Systemed Studies on Message Diffusing: Volume 2

By
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Systemed Studies on Message Diffusing: Volume 2

Published by

Dodd Memorial Library

Stuart C Dodd Institute for Social Innovation

Third Edition

Draft 4

November 2012

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Table of Contents

The Life and Work of Stuart C. Dodd xi
Sample of Stuart C. Dodd's ideas: xiii
A Preview Introducing and Evaluating the "Pan-Acts Matrices" (excerpt) xiii
Things Categories of Cosmists' Actions or Scientists' Four Aims xv
Things Liked Most xvi
Pan-Acts Cosmos Pictured as the Mass-Time Triangle xviii
General Systems: A Creative Search for Synthesis (excerpt) xix
Stuart C. Dodd Institute for Social Innovation xxi
Purposes xxii
Our Mission xxii
Our Methods xxii
SCDI Founder: Richard Spady xxv
The Leadership of Civilization Building xxv
The Forum Foundation xxvi
Presidential Address project xxvi
DVDs available from the Forum Foundation xxvi
Founding SCDI Executive Director: Rev. Dr. Richard S. Kirby (1949-2009) xxvii
World Network of Religious Futurists xxvii
SCDI Catalyst: August T. Jaccaci xxix
2008 Thomas Jefferson Returns xxix
Jefferson 2040 xxix
Unity Scholars xxx
Futurum Grid, 46th Annual Creative Problem Solving Institute Reference Sheet xxxi
SCDI Dodd Memorial Library Editor: Burt Webb xxxiii
The Nexilist Notebook xxxiii
Radiation Blogging xxxiii
Rare Earths xxxiii
Mindfields xxxiii
Dodd Memorial Library xxxv
Dodd Memorial Library Editor Note xxxv
12 published books xxxvi
List of 10 volumes remaining to be published xxxviii
Overview of Book 2
Preface to Systemed Studios on Message Diffusing 3
Preface to Article #18: Diffusion is Predictable 6
Preface to Article #19: The Logistic Law in Communication 6
Preface to Article #20: How Momental Laws can be Developed in Sociology 6
Preface to Article #21: The Moment Laws in Macrosociology 7
Preface to Article #22: The Counteractance Model 7
Preface to Article #23: A Power of Town Size 8
Preface to Article #24: Formulas in Linguistics 8

Preface to Article #25: Logistic Diffusion in Randomly Overlapped Cliques 8
Preface to Article #26: Exchange between Nicosia and Dodd on Diffusion 9
I: Critique by Nicosia: Some Reflections on a Study of Diffusion of Information 9
II: Rejoinder to Nicosia: S.C. Dodd Replies 10
Preface to Article #27: Modifying Logistic Diffusion 10
Preface to Article #28: Two Consensus-forming Experiments 10
Preface to Article #29: A Transact Analysis Producing Models for Consensus 11
Preface to Article #31: A 'Doubling and Halving' Technique 11
Preface to Article #32: Model for the Scientific Study of Prayer 12
Preface to Article #33: Model English 12
Diffusion Is Predictable: Testing Probability Models for Laws of Interaction[1] 13
I. What Factors Affect Diffusion? The Dimensional Candidates 14
II. What Curves Measure Diffusion? The Empirical Fits 14
A. The Activity Factor in Diffusion 15
B. The Population Factor in Diffusion 15
C. The Time Factor in Diffusion 16
D. The Space Factor in Diffusion 16
E. The Values or Motivational Factor in Diffusion 17
F. The Stimulation Factor in Diffusion 17
G. Summary of the Factors of Diffusion 18
III. What Preconditions Explain Diffusion? The Probability Hypotheses 19
A. Four Criteria for Preconditions 19
B. Three Preconditions for Diffusion of an Attribute 19
C. The Randomness Precondition 20
D. An Experiment Testing the Preconditions for the Logistic Model 21
IV. What Laws Predict Diffusing? The Moment-Powers Model 23
A. The Normal Probability Law in Diffusing 23
B. The Decaying Exponential Law in Diffusing 24
C. The Linear Logistic Law in Diffusing 24
E. The "Power-Moments" Model 25
Notes 27
The Logistic Law in Communications 29
Abstract 29
I. Problem 30
II. Background 31
III. Procedure 32
A. Equality of Opportunity as Sought by Selection of Homogeneous Observees (in 28 or more circumstantial respects) 32
B. Equality of Opportunity as Sought by Similar Experimental Treatment of Equally Free Observees (in the 24 standard dimensions of a transact) 34
IV. Findings 35
V. Theorizing 41
A. Note on the law of a "distributed joint probability" 41
B. Note on the "tell-hear" unit in communication 42
C. Note on the "reactance" model of which the logistic is a submodel 43
D. Note on applying probabilistic models in sociology 43

