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THE UNIVERSITY OF OKLAHOMA
GRADUATE COLLEGE

THE EFFECT OF MESSAGE ENTROPY ON SOURCE CREDIBILITY AND ATTITUDE CHANGE

A DISSERTATION
SUBMITTED TO THE GRADUATE FACULTY
in partial fulfillment of the requirements for the degree of
DOCTOR OF PHILOSOPHY

BY
WILLIAM G. POWERS
Norman, Oklahoma
1973

THE EFFECT OF MESSAGE ENTROPY

ON SOURCE CREDIBILITY AND ATTITUDE CHANGE

A DISSERTATION

APPROVED FOR THE DEPARTMENT OF SPEECH COMMUNICATION

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Introduction

In 1965, Broadhurst and Darnell raised the following questions regarding the fruitfulness of integrating information theory (Shannon and Weaver, 1949) into research concerned with human communication:

> Can we further generalize with the concepts (information theory) herein discussed? . . . Can information theory help to explain human behavior? We think the answers to these questions is a qualified "yes" (p. 452).

They go further to discuss the utilization of information theory as a basis for a comprehensive theory of organization. While this study was not directly concerned with the organization phenomenon, it did attempt to apply the basic tenets of information theory, slightly modified by Darnell (1970), to the operationalization of message entropy. The effect of different levels of message entropy in conjunction with induced source credibility were investigated relative to two traditional dependent variables--perceived source credibility and attitude change. These dependent variables were selected because: (1) both are acknowledged communication variables, (2) both have operationalizations with relatively high levels of reliability and validity, and (3) both have been shown to be susceptible to variations with the message.

While information theory has not gained widespread application to human communication research, this study was,

in part, an answer to the pleas of Miller (1953), Broadhurst and Darnell (1965) and Darnell (1970) for further exploration of these highly mathematical concepts. Little doubt exists that the science of speech communication would benefit from the integration of a substantial theoretical device into its theoretical research efforts. This study attempted to respond to the following research question: Do different entropy levels have an effect on the functioning of messages in the communication event?

This dissertation is structured in a four chapter sequence. Chapter I presents a review of literature relative to entropy and hypotheses relative to the effect of entropy on derived source credibility and attitude change. The procedures and method of analysis are presented in Chapter II. Chapter III indicates the results of statistical analysis and provides a discussion of those results. A summary of this study and suggestions for future research are contained in Chapter IV.

Chapter I

Rationale and Hypotheses

This chapter presents the relevant literature and theoretic positions concerning the application of entropy as an independent variable. The chapter is divided into four parts: (1) general overview of the rationale for the study, (2) entropy applied as a message variable, (3) the relationship of entropy to source credibility and attitude change, and (4) hypotheses.

Rationale

This study attempted to ascertain the effects of message entropy levels in conjunction with induced source credibility levels on perceived source credibility and attitude change.

Source credibility and attitude change are not new concepts to the discipline of speech communication. Research in these areas is abundant and will continue to be so. The relationship between source credibility and attitude change has been well documented (Anderson and Clevenger, 1963; Giffin, 1967; McCroskey, 1969; and Lashbrook, 1971). Message variables and their effect on source credibility and attitude

change have also received considerable attention (Wheeless, 1972; McCroskey, 1967, 1969; McCroskey and Mehrley, 1969).

A relatively new concept to the field of speech communication known as entropy (Darnell, 1970), was used to further the investigation of the potential effects of message variables. Entropy, which at times has been equated with information, is a measure of the information value of a message relative to the uncertainty which existed prior to exposure to that message. Through techniques to be discussed later, the potential information value of a message can be determined in a precise mathematical manner. The concern of this study was not with the traditional meaning of information in terms of statements of knowledge, but rather with the information value relative to uncertainty in a message and its effect on perceived source credibility and attitude change.

The overriding thrust of this study was the investigation of the viability of integrating information theory concepts within the parameters of human communication. Such an investigation should contribute to the theoretic sophistication of our field, particularly to our understanding of the function of messages in the communication event.

