception of attitudes noted above is paralleled by simplistic trait conceptions of personality (see Person Science and Personality in Chapter 7). Both fields will benefit from unification.
Judgment–Decision. Attitude function is intimately involved with judgment–decision. Integration of values is a central concern of judgment; construction of values is a primary function of attitudes.

This unity was recognized in the attitude integration theories discussed in Chapter 7, but nearly all were roadblocked by lack of true measurement theory. Judgment–decision theory has been similarly obstructed, as shown by its focus on normative models (see Functional Theory of Judgment–Decision below). Unification of these areas is possible with the psychological laws of information integration.

Learning. Attitudes are learned. Study of attitude learning can help liberate the learning field from its narrow, constrictive heritage of reproductive verbal memory (Figure 8.2). At the same time, attitude learning can help develop a functional framework in the attitude field, especially learning and functioning of moral attitudes.

Development. Attitudes about right and wrong begin early in childhood and are greatly expanded to take account of context variables in later life. One approach to attitude development was assiduously pursued with Kohlberg’s moral stages, but this suffered fatal shortcomings. One shortcoming was inability to study development in the 4–12 year age range, a basic period for development of attitudes and knowledge systems about right and wrong (see Moral Stage Theories in Chapter 5).

Integration experiments have found that children as young as 4 years of age follow simple algebraic laws for judgments of fairness/unfairness and blame (Chapter 5). These same integration laws are found at older ages and in different cultures. These laws offer an analytic base to study development and function of attitudes throughout the life span.

Attitude Knowledge System: AKS. Functional theory conceptualizes attitudes as knowledge systems. These systems can take account of contextual specifics that operate in constructing ARs. (“Oh, what a tangled web we weave—when first we practice to deceive.”) In general, an AR about degree and extent of some onerous obligation may depend on many specifics (see Analytic Context Theory and Conflict and Compromise in Chapter 7).

Structure of AKSs is a fundamental problem. One social–moral aspect of this structure problem concerns understanding of civil and legal regulatory systems. This focus can usefully operate in our schools, as in courses on history and citizenship. Social–moral AKSs of everyday life have central importance for attitude theory. By focusing on AKS structure, the attitude field can contribute to social betterment.
MORAL ATTITUDES

Moral attitudes are a wellspring of moral thought and action. Moral attitudes underlie our feelings and judgments about fairness/unfairness (Chapter 2), about responsibility and blame (Chapter 3), and about social–legal issues (Chapter 4). Development of moral attitudes (Chapter 5) has twofold importance: for understanding function and structure of attitudes and for improving moral levels of society.

FUNCTIONAL THEORY

Moral attitudes are considered moral knowledge systems that function in constructing moral thought and action. Their main function lies in valuation of stimulus informers in relation to operative goals.

Social psychology and moral cognition have much to offer each other. The mountains of work in social psychology cover many issues important in moral thought and action. Besides attitudes, these include roles, self-concepts, social attribution, and group dynamics. Although moral attitudes themselves have been neglected, much of this work is relevant thereto. Such work can contribute much to moral science.

Moral cognition can in turn be a fertile field for most areas of social–personality, including those cited in the previous paragraph. Many attitudes have substantial moral components. Moral attitudes are often strong and lead naturally to functional theory. Moral attitudes can help liberate the attitude field from fixation on “nonattitudes” to study how real attitudes function in real life.

Such liberation was seen in empirical studies of previous chapters. These experiments did not seek to change peoples’ moral attitudes. Instead, they studied how these attitudes function in moral judgment.

GENERALITY

Generality of moral attitudes is a notable advantage for the attitude field. Current research rests heavily on convenience issues specific to each investigator with little generality and often with little social relevance. Moral attitudes, in contrast, have universal relevance in every culture.

The algebra of moral attitudes is idiographic and nomothetic. This algebra can deal with personal differences, often large, in moral values. And it promises nomothetic generality across issue, age, and culture.
FUNCTIONAL THEORY OF MEMORY

How does memory function in everyday life? A primary function of memory follows the Axiom of Purposiveness: goal-oriented valuation of stimulus information. This function, represented by the valuation operator in the Integration Diagram, underlies virtually all thought and action. Judgment of blame or deserving, for example, may require valuation of responsibility, both social and causal, in which memory knowledge systems function in valuation of stimulus informers. Similar function appears generally in thought and action.