E. Note on the social meanings of the reactance, Am, hypotheses such as for "equal opportunities" 44
References Cited 47
How Momental Laws Can Be Developed In Sociology 49
I. Three Sets Of Elements – Ways Of Listing The Acts Of Men In Time 50
II. Seven Subsets – Ways of Classifying Man by One All-Or-None Act 50
III. Seven Probability Formulas – Ways of Measuring the Probable Acts of Men in a Period 52
IV. Seven Growth Curves – Ways of Predicting The Probable Acts of Men In Time 59
Summary 66
Notes: 69
The Moment Laws in Macrosociology 71
Abstract: The Moments Law in Macrosociology 71
I. Input for the Moments Model – Substantive Variables 73
II. Throughput in the Moments Model – Methodological Variables 75
A. Five General Procedures or Postulates 75
1. Extensional Thinking 75
2. Dimensional Analysis 75
3. Transactive Modeling 75
4. Stochastic processes 76
5. Cybernetic Processes 76
B. The Special Reiterant Procedure 76
III. Output from the Moments Model –Transactive Variables 79
A. Direct output – the Moments Model, pt = $\overline{Am}^{(t)}$ 79
B. Indirect Output – uses of the model 80
1. Detecting Disturbing Factors 81
2. Measuring Disturbing Factors 81
3. Controlling Further Factors Statistically 81
4. Controlling Further Factors Experimentally 82
5. Controlling Causal Factors Experimentally 82
Plates A-E Exhibiting – "The Moment Laws in Macrosociology" 83
Plate A: The Normal Law Approximated 84
Plate B: The Normal Law Distributed 85
Plate C: The Exponential Law of Organization in Societal Action 86
Plate D1: The Logistic Law Graphed 88
Plate D2: The Logistic Law Measured 89
Plate E: Conspectus of r the 'Moments Clan' of Actance Models 90
References Cited 93
Notes 95
The Counteractance Model 97
Abstract 97
I. What Factors Fit the Counteractance Model 99
A. Distance 100
B. Time 106
C. Population 107
D. Increments of stimulation 108

E. The hypotheses 109
1. Countering 110
2. Interacting 110
3. Unequal acting 110
4. Definite total action 111
5. Equal opportunity 111
II. Why the Counteractance Model May Be Useful 112
Notes 113
A Power of Town Size Predicts an Internal Interacting 115
I. The Dimensional Model Hypothesized 116
II. The Experiment Testing the Model 118
III. Interpretations of the Findings 121
References 125
Notes 127
Formulas in Linguistics 131
Note 135
The Logistic Diffusion of Information through Randomly Overlapped Cliques 137
I. The Problem 138
II. Background 139
III. Procedure 140
IV. Findings 141
V. Explanation 145
VI. An Application 146
VII. Research Needed 147
References 149
Notes 151
Exchange of comments between Nicosia and Dodd on Diffusion 153
I. Some Reflections on a Study of Diffusion of Information 154
II. S. C. Dodd replies 156
References (By Author) 159
Notes 161
Modifying Logistic Diffusing By Acquaintance, Sex, and Sampling Factors 163
I. Introduction – background theory 164
II. The Logistic model for items of diffusion or change of state 165
III. Experiments on three modifying factors 166
A. Hypotheses on 3 factors – sex, sampling, and acquaintance 166
B. Description of eight systematic experiments 168
C. Controls on the variables 168
1. Sex. 168
2. Acquaintance 168
3. Sampling. 169
4. The Experimental Situation. 170
IV. Findings 171
V. Systematic research recommended 176
References Cited 179
Notes 181

Two Consensus-forming Experiments: Demonstrating Transactional Models for Modernizing 183
I. A Preview 184
II. The Transactional Model for Modernizing 184
A. Postulate Scientific Methods 184
B. Poll Democratically for People's Goals 184
C. Experiment on Pair Consensus 185
D. Collaborate on Decision Research 185
III. The Sub-model on Polling Value-systems – to ascertain the goals in modernizing 186
IV. The Sub-model on Consensus-Forming Experiments – to help generate group decisions in modeling 188
Author's Bibliography 191
Discussion 192
Exhibits 197
Exhibit #1a: What is Liked Most? 198
Exhibit #1b: How to Start Ranking Human Values – A Questionnaire, Version A2 200
Exhibit #2: Why Poll the National Goals 202
Exhibit #3: Abstract of A Consensus-Forming Experiment 204
Exhibit #4: Conspectus of 24 Hypotheses in Project Consensus 205
Exhibit #5: Project Consensus – The Pair-Poll 206
Notes 209
How to Produce a Consensus: A Progress Report from Project Consensus 211
I. The Problem 212
II. Pilot Testings 212
III. The Techniques 213
The Hypotheses 214
IV. Findings on Causes 215
A. Hypothesis 1 215
B. Hypothesis 10 215
D. Hypothesis 13 216
V. Findings on Correlates 216
Implications 217
References 219
Original Editor's Commentary 221
Plates 223
Plate A: Forepoll 224
Plate B: The Pair Poll 226
Notes 229
A Transact Analysis: Producing Models for Consensus 231
I. Rules for Transact Analysis – illustrated on "consensus" 232
A. Using scientific methods – as currently best available 232
B. Selecting of "augmentive" problems 233
C. Measuring the 24 dimensions – of the transaction at issue. 233
D. Hypothesizing on each dimensions – in factor vs. addend terms 239
E. Experimenting on each dimension – alone first in combination later. 240
F. Predicting by matching dimensions – of earlier to later transactions 243