Entropy Applied as a Message Variable

Information theory (from which entropy is derived) was introduced by Shannon and Weaver (1949) as a measurement technique. This technique provided a mathematical base from which information could be quantified relative to specific encoders.

Information and entropy have been used interchangeably. The term "entropy" is derived from the fields of thermodynamics (particularly the Second Law) and statistical mechanics. Within these fields, entropy assumed a quantitative nature. Statistical mechanics utilized entropy as an indicator of order (relative to the arrangement of molecules) with disorder involving unpredictability based on a lack of knowledge (Pierce, 1961, pp. 20-22). This resulted in the conceptual relationship between amount of knowledge or information and entropy. Pierce applied this to communication theory with the following explanation:

> In communication theory we consider a message source, such as a writer or a speaker, which may produce on a given occasion any one of many possible messages. The amount of information conveyed by the message increases as the amount of uncertainty as to what message will actually be produced becomes greater. . . . The entropy of communication theory is a measure of this uncertainty and the uncertainty, or entropy, is taken as the measure of the amount of information conveyed by a message from a source (Pierce, 1961, p. 23).

Information then is equated with a degree of uncertainty on the basis that if one knows without doubt what is to follow, the occurrence of that event will provide no information. Entropy, as a measure of information, is a function of the number of alternatives and the probability of occurrence of those alternatives.

Entropy is measured in bits, which reflect the uncertainty of a message in terms of letters, words or messages.

> Bits of information are not the same as pieces, and it can be observed that the bit is an arbitrarily defined unit which serves to quantify the uncertainty

> in predicting, or the information needed to predict, the next symbol to be drawn from a set of symbols (Broadhurst and Darnell, 1965, p. 448).

A bit reflects the amount of information required to halve the alternatives. The computational formula for entropy, as measured in bits, for the case of equiprobable alternatives is as follows:

$$H = \log_2 m$$

where, H = entropy as measured in bits, and
m = number of equiprobable alternatives.

Since m alternatives are equally probable, the probability (p) of any one is equal to $\frac{1}{m}$ and conversely m is equal to $\frac{1}{p}$. Thus the formula is redefined as:

$$H = \log_2 \frac{1}{p}$$

where, p = probability of occurrence of an event.

In the case of unequal probability of alternatives, the formula is redefined as:

$$h_i = \log_2 \frac{1}{p_i}$$

where, h_i = entropy of a particular alternative, and
p_i = probability of occurrence of a particular alternative.

In the case of an altered coin which lands "heads" nine-tenths of the time and "tails" one-tenth, the probability of "heads" equals .90 and "tails" equals .10. According to the above equation, the information or entropy associated with the fall of a "head" will be

$$h_i = \log_2 \frac{1}{.90} = \log_2 1.11 = .15 \text{ bits}$$

and that associated with a "tails" will be

$$h_i = \log_2 \frac{1}{.10} = \log_2 10 = 3.32 \text{ bits.}$$

If one takes the mean of all the h_i values which would be obtained over a long series of tosses, one arrives at a mean value for H, or average information or entropy associated with each toss. However, because .15 bits will occur ninety per cent of the time and 3.32 bits will occur ten per cent of the time, a weighted average formula can now be developed.

$$H = (.90)(.15) + (.10)(3.32) = .47 \text{ bits}$$

For m alternatives, each with its own h and p, the formula for a weighted average may be written as follows:

$$H = p_1h_1 + p_2h_2 \cdot \cdot \cdot + p_ih_i \cdot \cdot \cdot + p_mh_m$$

or $$H = \Sigma - p_i \log_2 p_i$$

This is sometimes termed the absolute entropy. The relative entropy (R) may be obtained through describing H as a proportion of the maximum entropy, i.e., $R + \frac{H}{H_{max}} = \frac{H}{\log_2 m}$.