The need for a functional approach to memory arose in a study of attitudes toward persons. At that time, it was an “article of faith” that attitude at any later time would rest on what was remembered of the original stimulus materials. This faith underlay the attempt of the Yale group led by Carl Hovland to ground attitude theory on the mass of results about verbal memory.

This faith in verbal memory ran aground in Anderson and Hubert (1963) who used the personality adjective task to study both the judgment of the person described by trait adjectives and the recall of the adjectives themselves. The two should covary according to the “article of faith” that judgment depends on recall. Instead, a dissociation was found: what was best remembered had least effect on attitude.

Striking confirmation of this dissociation was obtained in subsequent work that used functional measurement to assess the contribution of the adjective at each trial to the judgment made after all the adjectives had been presented. The judgment curve in Figure 8.2 showed near-linear primacy; the recall curve showed uniform recency (next page). This dissociation was adopted by nearly every contributor to Person memory (Hastie, Ostrom, Ebbesen, Wyer, Hamilton, & Carlston, 1980; Note 3).

Once recognized, this dissociation makes good sense. The primary task was to judge likableness of the person described by the list of adjectives. As each adjective is given, it may be valued on likableness and this value integrated into the cumulating person cognition. This done, the adjective itself need not be retained in memory.

This dissociation showed that functional memory differs conceptually from traditional verbal memory, which is dominated by concern with accuracy: how accurately the learner’s response mirrors given stimulus materials. This accuracy focus appears in the universal measures of recall and recognition which conceptualize memory as remembering.
Figure 8.2. Functional memory differs conceptually and empirically from traditional verbal memory. Recall curve for adjectives in person description shows strong recency over last six serial positions, a standard result. Judgment curve for effect of these same adjectives in person cognition shows uniform primacy, with lesser effects at later serial positions. Contrast between recall recency and judgment primacy implies basic differences between person memory and verbal memory. (Recall curve from Anderson and Hubert, 1963; judgment curve slightly idealized from Anderson, 1965b, 1973c).

Memory function has central importance in goal-oriented thought and action. Knowledge systems are the main content of memory. Knowledge systems function in valuation of stimulus informers relative to operative goals, as with attitudes about U.S. presidents (Figure 6.1).

Constructionist views of memory have been pursued since Bartlett’s (1932) “remembering . . . is an imaginative reconstruction,” but had focused on accuracy of remembering given stimulus materials or their “gist” (Anderson, 1989a, 2008, p. 279). Theory and research on memory have been trapped in focus on accuracy, neglecting the main function of memory in living (Functional Memory, Chapter 11, and Algebraic Language Processing, Chapter 12, Anderson, 1996a).

In sharp contrast, the functional conception of memory illustrated in this experiment on person cognition has fundamental differences. What is remembered is not the given stimulus materials but goal-oriented construction therefrom—construction that may be entirely different for different goals. And for different persons. Such goal-oriented function should become a primary concern of memory theory.
INFORMATION LEARNING THEORY

Learning is information integration. Learning has two major functions. One has been much studied, namely, integration of the same stimulus information repeated over a succession of experiences or “trials.” This function has almost come to define learning in research and theory. The other function, not much studied, is the use of past learning to construct goal-oriented meaning of stimulus informers on any present occasion.

The dissociation of Figure 8.2 given above illustrates a basic property of functional learning. “Correct response” and “reinforcement,” the backbone of traditional learning, often lack relevance or meaning in everyday life, as with social and moral learning. The psychological laws of information integration make this functional approach effective.