G. Predicting by multi-dimensional matching – a case of multiple matched dimensions ……. 244
H. Controlling by aligning dimensions – of goals, means, and results 245
I. Modeling by applying these rules – a theory of consensus 247
Tables 249
Table 1: How to Produce a Transact's 24 Dimensions, X^X 250
Table 2: How to match Transacts 251
Table 3: Conspectus of 24 Hypotheses in Project Consensus 252
Notes 253
A "Doubling and Halving" Technique for Measuring Causation among Opinions 255
I. The Model 256
A. Procedure: Change stimulus opinion A by fractions in isolation 257
Form 1: 258
Form 2: 258
Form 3: 258
Form 4: 259
Form 5: 259
B. Findings: One-way causation was isolated and measured 261
II. Testing a Reinforcing Influence (Among Three Opinions) 264
Discussion 266
Conclusions 269
Appendix 271
A. A variance analysis 271
B. "Half" of what? 273
References 275
Notes 277
Model English: an Example of a National Language Regularized For Machine Translation 281
Rules for Model Languages 282
Familiarity rules for a model language: 282
Regularity rules for changing a folk language: 282
Rule 4 - One Word Order 283
Rule 5 - Just One Meaning for Each Word 284
Rule 6 - One form for Each Word - No Inflections 285
Case 285
Number 285
Persons 285
Degree 286
Tense 286
The passive 286
Mood, etc. 286
Participles 286
Nouns from verbs, etc. 286
Verbs from nouns or adjectives 287
Summary 287
References 289
Model for the Scientific Study of Prayer – An Exercise in Scientific Methods 291

I. A Challenge Stated 292
II. Scientific Methods Expounded 292
III. Scientific Methods Illustrated In Vicarious Prayer 293
Step 1. Observing the Variables – The Definitions 294
Step 2. Measuring the Indices – The Scales 296
Step 3. Correlating the Indices in Pair-Relations – the Hypotheses 297
Experiment I. Do supernatural forces operate human affairs? 298
Experiments 2 thru 7. What conditions may prove vicarious praying? 299
Step 4. Systematizing All Relations –The Model 301
The Challenge Restated 302
References 303
Publications of Stuart C. Dodd 305
Books 305
Research Articles 306
Articles Unpublished as of January, 1971 316

Overview of Book

This book was originally intended to be one of a set of four themed volumes covering the life's work of Dr. Dodd for publication by an academic publisher around 1970. Unfortunately, the project was cancelled. This is Volume 2 of Dodd's collected papers on Message Diffusing.

Preface to Systemed Studios on Message Diffusing

For a very long time men have struggled for control of their environment. That environment has always included other son. Sometimes mod have moved toward, sometimes away from this goal of environmental control, at over the long time span, man has gained nor* than helms fallen back. The animal world has slowly gives ground to its self-proclaimed master. The systematic application of sun's accumulated knowledge has caused the plant world to yield to and for man. Even seemingly unending and unbending space seems now on the point of crying uncle (be it San or Ivan).

The systematic institutionalization of this search for knowledge, mats-voted by man's desire to control, we call science. But whereas the accomplishments of physical and biological science have been awe-inspiring, those of social science have been much more modest.

In any field, increasing control comes only after vast amounts of time, energy, and material wealth have been spent -- even squandered -- in the preliminaries of perceiving, sorting, describing, ordering and testing of the data. (Sometimes the effort even seems to be spent in the wrong direction, at the wrong time, on the wrong things, and for the wrong reasons!) But out of such investments emerge new tools and new uses for old tools. New ways of thinking about old problems bring ever more combinations of ideas and tools to be tested and selected for the solution of ever more complex problems.

The social scientist, committed to the study of man's interactions with his fellows within the environment, may take that most useful tool, mathematics to help describe, explain and predict man's behavior. S. C. Dodd helps to do this in his Transactional Sociology: explaining and predicting man's behavior in terms of the transact, B = APVTLC. That is, Behavior equals the Acts-of-People-for things-Valued-in-Time-and-Length-of-space-and-residual-Context.