A complementary quality known as redundancy (C) is calculated by subtracting R from unity, i.e., $C = 1-R$.[1]

Broadhurst and Darnell (1965) provide an excellent example of the application of the H formula to an altered deck of cards:

> Suppose we now take our deck of cards and withdraw four spades and two clubs and add six hearts. Again we are concerned with predicting the suit that will be exposed on the next draw. The probability that the next card will be a heart is approximately .37, a diamond .25, a club .21, and a spade .17. If we insert these values in the formula given above we find:

---

[1] The author is indebted for the preceding explication of formulae to Fred Attneave, 1959.

$$-.37 \log_2 .37 = .5307$$
$$-.25 \log_2 .25 = .5000$$
$$-.21 \log_2 .21 = .4728$$
$$-.17 \log_2 .17 = .4346$$
$$\text{Total} \quad 1.9381$$

> Thus, the four-choice situation with the probabilities .37, .25, .21, and .17 contains approximately 1.94 bits of information, entropy, uncertainty. We could also show by working some more examples that the more disparate the probabilities become the less entropy there is in the system, the less uncertainty there is in predicting the next symbol. If, for example, the probabilities were .75, .10, .08, and .07, only 1.2 bits of information are required to reduce the uncertainty to zero (Broadhurst and Darnell, 1965, pp. 448-449).

The main thrust of research, which has applied information theory to the communication process, has been concerned with non-human communication. Channel capacity, overload, noise, and other factors have received the benefits of information theory in connection with telecommunications engineering (Pierce, 1961). A variety of research has utilized the conceptual framework of information theory--without the mathematics--in studying human communication (Macy, Christie, and Luce, 1953; Bateson, 1966; Schramm, 1955; Owen, 1968).

The majority of research applying information theory mathematics to the human communication process has concerned itself with maximum rates of transmission and the quantity of information which can be conveyed (Attneave, 1959).

A trend has recently developed toward the utilization of the mathematics of selected portions of information theory (specifically entropy) in the investigation of more traditional

communication variables. For example, Darnell (1970) applied the mathematics, with a slight alteration, to the problem of measuring language proficiency. Through a combination of the entropy measure and cloze procedure, a method was devised for testing the English language proficiency of foreign students. This particular combination was termed "clozentropy" (Darnell, 1970). Darnell's major concern was a test of proficiency relative to a group norm. On this basis, he utilized the H score of each blank in a message administered to a particular group as the standard of English proficiency. The singular formula of $\log_2 \frac{1}{p}$ (symbolized as "I") was used to compare a sample of foreign English speaking subjects to the criterion group. The difference score (D) was obtained by finding the difference between the criterion group score (H) and the individual subject's comparative score (I). This resulted in the following formula: $D = H-I$. This procedure was repeated for each blank in a fifty blank passage and D scores were summed for each individual case. When the I-score was the score of an individual within the criterion group, it was termed the abnormality score and when the I-score was from an individual outside the group (who completed the same passage), it was termed a compatibility score. Results indicated that the D score was a reliable and valid measure of English language proficiency.

The cloze procedure Darnell used to collect data was particularly suited to the application of information theory

techniques. Cloze procedure was first developed by Wilson L. Taylor (1953) as a measure of passage difficulty in terms of readability. The cloze procedure consisted of deletion of words either randomly or systematically within a passage of at least 175 words in length. Subjects were asked to complete the passage. Passages were then judged as to readability on the basis of the proportion of correct completions. A correct completion was determined by exact replication of the missing word. Cloze procedure as a tool to measure readability quickly caught on as a research area and was reported in a variety of journals. Research by Taylor (1954, 1956) and Bormuth (1962, 1966) seemed to confirm the use of the cloze procedure as a viable method of determining passage difficulty. Research on cloze procedure was extended to message comprehension. Bormuth indicated:

> Many experts contend that comprehension ability is a set of generalized skills enabling the person to acquire knowledge from materials. Reasoning from this point of view leads to the claim that comprehension ability is best represented by a score obtained by finding the difference between scores on a test administered before and after the passage is read. Comprehension measured in this way will be referred to as knowledge gain (Bormuth, 1967, p. 4).