AVERAGING LAW OF LEARNING

Learning is a process of information integration. This process often obeys an averaging law, as in Equation 1 of Chapter 4:

$$\rho_n = \omega_n \psi_n + (1 - \omega_n) \rho_{n-1}.$$

The response $\rho_n$ on trial n is an average of the value $\psi_n$ of the informer stimulus on that trial and the response $\rho_{n-1}$ from the previous trial, with respective weights of $\omega_n$ and $(1 - \omega_n)$. This learning law embodies a functional, goal-directed conception of learning.

This functional focus may be illustrated with the bigamy trial of Thomas Hoag, summarized in the learning curves of Figure 4.3. Verbal memory for the quoted testimony of Catherine Conklin, Hoag’s bigamous wife, has minor relevance; what is relevant is the value of this testimony relative to guilt of the prisoner at the bar. The main functions of learning lie in constructing this short-term value and then of integrating this value into the longer-term, cumulating attitudinal knowledge system. The learning curves of Figure 4.3 represent such functional learning.

ACROSS-TRIAL LEARNING

Much learning takes place over a succession of experiences, formalized in the trial-by-trial learning curves of traditional learning theories. New
methods to analyze such trial-wise learning processes were provided by the theory of information integration.

Integration learning design is a useful method. In one simple form, some trials are treated as a factor with two levels, high and low. The response on any later trial can then be dis-integrated to measure the contributions from such prior trials. One result was shown in the contrast between the recall and judgment curves of Figure 8.2—what was best remembered had least effect on the final response.

Analytic potential of this integration-theoretical analysis may be seen in Schlottmann’s (2001) experiment, in which children judged amount of treasure hidden under streets of a city. Each trial presented one street, which revealed precious gold or worthless rock, the two levels of each trial in her serial-factor design. Judgments of amount of treasure in the city were made on a graphic rating scale on each trial.

The two curves labeled R4 in Figure 8.3 show relative effect of each of the four trials on the final judgment. Each data point on the R4 curve represents the difference between effects of gold and rock at each trial on the final response. The first three trials have roughly equal effect whereas the last trial has much larger effect, especially for 6-year-olds. Similar pattern appears with the R3 curves.

This pattern in these curves represents basal–surface structure. The near-total disappearance of each sharp upswing on the next trial shows that it represents surface learning. The near-equality of effects of preced-
ing trials represents enduring basal component, nearly equal across trials. Note that 9–year-olds learn more basal and less surface on each trial than 6–year-olds. This represents a novel developmental trend that deserves systematic study (Note 4).

The basal–surface pattern of Figure 8.3 is not peculiar to simple stimuli judged by children. Very similar patterns were obtained with adults’ attitudes about U. S. presidents based on biographical paragraphs (Anderson & Farkas, 1973; see Figure 2.II, p. 152 in Anderson, 1981a).

CONDITIONING THEORY

Traditional S–R conditioning theory has limited relevance to information learning. In classical conditioning, what is learned is prescribed: the unconditioned response or some closely related response, as with Pavlov’s bell-shock leg flexion in dogs. In instrumental conditioning, what is learned is a response emitted by the organism that has satisfying consequences. Examples include the exit latch on Thorndike’s puzzle boxes and the bar or key in a Skinner box. Both also have some importance in human life. This work, however, is grounded on observables in the external world (see The Two Worlds: Internal and External, Chapter 7; The Matching Law, Chapter 6).

Human learning needs a broader conceptual base—in the internal world. The present functional approach to learning/memory is effective by virtue of functional measurement based on the psychological laws of information integration. These laws of the internal world can help liberate learning theory from bondage to the external world.

CONNECTIONIST THEORIES

Associative networks are a basic form of knowledge. Moral attitudes about obligation and deserving, for example, are considered associative knowledge systems. Network representation is also needed for valuation processes that can take account of multiplicity of goals, multiplicity of context variables, and multiplicity of past experience.

Attitude learning is an ideal domain for connectionist theory (see Anderson, 2008, p. 139). Goal-oriented valuation of a stimulus informs depends on associational networks. What is learned becomes part of an AKS, also an associational network.

Functional theory requires extensions of connectionist theories. Foremost is that the narrow constraint of correct response must be given up. This was discussed with the Hoag bigamy trial (Chapter 4) in which
the value of the testimony of each witness was an idiographic construction of each individual juror. Instead of correct response, constraints of goal-directed valuation must be incorporated.