This collection of Dodd's articles in Volume 2 of the series entitled; Systemed Studies on Human Transactions", deals with that portion of his work which bears on the diffusion of items through people, whether small groups, societies, or whole cultures. The articles, as here collected and arranged, provide a type of behavioral system summarized in a mathematical formula that definitely unifies this human behavior-in-context. This unitary theory Dodd calls the "Transaction Theory." It deals with acts-in-context wherein an early transact will predict a later transact insofar as the two are matched, feature for feature.

Besides relating to Dodd's larger theory of human behavior as a transactional system, these articles develop mathematical models for the basic growth curves of interaction and

In addition, however, to providing a systematic frame of reference for research and the interpretation of finds, this volume gives a great deal of experimental evidence on stochastic diffusing processes, in which each state determines the next state in a probabilistic fashion. These experiments are empirical and, increasingly, controlled experiments, but still lack elegance of mathematical expression here. Stochastic theory had not diffused, to sociology or general social science literature, in the period when these articles were being developed.

The articles do, nevertheless, offer experimental and raw empirical material for better trained mathematicians to re-express as predictive models that eyesore rigorously formulated in mathematical and statistical language. If Dodd were doing the experiments now he would doubtless try to express the hypotheses to be tested as stochastic-equations, with their density functions, characteristic equations, generating functions, etc. It is to be hoped that in time others will re-express his work in that way.

This volume on diffusion is the second of a series of volume that are being published by

Gordon and Breach. The first serial volume is entitled Systemed Studies on Human Values. The second in the series is the present Systemed Studies on Message Diffusing. The third volume in this series is entitled Systemed Studies on Opinion Polls. It collects some forty of Dodd's articles with a focus on polling. The fourth volume in the series is proposed under the title Systemed Studies on Interactive Symbolizing. All the articles in the four volumes together account for the 144 of Dodd's research articles in professional journals. Most of these were developed over the 20-year period 1950-1970.

Though unified in part, in retrospect, these represent a lifetime's research process. This flow of incipiently tested thinking aims to help develop laws of human behavior in the elementary field of diffusing item messages through a population and a period. Dimensionally, the Behavior deals with Acts of People in Time. (An APT formula!) Increasing these behaviors can be more rigorously stated as stochastic processes, or laws of changing probabilities. I see scientific laws about events as sequences in time, which, if correlated, spell out effective means to human ends. By this definition, few men, if any, have equaled Dodd's contribution to the development of sociological laws about diffusion.

All of the articles collected here have been presented or published previously. Some represent propositions for test; some are reports of such empirical tests. Although the use of uncut articles introduces a certain amount of redundancy, this could prove to be useful, particularly for those who are unfamiliar with mathematics and who find the material difficult to absorb in a single exposure. The inclusion of Dodd's transact model (article 11), and the reiteration rule (article 12), provides a broad theoretical base, and permits placing the diffusion research studies into a larger framework.

Stuart Dodd chose behavior science as field before the term was invented, and at a time when many scholars still asserted that it was t contradiction in terms. It has been he, and men like him, who have demonstrated that behavioral science is possible. The dimensional frame he developed to help order and guide his thinking has thus had a subtly profound effect upon the development of sociology, even though it has not been widely used in direct quotation by other scientists. Although not only yet living but still prodigiously productive, Stuart Dodd has even so already become part of the folklore of sociology. I doubt if there are any sociologists in the world, beyond the level of the undergraduate student, who has not heard of him. Since I believe this to be the case, a little biographical material of how his thinking grew seems in order.

Throughout his 40 years of scientific productivity, Dr. Dodd has been putting out articles and books at a mean rate of four a year. The main thread through these I see as seeking for systematizing of the situation. He seeks the uniform, the invariances, the generalizations, the laws that are increasingly emerging with greater and greater university. He has the general point of view that scientific methods are any and all methods that enable us to so describe as to explain and predict and increasingly control better than we could otherwise. He sees the pursuit of what most men want, most deeply and durably, to be most hopeful if scientific methods are used increasingly. But there is always something new cropping up, new combinations and permutations of existent patterns, so that one never looks forward to a time when all problems will be solved.

His missionary home in Turkey had a great deal to do with his feeling a high sense of interest and responsibility to contribute to society, to speak up on how to improve the world in the ways he can, which is chiefly through research. Others might choose political activity; his brother, Alexander Dodd, chose life in the Society of Brothers, a Christian group practicing

community of goods, as a way of demonstrating by example how men ought to live together in love. Two other brothers followed their father's business in choosing to become medical missionaries. A fourth brother after fifty, found his best contribution in applying simple Christian faith for rebuilding the inner city around community and spiritual values - becoming Man of the Year in Stanford (Conn.) thereby. His sister pursued the teaching of art and its spiritual messages. But behavioral research as a social scientist is the way Stuart Dodd has chosen to make his contribution, chiefly. He enjoys bringing items that seem most remote abstract or general into more Immediate, concrete, and particular application.