The value of using the cloze procedure in conjunction with information theory formulae is that the major thrust of both procedures is directed toward a concept of information. Taylor also indicated, "a cloze score appears to be a measure of the aggregate influences of all factors which interact to affect the degree of correspondence between the language

patterns of the transmitter and receivers (Taylor, 1953, p. 432)."

Darnell (1970) did not use the right-wrong proportional scoring method of Taylor, but applied the H formula based on the number of different words used to complete each blank in relation to the number of responses. For example, if twenty subjects responded to the first blank of a message and the distribution of words used was "red"--5 occurrences, "blue"--5 occurrences, "green"--5 occurrences and "yellow"--5 occurrences, the H score for that blank would be computed as follows:

Response	$-p_i \log_2 p_i$	=	$-p_i \log_2 p_i$	=	Bits
red	$-\frac{5}{20} \log_2 \frac{5}{20}$	=	$-.25 \log_2 .25$	=	0.50
blue	$-\frac{5}{20} \log_2 \frac{5}{20}$	=	$-.25 \log_2 .25$	=	0.50
green	$-\frac{5}{20} \log_2 \frac{5}{20}$	=	$-.25 \log_2 .25$	=	0.50
yellow	$-\frac{5}{20} \log_2 \frac{5}{20}$	=	$-.25 \log_2 .25$	=	0.50
					2.00

$H = \Sigma -p_i \log_2 p_i \therefore H = 2.00$ for blank 1

He also was concerned with the independence of each blank and therefore chose to delete every tenth word.

Boyd (1971) investigated language compatibility as a predictor of occupational success. Language compatibility was measured through the clozentropy technique of Darnell (1970). Significant results were not reported. However, the reliability of the clozentropy measure was supported.

The Relationship of Entropy to Source Credibility and Attitude Change

The amount of research concerned with the antecedent and consequent conditions of source credibility and attitude change is enormous. However, little research has been conducted utilizing an entropy measure in connection with these variables. That research which has been conducted has not been published in major journals.

D'Angelo (1971) explored the viability of using an entropy measure of attitudinal compatibility. Major hypotheses dealt with the relationship of attitudinal compatibility to success and level of attraction within social fraternities. Only partial confirmation of hypotheses was reported; however, D'Angelo contends:

> One important implication for future research was that with appropriate designs, the future looks bright for entropy analysis in studies including attitudinal compatibility as a variable (1971, p. 1108-A).

The D'Angelo study is an instance where the entropy measure was introduced to the broad area of attitude research. Results do not have a direct bearing on this study other than the indication of the value of the clozentropy technique as a measure of language behavior and its impact on the broad variable of attitude.

Babich (1971) was concerned with a subject's Perceived Information Level (PIL) of persuasive messages, hypothesizing a curvilinear relationship to attitude change. PIL was operationally defined through a combination of Taylor's right-wrong

technique and Darnell's clozentropy technique. Following completion of a 54 blank clozed message, H scores were computed for each blank. The PIL score for each subject was computed by awarding the appropriate H score on each blank in which the subject's response matched that which had been deleted. A zero score was given to all non-matches. H scores across blanks were summed for each subject. Attitude change was operationally defined through a modification of the technique used by Sherif, Sherif, and Nebergall (1965). The main hypothesis of a curvilinear relationship between PIL and attitude change was not found to be significant. Topic relevancy, evidence and source credibility were tested as antecedent conditions of PIL. Significant differences were observed between relevant and irrelevant message conditions and between evidence and no-evidence message conditions relative to PIL scores. The credibility manipulation resulted in no significant difference. Although this study was concerned with the general problem area to be investigated by the present study, the Babich study was concerned with information level as a function of the perception of the individual and not as an inherent phenomena of the message itself.