The integration laws of IIT can dis-integrate a response to obtain functional measures of each operative variable. These capabilities with metric response as true psychological measurement could be useful with connectionist theory. Cognitive Unitization (benefit 5 of the parallelism theorem) allows complex networks to be treated as units whose net effect can be exactly measured. This functional measurement can help with deeper analysis of networks (*Analytic Context Theory*, Chapter 7).

**WITHIN-TRIAL INTEGRATION**

Traditional across-trial integration, exemplified in the foregoing learning equation, needs extension to include within-trial integration. Conjoint within-trial/ across trial integration is common in everyday life. Examples appeared in the Hoag bigamy trial of Figure 4.3 and the presidents experiment of Figure 5.1. In both cases, each trial presented a paragraph that needed to be integrated to construct its value relative to the assigned goal. This value would then be integrated with the cumulative value from previous trials, ready to serve similar function on any future trial.

Information learning theory has two ways to study within-trial learning. One way is to construct each trial from an integration design, either across-trial as in Figure 8.3, or within-trial which has not yet been done. The other way is to apply the principle of Cognitive Unitization, treating each trial as a unit, as with the paragraphs of the cited jury trial and presidents experiments.

Traditional learning theory has narrow relevance to psychological science. The concept of reinforce needs be replaced by informer. Habit needs to be extended to knowledge systems. Primary focus should be on adaptive transfer.

**ADAPTIVE TRANSFER**

*Adaptive transfer* is the fundamental issue in education. How much of your school learning will be useful in later life? This transfer question once had a simple answer—teach logic and Latin; these formal disciplines instill thought processes with universal efficacy.

But when Thorndike put this dogma to experimental test around 1900, he found learning to be very task-specific, a conclusion well supported over the following century. Several hypotheses about transfer
have been suggested (Haskell, 2001), but experimental evidence remains distressingly meager despite its paramount importance in education.

Thorndike deserves high tribute for his condemnation of then-current anthropomorphic views of animal psychology and introduction of sound experimental method. Unfortunately, his approach hardened into narrow behaviorism that has contributed little to the fundamental issue: adaptive transfer. Study of adaptive transfer requires a base in information learning theory and knowledge systems.

*Adaptive transfer* should be the guide for teaching at every level, from preschool to postgraduate and beyond (Notes 5–7).

**Education: Serve the Student.** Functional theory of learning is a framework for education. *Adaptive transfer* is the central problem— to teach so learners will be better able to utilize their school learning in later life. Transfer requires constructionist, contextual thinking—adapting one’s KSs to valuation and integration of multiple stimulus informers in the situation at hand.

The need for new ideas and methods is clear from the massive unconcern of the educational establishment with *adaptive transfer*. Typical textbooks aim to teach their specific subject as a self-contained body of knowledge; instructors follow suit. Concern with transfer is focused on the final exam.

*Serve the student* is the proper goal of education. Student-oriented education is needed. Education should aim to teach students what they need to know—ability with *adaptive transfer*.

Study of adaptive transfer faces three problems. *First*, to find out what students need to know in later life. *Second*, to find out what they actually transfer from what they are currently being taught. *Third*, to find ways to teach for better transfer [italics added].

The first two problems are little studied. The third has been an earnest concern of many dedicated teachers (e.g., Bernstein, Jonson, & Smith, 2000; Halpern, 1998; Haskell, 2001; McDermott, 1991) but little is yet known about adaptive transfer. Creative thinking courses, Headstart programs, and other such movements have positive value, but they have contributed little definite knowledge. These three problems deserve foremost consideration in cognitive theory and throughout the educational system. (Anderson, 2008, pp. 282f.)
FUNCTIONAL THEORY OF JUDGMENT–DECISION

Judgment and decision are central in moral thought and action. Aristotle’s justice equation, \( \frac{O_A}{I_A} = \frac{O_B}{I_B} \), involves judgment about input, outcome, and their proportionality for each person, an idea continued in modern equity theory (Chapter 2). The utilitarian “greatest good for the greatest number” asks for maximization of utility. Resolving moral dilemmas requires compromise among conflicting alternatives.