In his sophomore year in high school, he had an excellent mathematics teacher who gave stimulating encouragement. One day the teacher cane into class and said, "Gentlemen, I want to call your attention to something," and he held out Dodd's homework - - "After almost 3,000 years of geometrical thinking by the human race, here is an entirely new proof of a theorem of Euclid's that Stuart Dodd has produced yesterday." Dodd hadn't even supposed it to be unusual! It will be left to future generations to assess the full impact of the material presented in this book. But all must surely even now agree: it is unusual!

This collection is intended for use by several audiences. It will be useful for graduate students in the behavioral sciences, especially in those studies and theories which draw on mathematics for more exact prediction of human behavior. Although students with a firm background in modern mathematics (especially set theory) may find some passages difficult, they will be rewarded for their effort.

Indeed, as the number of students with the requisite mathematical knowledge increases, this collection of articles should find an even wider audience as an undergraduate supplemental text.

Mathematics students may find some interest in simple applications of mathematics to the social sciences. Students from such diverse disciplines as education, political science, and communications may also find implications for their special fields of interest. And all social scientists with an interest in diffusion will want this book in their libraries.

Preface to Article #18: Diffusion is Predictable

The next article, “Diffusion is Predictable”, was Dr. Dodd’s presidential address at San Francisco before the Pacific Sociological Association. It claimed that we had a law of social behavior. At that time (1954) most sociologists thought there was no such thing as scientific laws in sociology, and some even went so far as to say that there never would be any. This paper came out with the definite assertion that here is on law of social behavior and gave the evidence for it. This stochastic law predicts diffusion across space, as well as through time and through a population.

Preface to Article #19: The Logistic Law in Communication

The next article, "The Logistic Law in Communication," was written with Marilyn McCurtain. It deals with a definite condition of human interaction, interaction in pairs, and examines cumulation through time. This was the most thorough statement of the logistic law up to the date of its publication, 1953. It examines the law from half a dozen points of view.

The article demonstrates again that this logistic law, like any stochastic law, is universal to all the sciences. The logistic law, pq, is a summed joint probability of a change of state in a proportion, p, of any set at the expense of its complement, q (i.e. where p and q = 1). The set of elements may be people or cells or photons or mathematical units. The law is invariant for any simple random interacting in pairs through time between the two subsets of any set whatever.

Preface to Article #20: How Momental Laws can be Developed in Sociology

“How Momental Laws can be Developed in Sociology by deducing testable and predictive 'actance’ models from transacts" derives these moment models from two sets of elements. By counting the number of elements and their ratios one re-expresses them as probabilities. Then by taking those probabilities as cumulatively changing in successive periods of time, one derives their growth curves. Dodd and his colleagues at the Washington Public Opinion Laboratory developed these growth curves as scientific laws that predict from the past to the present to the future in law-abiding growth processes or continuous curves that follow definite formulae.

In deriving these momental laws among stochastic processes, one may start with the statistical moments of any distribution of extents by their acts (or other properties). These moments are best expressed as discrete probabilities or percents of the population: to free them of variations in size of populations studied. Then human life means interacting and is mostly in pairs or can be so analyzed. This interacting x is algebraically expressed as forming self-products or squarings in a relevant period. Successive self-products or squarings defines the Gompertz growth curve of negative and positive entropy. Human cohorts undergoing entropic organizing and disorganizing spell out the laws of societal evolving and devolving.

Thus this article exposes some mechanisms explaining the vast regularizing trends or stochastic processes in social evolution. Thus the extensional viewpoint – of looking at every word or symbol as a name for a set of referent elements or instances of the thing-named

viewpoint – scores another triumph in science. Extensional thinking, as here in Sociology, seems a promising route to scientizing the study of society. This is the central theme of these four volumes of Systemed Studies an Human Transacting as stated in the introduction to the series.

Preface to Article #21: The Moment Laws in Macrosociology

"Moment Laws in Macrosociology" discusses the first three moments of statistical distributions. The normal law, the exponential law, and the logistic law are a family which is now so fully understood that these laws can be produced to order in a laboratory or observed in a total society. Evidence, given here that this is so is such as the six wars of America in this century in which the growth curve of the armed forces leading up to their full strength is a smooth exponential. Mass behavior towards winning a war shows alike from indices computed as the number of man under arms, or the number of casualties, or the number of deaths, or even the size of the national budget. These curves, when their differing maximally strengths are normalized by dividing each by its maximum so that the difference in maximal intensity of the wars are obliterated, come closely together. If we also normalize the duration of the wars, the curves come fully together.