Adrian (1967) investigated the relationship between language usage congruency and perceived ethos. The degree to which the source's language usage was congruent with the

audience language usage was related to the perceived credibility of the source. The clozentropy technique of Darnell (1967) was used as the operational definition of language usage congruency. Significant results were not found. From this one may conclude that credibility is not dependent upon the similarity of language usage between the speaker and the audience. A significant relationship ($p < 0.0001$) was reported between source/audience language congruency scores and intelligence. However, the result was in response to the utilization of a null hypothesis as a research hypothesis. A variety of methodological difficulties which depreciate the value of the research is apparent.

Hypotheses

Communication scholars generally agree that credibility is a function of three phases of the communication process: (1) prior knowledge of the source, (2) message form and content, and (3) delivery. The present study attempted to control and manipulate these phases to ascertain the effect of message entropy on source credibility. In a similar manner, source credibility, message form, content, and delivery were controlled and manipulated to ascertain the effect of message entropy on attitudes. Due to the lack of previous research with message entropy and the resulting lack of knowledge as to its antecedent and consequent conditions, hypotheses relative to message entropy were intuitively based. It appeared that different levels of source credibility would

produce levels of expectations regarding messages. These expectations of messages may be measured by entropy. When inconsistency developed due to violated expectations, it seemed reasonable to anticipate an effort to resolve that inconsistency. Hypotheses generated on this basis were as follows:

H_1: A significant difference will be observed on the source credibility variable between the high entropy message, low credible source condition and the low entropy message, low credible source condition.*

H_2: A significant difference will be observed on the source credibility variable between the high entropy message, high credible source condition and the low entropy message, high credible source condition.*

H_3: A significant difference will be observed on the source credibility variable between the high entropy message, no source condition and the low entropy message, no source condition.*

H_4: A significant difference will be observed on the attitude variable between the high entropy message, low credible source condition and the low entropy message, low credible source condition.

H_5: A significant difference will be observed on the attitude variable between the high entropy message, high credible

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*Hypotheses with source credibility as the dependent variables should be understood to consist of individual hypotheses for each of the five dimensions of source credibility.

source condition and the low entropy message, high credible source condition.

H_6: A significant difference will be observed on the attitude variable between the high entropy message, no source condition and the low entropy message, no source condition.

The following chapter will present the method of analysis used in systematically testing these hypotheses.

Chapter II

Method of Analysis

Chapter I developed a rationale for the manipulation of initial source credibility and message entropy as antecedent conditions to derived source credibility and attitude change. Hypotheses were presented. This chapter indicates the procedures, variables, and data analysis techniques used in systematically testing those hypotheses.

Procedures

This section consists of an explication of the required pre-testing techniques, the subjects of the experiment and the population to which the study is generalizable.

Samples used in this study were drawn from students enrolled in the Fundamentals of Speech Communication course at the University of Oklahoma, Spring, 1973. Generalizability is limited to this population.

Pre-Testing Procedures

Pre-tests were required for discriminating purposes in three facets of this study: (1) topic selection, (2) high versus low credibility, and (3) high versus low entropy.

A randomly selected section of the basic course in speech communication at the University of Oklahoma was

used for topic selection and high and low source credibility selection. Six topics were presented (see Appendix A). The topic which elicited attitude scores which most nearly represented a normal distribution was selected. In addition, six public figures were presented (see Appendix A). Two were selected following the procedure discussed in the section on variables in this Chapter.

Forty-four students from two sections of the Basic Fundamentals of Speech course were assigned the task of composing a favorable speech of approximately 600 words over the selected topic. This was accomplished as a normal class assignment. Only those speeches falling within a range of 525 to 725 words were accepted. Six speeches were randomly selected from the thirty-six acceptable speeches and clozed in a systematic manner, i.e., the first word to be deleted was the twenty-fifth word of the message followed by the deletion of every tenth word until a total of fifty deletions had been reached.[2] The six clozed speeches were randomly presented to 120 subjects in eight randomly selected sections of the Basic Course in Speech Communication at the University of Oklahoma. Entropy scores were computed for each blank of every message. Entropy was then summed across each message. The messages with the highest and the lowest total score were selected to represent high and low message entropy respectively.