COGNITIVE AND NORMATIVE

Multiple determination is well recognized in judgment–decision; mathematical models for integration of multiple stimulus informers are stock-in-trade, as with the equity models just cited, and with multiattribute analysis. Normative models that prescribe optimal behavior have been most popular by far. Normative models, however, have obstructed understanding real behavior. Functional theory requires that normative models of judgment–decision be replaced by cognitive laws.

Cognitive Laws. Three cognitive laws govern many issues in judgment–decision. They often disagree, however, with normative dicta. Three of numerous examples are noted next (see also “Bias” in Chapter 7).

A long-known nonnormative behavior appears with the ubiquitous averaging law. The sure-thing axiom, once a cornerstone in attempts to develop rational theory of judgment–decision, implies that adding a positive good to a positive good will increase the value of the whole. This sure-thing axiom has been repeatedly falsified by findings of opposite effects (e.g., Figures 5.2, 6.1) of the nonnormative averaging law.

Another nonoptimal behavior is the confidence-proportional strategy of betting revealed in Lopes’ (1976b) PhD thesis with a computerized poker game—betting real money on an even-money gamble in proportion to confidence of winning. Rationally, participants should have bet the (small) maximum when their confidence was greater than \( \frac{1}{2} \), the minimum if less than \( \frac{1}{2} \) (see Figures 10.5 and 10.6, Anderson, 1996a).

Bayesian statistical theory incorporates subjective probability and so was thought to provide a base for cognitive theory of judgment–decision. But Bayesian theory has severe limitations (see Cognitive Alternative to Bayesian Theory, Anderson, 1996a, pp. 331ff). One failure is Shanteau’s (1975) water down (dilution) effect: uninformative samples can have substantial effect (by virtue of averaging process).
**Measurement Theory.** Much work on judgment–decision has suffered a critical roadblock—lack of true measurement of psychological quantities. Subjective values—the heart’s blood of living judgment–decision—remain largely outside the normative framework. Cognitive theory of judgment–decision requires true measurement of personal values.

A classic case of necessity for true measurement appeared in repeated conjectures that the objective multiplication, Expected Value = Probability × Value, had a subjective counterpart:

Subjective Expected Value = Subjective Probability × Subjective Value.

This conjecture was finally established with the linear fan theorem of functional measurement (Anderson & Shanteau, 1970; Shanteau & Anderson, 1972). Functional measurement helped overcome this measurement roadblock to a cognitive theory of judgment–decision.

**MORAL JUDGMENT–DECISION**

Moral thought and action are inherently matters of judgment and decision. The moral algebra presented in previous chapters provided an effective analytic base for several issues. These include deserving and equity (Chapter 2), responsibility and blame (Chapter 3), legal issues (Chapter 4), and moral–social development (Chapter 5).

Moral dilemmas have long been popular, not only in psychology, but especially in philosophy, as stark examples of conflicting considerations. They should have catalyzed psychological analysis of conflict. Instead, they obscured the problem (see Moral Philosophy in Chapter 7). Cost-benefit analysis, however rough, underlies all judgment–decision. The algebraic laws, conjoined with functional measurement, allow progress on moral cost-benefit analysis.

**UNIFIED THEORY**

Unification of moral psychology and judgment–decision has much to offer both fields. Moral psychology can benefit from analytic modes of thinking developed in judgment–decision research. Such benefit was illustrated repeatedly in studies in the initial empirical chapters.

Judgment–decision research can benefit even more by shifting from preoccupation with normative models of optimal behavior in artificial tasks to deal with real psychology of real life. An effective foundation is available with the psychological laws (see Cognitive Theory of Judgment–Decision, Chapter 10 in Anderson, 1996a).
FOUNDATIONS OF SOCIAL MORALITY

Human societies are an astonishing phenomenon, unprecedented biologically. Modern systems of production and distribution of material goods can provide opportunity for all. Other important forces include custom and law that keep self-interest and anti-social tendencies under some measure of control.