All the curves of the American wars become just one smooth curve in which the exponential process may be seen as simply due to a random set of interacting cells building up. The same curves developed when a set of nations waging World War I (with differing sizes of population, strengths of effort, etc.), were normalized. Here a law was discovered in part by the semantic use of the best units and scales in which to observe it. Normalizing eliminates some of the parameters. This gets at the fundamental shape of the curve.

Here also is a good illustration of the ergodic process discussed earlier the growth in people in the United. States who joined the PTA by state organizations from the period when they were first started till they reached their maximum and tapered off. That curve is twice interrupted: by World War I and by the Great Depression of the 1930's. Each time, the curve snapped back to where it would have been if there had been no war interruption at all.

Preface to Article #22: The Counteractance Model

In the "Counteractance Model", we are dealing with negative exponents. Negative exponents are used in Dimensional Sociology to stand for factors that are in the denominator of a ratio showing that they counteract, or divide, or countervail the rest of the diffusion factors. This study is, by the way, a fine example of curve-fitting

The countering factors studied here first are the standard and most ubiquitous dimensions of any human transaction. The study shows how in a set of interacting people when communicating an item of knowledge belief or practice -- the element of any community or society -- each basic dimension can be an index of a countervailing subset of influences.

Thus intervening distance absorbs some of the energy of the interactors--they interact least when furthest apart,

intervening time overlay any event with further events decreasing its salience and likelihood of being remembered and reported;

enlarging populations around a fairly fixed set of message knowers will increase the

changes of retelling to more people absolutely but relative to the whole will shrink the proportion of k new knowers:

increasing the stimulation as in leaflets dropped per capita will increase the absolute number of respondents but shrink the pm proportion of respondents per added leaflet. This is the precept of diminishing returns and explains

the Weber Fechner law of psycho-physics and perhaps any effects measured by logarithms.

Preface to Article #23: A Power of Town Size

The last article in Section V, Laws of Diffusion, is "A Power of Town Size Predicts Its Internal Interacting." This number experiment related the amount of interaction to the number of potential interactors. It was another outcome of Project Revere. Dr. Dodd noticed in their sets of data that as the size of the town went up from villages of a few hundred people to the metropolis of Birmingham (where there was almost a third of a million people) the amount of interaction went up also (as measured by the amount of retelling of the massages). With a constant ratio of leaflets dropped per capita, the per cent of the town's population becoming knowers of its message increased as the exponent of the town's size. This regularity had a simple explanation which had been foreseen and predicted and then observed –a pioneering case in behavioral science where a new behavior could be accurately foretold and experimentally checked. "Common sense" might have foretold an opposite conclusion: that the percentage of knowers in small towns would be higher. This would seem "reasonable", because small places are more "personal" -- people are said to ignore each other more in big cities.

Science wins again!

Preface to Article #24: Formulas in Linguistics

Now let us look at another law, which was formulated in the field of linguistics and published by an anthropologist in Science magazine. This law of chronology states how language develops by slow changing or eroding of the sounds of the words at a rate of about fourteen words per hundred in a millennium of time, in preliterate civilizations. This is known so accurately that the process can be used to fix the date when two peoples separated, or the date, on the other hand, when they converged and developed a common language. One can, thus, date the Teutonic invasions of Britain by the Angles, Saxons, Kents, Normans and so forth from about 500 A.D to about 1100 A.D. For 600 years the different waves of migration from the continent came, over about a hundred years apart or so. From word counts one can calculate these dates and check them against the historical record. Where this has been done, the formula has been validated.

In this article Dodd's knowledge of the momental laws of probability enabled him to detect (and correct in a later issue of Science) an error in both the earlier published formula and in its application.

Preface to Article #25: Logistic Diffusion in Randomly Overlapped Cliques

Now we go to Section VI on applications. Here Dr. Dodd takes these logistic and momental laws as given and says, "So what?" "What can be done with them?" "How can they be used?" “What sorts of factors can be manipulated to modify the diffusing?" “What sorts of factors can be held constant in order to isolate further factors, such as urgency of the message, or size and density of friendship networks, or such?"