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[2]The deletion of every tenth word follows the procedure used by Darnell, 1970.

Variables

This study employed the manipulation of two independent variables (message entropy and source credibility) to ascertain their effect on two dependent variables (source credibility and attitude). The operational definitions of the independent and dependent variables constitute the remainder of this section.

Independent Variables

High message entropy: The highest total entropy score across a fifty blank clozed speech derived from six randomly selected speeches (see Appendix D).

Low message entropy: The lowest total entropy score across a fifty blank clozed speech derived from six randomly selected speeches (see Appendix E).

High source credibility: The source introduction scoring in the 16-21 range (Wheeless, 1972) on the most dimensions of the McCroskey, et al. (1972), Public Figure Credibility Scale was used to classify high source credibility. Three items, as suggested by McCroskey, were used on each of five dimensions (see Appendix F).

Low source credibility: The source introduction scoring in the 3-8 range (Wheeless, 1972) on the most dimensions of the McCroskey, et al. (1972), Public Figure Credibility Scale was used to classify low source credibility.

No source credibility: No credibility introduction was supplied.

Dependent Variables

Source credibility: The McCroskey, Jensen, and Todd (1972) Public Figure Credibility Scale was used to measure source credibility (see Appendix F). Each of the five dimensions was analyzed separately.

Attitude: The evaluative dimension of Osgood, Suci, and Tannenbaum (1957), as modified by McCroskey, Young, and Scott (1972),[3] was used as the indicator of attitude (see Appendix G).

Data Analysis

A 2x3 after-only simple randomized experimental design was selected. Four sections of the Basic Course in Speech Communication were randomly selected. Ten subjects were randomly assigned to each condition (N_t=60). Each subject received a packet consisting of the following: (1) introduction and instructions (see Appendix B), (2) credibility induction (see Appendix C), (3) message (see either Appendix D or Appendix E), (4) source credibility scales (see Appendix F), and (5) attitude scales (see Appendix G).

This chapter has presented the procedures, variables, and data analysis techniques that were used in testing the hypotheses presented in Chapter I. The following chapter will present the results of the analysis.

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[3]McCroskey, Scott, and Young (1972) indicate this instrument was initially reported by McCroskey (1966).

CHAPTER III

Results and Discussion

This chapter reports the results of the experimental manipulation described in Chapter II. This chapter is divided into two major sections: (1) a report of the statistical analysis of data gathered under the conditions set forth in Chapter II, and (2) a discussion of those results relative to the research question of this investigation.

Results

This section indicates the results of statistical analysis of the data gathered as previously stated. Two major divisions are of concern: (1) pretesting analysis and (2) hypotheses analysis.

Pretesting Analysis

Three major areas of pretesting required analysis: (1) topic selection, (2) message entropy, and (3) source credibility.

Six topics were selected for pretesting as indicated in Chapter II. The concern of this analysis was to select the

topic most representative of a normal distribution. Appendix H includes frequency distributions of subject attitudes toward each topic. Following inspection of these distributions, the topic selected as most representative of a normal distribution of attitude was "Local School Boards should continue to have primary control over public elementary and secondary schools".

Entropy analysis of six randomly selected messages consisted of selecting the messages with the highest and lowest total entropy score. Table I indicates the total entropy scores and respective mean entropy score for each message.

Table I
Total and Mean Entropy Scores

Message	Total Entropy Score	Deletion N	Mean Entropy Score
1	94.3261	50	1.8865
2	85.8191	50	1.7164
3	83.6787	50	1.6736
4	81.9754	50	1.6395
5	77.9226	50	1.5585
6	75.9475	50	1.5189

On the basis of this analysis, Message One and Message Six were selected to represent the high and low message entropy conditions respectively. The text of these messages are found in Appendices D and E.