Moral considerations infuse every society, as once in divine right of pharaohs or kings, currently in doctrines of equality, and always in social hierarchies. Progress has been substantial, as with rights of children and women. Further progress is most desirable and many directions have been advocated.

The position advocated here is that the same forces that have led to the present system are the primary basis for improvement. These forces have produced moral progress in the past, as with continuing increases in equality and opportunity. These same forces have potential to produce further moral progress. How to accomplish this must be determined by experimental analysis embedded in field situations, especially families, schools, and work.

This position may seem unattractive because it does not give an explicit foundation or final goal. Moral philosophy, in sharpest contrast, has been dominated by the idea of absolute moral law that holds for all times and cultures. But although contractarian and utilitarian theorists have fostered the concept of equality, moral philosophy has been largely barren verbal subtleties (see Moral Philosophy, Chapter 7).

Indeed, most writing on morality has aimed at general formulations with slight regard for empirical base in psychosocial reality. Whole books are written with at best hand waving concern for family life, education, or social groups as matrices of morality. Moral science requires empirical grounding on basic problems of cooperation and conflict such as those discussed in Chapter 7 (Notes 8 and 9).

A functional perspective is adopted in this book: moral systems are studied in terms of their dual functions—for individuals and for society. These two functions are intimately related. Society consists of individuals who have self-interests that need to be harmonized enough to allow social groups to persist and accomplish social goals.

One function of moral systems is thus to entrain self-interest to the interest of the group. This function appears in everyday beliefs and customs about friendship, caring, fairness/unfairness, obligation, and blame as well as in legal/regulatory systems and religion. These have
done reasonably well for they allow existence of societies of many millions of individuals, immeasurably aided by developments in utilizing natural resources, in farming and manufacturing, and in socioeconomic organization (Note 10).

The family is primary in social–moral learning. The high divorce rate shows the need for education to improve family interaction and increase family satisfaction. The need for such education is underscored by its near–complete absence in our educational system, especially in our colleges and universities. Education for raising children has foremost importance.

Schools could be central in social–moral education. Present curricula focus on specific subjects such as geography, history, and science. These tend to be taught as self-contained bodies of knowledge. Every one, however, can be directly relevant to moral education as suggested in Education (Chapter 7).

Experimental–field studies are needed to improve social–moral education in family and schools. There is no shortage of well-intentioned opinions or books. But good intentions need to be grounded on scientific knowledge, which is in short supply (see quote from Brooks and Goble under Education in Chapter 7; see also Betts & Atkinson, 2012; Stengel & Tom, 2006).

Moral systems have a second function. Society should subserve the good of its individual members. In substantial part, of course, individual good is subversed by the general social good, notably with economic, educational, and legal systems. Nevertheless, individual self-interests have their own moral priority.

This function of individual self-fulfillment has been relatively neglected in moral theory. One reason is the primary need to implement the first function. This neglect has been fostered by many writers, not least by moral philosophers who maintain that self-interest can never truly conflict with social morality (see Moral Philosophy, Chapter 7).

Moral systems should seek to promote individual self-interest without detracting unduly from others’ interests. Instilling positive attitudes of family, friendship, group belonging, helpfulness, and job performance, as well as respect for law, can contribute to both goals. No less important is to encourage pursuit of individual goals, not merely those that benefit society, but also those that enhance individual accomplishments and feelings of worth without necessary regard to social benefit. This self-fulfillment function has fundamental moral significance.
TOWARD UNIFICATION OF PSYCHOLOGY

The moral domain can be a foundation for unifying much of psychology. Unification has been illustrated in the four areas discussed in preceding sections: person science, social attitudes, learning/memory, and judgment–decision. Each of these areas is important in moral thought and action; all can interact mutually and constructively in this domain. Moral attitudes are basic components of the person that each of us is; how moral attitudes are learned and how they function in judgment–decision are important for theory and practice.