So with the first of these applicational articles, using the logistic as a baseline, Prof. Dodd and Miss McCurtain explored deviations from it by noting the effect of clique sizes in the population. They assumed people were restricted to communicating mostly in their cliques, i.e., the people they would meet in the course of a day. They found that as the clique size grew from two to n (the whole population involved in the diffusing.), in, the diffusing) the diffusion rate increased. The slope of the curve became steeper and the diffusing process went up faster as there were more people in a clique whereas boundaries between cliques were impeding the diffusing process. They had predicted that with the elimination of boundaries, with increasing size of the cliques, diffusion would grow faster and approach the simple logistic at the top as a "clique of the whole". They tried the experiment and got a very exciting finding; namely, that as the size of cliques went up from two to four, the hypothesis was verified. With increasing size of cliques, the diffusing went faster. But, instead of stopping at four, it went on going up and exceeded the clique as a whole from then on, contrary to the hypothesis. This indicated that there must be some further factor(s) in the situation that they had not tracked down that was making it exceed what they thought would be the top limit. So they reanalyzed the situation and found it

In the normal process of communicating person to person you ask the other person, "Have you heard that...?" If he has heard, it's not news to him and you don't tell. You go on looking for a person who is ignorant of it to tell it to. There is thus a seeking out of non-knowers in the ordinary human interaction process. They therefore built into a simulated process a feature called "seeking out non-knowers." if the computer in seeking a person’s random partner came up with a knower, it would draw again. Then they designed a new strictly-randomizing experiment in which they did not draw again. With the new experiment in which they had no seeking out of non-knowers, the hypothesis was completely verified. As clique sizes enlarged, and boundaries were reduced, the rate of diffusion went up, reaching at its maximum the "clique of the whole" that gave the simple logistic. They here found that clique barriers slowed up the diffusing, while seeking out non-knowers speeded up the diffusing. These two forces just cancelled each other out at cliques of size four -- and thus gave us a way of measuring these two forces each in units of the other!

Here, failure to confirm a prediction led to further discoveries of other factors that could be corrected and built into the revised model. A more exact and predictive model resulted there from.

A find example of serendipity!

Preface to Article #26: Exchange between Nicosia and Dodd on Diffusion

I: Critique by Nicosia: Some Reflections on a Study of Diffusion of Information

Nicosia raised some questions and some criticisms on the preceding article, “Logistic Diffusion in Randomly Overlapped Cliques” when it was published.

II: Rejoinder to Nicosia: S.C. Dodd Replies

This article answers some questions and criticisms raised by Nicosia in the preceding article on Article #25, "The Logistic Diffusion in Randomly Overlapped Cliques." These incisive queries (for example: "Why choose the logistic curve to measure the pair diffusion here?") are answered in large part by drawing on Dodd's further research findings and experience besides what was reported in Article #25. The interchange usefully cleared up or enriched several refined aspects of logistic diffusion theory.

This opportunity to discuss his methodology more generally was taken by Dodd to review his long-term strategy in developing transact theory – the theme of this volume. He presents an ex post facto and comprehensive classification of his previous articles showing where contributions had been made throughout a wide range from transact theory, to sub-classes of it and to sub-sub-classes or most specialized topics. He also noted contributions to super-classes, of which transacts were only a part, on up to pan-acts or modeling of the whole cosmos. The contributions to cosmic synthesizing are presented at the end of Volume IV (on Interactive Symbolizing) in this series of Systemed Studies on Human Transactions.

Preface to Article #27: Modifying Logistic Diffusion

Now we go on to the second application of diffusion theory. Prof. Dodd, again, with Miss McCurtain, wrote a design using the logistic as a baseline. They then set out to vary and measure the effect on diffusing from three further factors, observed singly, in pairs and all three together.

The three overlaying or deviation-producing factors were

(1) sampling fluctuation,
(2) sex differences, and
(3.) acquaintance.

These accounted, respectively, for 1 per cent, 1 per cent, and 13 per cent of the variance. With the three varying uncontrolled the observed diffusion increments correlated at only .84 with the true logistic increments. When the three disturbers were controlled the (rigorous intraclass) correlation rose, as predicted, reaching .998. With such predictivity I feel that the social sciences are beginning to "come of age" us mature exact sciences.

Here is a clean case in the social sciences where rigorous laws are completely possible and do exist. In proportion to our degree of control of the vast set of overlaying variables, we can see and increasingly manipulate the law itself in isolation. But of course one has to observe under conditions either of massive numbers or else with a high degree of control of the conflictive, competitive, or cooperative factors in the human, normally complex, social situation.

Preface to Article #28: Two Consensus-forming Experiments

Next, we go on to deal with the consensus experiments. The first article of the two following represented (at a conference in Korea on "modernizing Asia") an introduction into Asiatic social science circles of experiments and laws for diffusing and for persuading and for

changing opinions towards a consensus in a group. Two other articles were jointly co-authored with me, one of which has appeared (1970). The other, included in this volume, is expected at, this writing, to be published elsewhere soon. I think they can make a useful contribution to the development of self-governing group behavior and democracy. They can systematically show how the engineering of group-decision making and changing of opinions toward consensus can be increasingly improved in groups that want to develop self-government. They extend the focus of this Section VI on launching further experiments using diffusion principles to diffusing a common opinion as forged from discussions with originally diverse opinions.