... the concept of person constitutes a prime base for cognitive theory. Not only does person unify diverse areas of psychology, but it reveals them in a new light, as with affect, memory, and social–cognitive development. In this functional perspective, psychology focuses on what many think should be its primary concern—the study of phenomenal experience and purposiveness in everyday thought and action. (Anderson, 1996a, p. 464.)

The moral domain can facilitate unification by providing common ground for these several areas of psychology, which now pursue their several directions with little interaction. Many writers have complained of this fragmentation, but fragmentation proliferates, even within each area (see e.g., Anderson, 2008, Notes 1-4, pp. 421f).

Unification is possible by shifting to a functional approach in each of these areas. Person science needs to shift from static traits to dynamic knowledge systems. Attitude theory needs to shift from “nonattitudes” to study how strong attitudes function in everyday life. Learning/memory needs to shift from rote memory and conditioned reflexes to study goal-oriented constructions that may have distant relation to the stimulus materials per se (see dissociation in Figure 8.2). And the field of judgment–decision needs to continue its shift from normative models to psychological laws of information integration, a shift already pursued by a number of workers.

Conceptual foundation for unification is provided by two axioms: Purposiveness and Integration, both represented in the Integration Diagram of Figure 8.1. Purposiveness underlies the valuation operation, an essential link between the external world of stimulus informers and the internal world of goal-oriented meanings and values. Integration of multiple informers is basic in all thought and action. Valuation and integration are fundamental processes in every field of psychology.
Empirical foundation for unification is provided by an almost miraculous blessing of Nature—three algebraic laws of information integration. A key property of these laws is that valuation and integration are independent operations. Hence a simple pattern of parallelism in an integration graph gives an exact test of adding-type laws; nothing need be known about the values that are integrated. Indeed, these values may be derived from the integration graph (see e.g., Figure 1.2 in Chapter 1). These laws thus solve the long-standing roadblock of true measurement in psychology, both on the response side and on the stimulus side (benefits 2 and 3 of the parallelism theorem in Chapter 1).

These three integration laws have extensive empirical validity across diverse areas. They are common throughout human psychology, not only in the moral domain (Chapters 2-5), but also in general cognition (e.g., Anderson, 1974a,b,c, 1996a, 2013). They operate in young children, revealing high cognitive capabilities previously denied, and continue across the life span. Hence they can help study development and functioning of knowledge systems and values. They have shown promising generality across cultures. They have done well in single person experiments, recognizing and measuring large individual differences in values. These laws of cognition are thus both nomothetic and idiographic.

Social betterment should be no less important than cognitive analysis for psychological science. The present research program began with cognition; appreciation of the importance of bettering everyday life developed gradually, in part a consequence of the experimental studies of moral cognition discussed in previous chapters, especially studies of children and marriage. This work led to realization that the moral realm provided substantive ground for unifying the psychological field. This grounding can be actualized by virtue of the three laws of information integration.

Investigators in many countries have contributed to Information Integration Theory. Their work has established moral cognition as a base for unification and working interaction across the diverse areas of our field. This book stands as tribute to their insight and dedication.
NOTES

Note 1. The present distinction between AKS (attitude knowledge system) and AR (attitudinal response) has similarity to William James’ ME and I respectively. Much of I, however, may remain nonconscious (Self-Cognition: I and ME, p. 411, in Anderson, 2008).

Note 2. Similar “nontraditional” view appears in “Attitudes as temporary constructions” (Wilson & Hodges, 1992). In IIT, however, such temporary constructions are only attitudinal responses (ARs), as indicated in the quote in the text. Attitude proper is a more enduring knowledge system (AKS).

Note 3. The dissociation between attitude and verbal memory discovered by Anderson and Hubert (1963) has been supported by other investigators including Dreben, Fiske, and Hastie (1979), Riskey (1979), Brink (1974), and Crano (1977), discussed in Anderson (1981a, pp. 253ff). As Crano (1978) concluded

It seems apparent now . . . that the simple isomorphism of retention and attitude, so long an article of faith of the classical attitude theorists, simply does not exist. (p. 94.)

This dissociation led directly to the functional conception of learning. Effective analytical tools are available with the integration law, illustrated in Figure 8.2.

The availability heuristic of Tversky and Kahneman (1973) could not explain such dissociation, not even with the attempt to salvage it by Reyes, Thompson, and Bower (1980, pp. 20) who concluded that “important arguments that are unreliable” will have little or no effect—contrary to the dissociation illustrated in Figure 8.2.

Note 4. Basal component that lasted over a hundred trials has been found with adults in probability learning, both with choice response (Anderson, 1960; Friedman, Carterette, & Anderson, 1968) and with metric response (Anderson, 1969). Basal-surface structure may thus have some generality in learning. Functional learning theory may thus help extend the short-term/long-term theory of Atkinson and Shiffrin (1968) from traditional reproductive memory to functional memory.

Note 5. This disjunction of education from student needs for adaptive transfer is extreme in undergraduate statistics in psychology. A review of the first edition of one such text concluded, “Until there is an end to teaching statistics and a beginning of teaching the student, undergraduate statistics will remain one of the professions’ principle misfeasances” (Anderson, 1962, p. 313). This misfeasance continues. Indeed, this statistics text has prospered through multiple editions.

Statistics should not be taught as such at the undergraduate level. Instead, primary focus should be on research methods.

Note 6. This disjunction of education from student needs with adaptive transfer seems general across disciplines. Standard texts typically aim to teach their subject per se. Most instructors follow suit. Students are being systematically shortchanged by our current educational system. So also is our society.

Texts and teachers need to focus on the three problems of adaptive transfer listed in this quotation. Teaching for adaptive transfer seems a moral responsibility.
Note 7. Contributions to adaptive transfer have been discussed by a number of persons, including McDermott (1991), Halpern (1998), Haskell (2001), Bernstein, et al. (2006), and in contributed chapters on creative thinking in Dunn, Halonen, & Smith (2008).

Note 8. One empirically oriented approach seeks to base human morality on evolution, an approach foreshadowed by Darwin (Descent of man, 1871). He argued that natural selection had acted to enhance altruistic behavior because it helped preserve human groups. Survival of the fittest was thus extended from the individual to the group.

Another appeal to evolution appears in sociobiology (Wilson, 1975; Stent, 1980), especially in its emphasis on genes that tend to perpetuate themselves. Few can doubt that humans are evolutionary products or that genes underlie behavior. However, the immense gap between morality in humans and parental behavior or pecking orders in infrahumans casts doubt on explanatory capability of sociobiology. Indeed, genetic explanations largely ignore culture, as noted by several contributors to Stent (1980).

Another empirically oriented approach seeks a base for morality in neuroscience. Thus, Churchland (2011) is enthusiastic about findings that oxytocin increases mother–child attachment. Such findings can lead to useful techniques for social betterment, as suggested in work on contact comfort by Harlow and on attachment by Bowlby. But they are far from being able to explain fairness/unfairness, praise/blame, or even attachment itself (see quote in Science of Phenomenology, Chapter 7).

Of course, evolution, and sociobiology, have distant relevance to moral science. It is interesting, of course, to see primitive signs of human social behavior in lower animals. But these primitive signs largely emphasize the immense gap below anything like language, religion, and legal systems. Unfortunately, such claims obscure real social–moral problems: cognitive theory and social betterment (see next note).

Note 9. Sociobiology also hardly recognizes the importance of family life in transmitting culture across generations. More generally, Fried (1980, pp. 193f) comments that

Social theorists have always been troubled by the tendency of the family to interfere with their projects for the ideal society, whether it be a community of perfection, as in Plato’s Republic, or of equality, as in the Marxist state. Thus Rawls is troubled by the tendency of the family to make more difficult the establishment of a regime of distributive justice. My suggestion is that the family is the cradle of individuality.

In the present view, the family is the cradle of morality and of society.

Note 10. The importance of natural resources for social morality deserves consideration. Past progress has depended heavily on increasing exploitation of natural resources but these are steadily diminishing. Overpopulation in Africa and elsewhere is an increasing problem with little sign of solution. How long egalitarianism can survive is thus open to question.