Preface to Article #29: A Transact Analysis Producing Models for Consensus

The last article in the volume is "Transact Analysis Producing Consensus." It is appropriately placed, for it was written in response to a frequent request, or comment, among students and others namely: "Transact Analysis seems to work well in your hands, but the rest of us can't make as clean or successful go of it as you do. Can you tell us how to use it more effectively?"

This article is an attempt to do just that. Its appearance here is its first publication. It develops ten working rules of thumb for applying scientific methods. It heads towards the testing of hypotheses more rigorously by increasingly controlled experiments as the best or most effective method for testing laws or behavior under recurring conditions.

Preface to Article #31: A 'Doubling and Halving' Technique

Another application of the principles of diffusion developed in Section V is the doubling and halving technique, for measuring causes of an opinion. This paper, done with Chick Hong in Project Concord, developed an interesting new experimental control. They wanted to measure prejudice, such as anti-Semitism, in a population. The difficulty in experimenting on prejudice is to overcome the historical associations the population has to those groups. They made a happy invention of a device whereby they gave in a paragraph a description of a fictitious "Ethnians$_1$" group who behaved very provocatively and obnoxiously, demanding much more privilege for themselves than society gave to any of its members otherwise. Another paragraph described a second group of "Ethnians$_2$" with none of this provocative behavior. Then "Ethaians$_3$" showed intermediate half-way provocative behavior. So one could think of Ethnians as groups having this provocative behavior, or having half of or having none of it.

Two social distance tests showed people's dislike for Ethnians known to them only by these paragraphs increased causally in proportion to their perceived provocative behavior. Here again Dodd was able to account for 100 per cent of the variance due to exactness of the experimental control of the variables involved. He was able to show that not only massive social prejudices were not a pure function of uncaused malicious attitude of the majority but also were in part a definite reaction to a cause, namely, the provocative behavior of the minority as perceived by the majority.

Shortly after the culmination of Project Concord, which was ongoing from 1958 to 1961 and was carried out jointly with George Lundberg, Lundberg retired and Dodd shed the directorship of the Washington Public Opinion Laboratory to get time to pursue his own research projects.

Preface to Article #32: Model for the Scientific Study of Prayer

Next is a rather weird application of laws of diffusion. The Model for the Scientific Study of Prayer developed hypotheses (still waiting for somebody to come along and test them) that prayer is a natural process of self-stimulation through verbally addressing one's sincere desire towards a divinity or some power. The hypotheses are that prayer for the recovery of people from sickness will increase in effectiveness in proportion as the following facilitating factors have operated: first, the persons praying and the persons prayed for must believe in the efficacy of that prayer; secondly, the person prayed for should know of it -- the more vividly he is aware of being prayed for, the greater its stimulating influence on him; thirdly, he must believe in it, know that it, is happening, and participate in it. Consider a devout sick person in the hospital ward is making a long, slow recovery. If the family comes and visit, or his pastor, and they pray together, and they pray together earnestly, and he feels inspired at the obvious concern of his loved ones wanting him to recover and all, and if his faith in God is strong that he will be healed if he asks for it, and if he participates in the prayer, then to that extent there communication, interstimulation., self-stimulation, emotional reinforcement of the psycho-somatic factors in him towards getting well. This article developed an experimental design or testing a set of seven such psychosomatic hypotheses.

Preface to Article #33: Model English

This article was written as an invited paper at an M.I.T. conference on machine translation. It developed the basic principle that regularizing the input and output languages is an essential procedure or factor in mechanical and electronic translation. Irregularities, idioms, etc., need to be re-expressed for machine processing in regular, or rule obeying forms. To this end fully rule-obeying or "ruly English" has been invented by Dodd. Its applied usefulness was illustrated by a letter to him from the Director of the U. S. Patent Office. It said that this ruly English had been the basis for the recoding and reorganizing of the U. S. Patent Office when its archaic procedures were modernized into computers with electronic memory and retrieval systems. Although, he said, their special needs had altered Dodd's ruly English beyond its inventor's recognition, yet that regularizing of English had been their explicit starting point.

An example of this regularizing in English is the elimination of all irregular verb conjugations by tense through adopting as standard and exclusive usage the rule to use the auxiliaries “will”, “now", and "did" along with the uninflected verb root for the future, present, and past tenses. Ten such rules of grammar or syntax, if practiced without exception as machines do, were shown: to be enough to make our ordinary English more regular, and therefore more fit for mechanizing, than any of the artificial languages extant.

Thus this item of knowledge and practice (i.e., "regularize any language to fit it for machine translating") has now been so well diffused amongst computer people that they apply it automatically, unconscious of its many and mostly forgotten roots.