Credibility pretesting consisted of testing six Oklahoma public figures as indicated in Chapter II. On the basis of the operational definition established in Chapter II, Bud Wilkinson was selected as the high credible source and

Curtis Harris as the low credible source. Table II indicates the credibility results for each source.

Table II

Results of Credibility Pretest

Source	No. Dimensions 3-8 Range	No. Dimensions 9-15 Range	No. Dimensions 16-21 Range
Bud Wilkinson	3	45	47
Fred Harris	10	49	36
Ed Edmondson	2	57	36
Paul Sharp	3	60	32
David Hall	15	53	27
Curtis Harris	21	55	19

Hypothesis Testing

As a prerequisite to individual hypothesis testing, a series of six 2x3 Analyses of Variance[4] were conducted over the five dimensions of source credibility and attitude scores. The error term derived from these Analyses of Variance was utilized in the appropriate testing of hypotheses where the t-test statistic was required. The .05 level of significance was established. Since source credibility (the dependent variable in the first three hypotheses) was measured on five

[4]A main effect for the entropy condition was found on the composure dimension ($F=8.953$, $p=0.0044$, $df=1,59$). In addition a main effect for the entropy condition was found on the extroversion dimension ($F=12.125$, $p=0.0013$, $df=1,59$). No significant interaction effect was found. The results of these analyses are found in Appendix I.

dimensions, each of the first three hypotheses consists of five sub-hypotheses.

H_1: A significant difference will be observed on the source credibility variable between the high entropy message, low credible source condition and the low entropy message, low credible source condition.

This hypothesis was tested through analysis of each of the five dimensions comprising source credibility. Table III indicates the t values and mean scores on each dimension.

Table III

Mean Scores and t Values of H_1 Dimensions

Dimension	Hi Mess.Ent.Mean	Low Mess.Ent.Mean	t Value
Competence	11.8	12.1	0.1716
Character	11.8	12.9	0.723
Composure	12.1	7.8	2.1958*
Extroversion	15.2	18.5	2.7642*
Sociability	10.1	10.7	0.4293

* $p < .05$ ($t=2.101$, $df=18$)

On the basis of these results, the null hypotheses relative to competence, character, and sociability dimensions could not be rejected. Significant differences were indicated on the composure and extroversion dimensions, permitting rejections of the null hypotheses.

H_2: A significant difference will be observed on the source credibility variable between the high entropy message, high credible source condition and the low entropy message, high credible source condition.

This hypothesis was also tested through analysis of each of the five dimensions of source credibility. Table IV

indicates the results of that analysis. The null hypotheses relative to competence, character, composure, extroversion, and sociability dimensions could not be rejected.

Table IV
Mean Scores and t Values for H_2 Dimensions

Dimension	Hi Mes.Ent.Mean	Low Mes.Ent.Mean	t Value
Competence	14.2	15.3	0.6294
Character	15.9	15.9	0.0000
Composure	14.7	13.1	0.7931
Extroversion	16.0	17.7	1.424
Sociability	14.4	14.6	0.1431

* $p < .05$ ($t=2.101$, $df=18$)

H_3: A significant difference will be observed on the source credibility variable between the high entropy message, no source condition and the low entropy message, no source condition.

Again, this hypothesis was tested through analysis of each dimension of source credibility. Table V indicates the results of those analyses.

On the basis of these results, the null hypotheses could not be rejected relative to the competence, character, extroversion, and sociability dimensions. However, the null hypothesis was rejected relative to the composure dimension.

H_4: A significant difference will be observed on the attitude variable between the high entropy message, low credible source condition and the low entropy message, low credible source condition.

The t value obtained for H_4 ($t=0.1223$, High Message Entropy Mean=29.4, Low Message Entropy Mean=29.9) was not

significant ($p < .05$, $t=2.101$, $df=18$). On this basis the null hypothesis could not be rejected.

Table V

Mean Scores and t Values for H_3 Dimensions

Dimensions	Hi Mess.Ent.Mean	Low Mess.Ent.Mean	t Value
Competence	13.1	10.8	1.3160
Character	14.1	13.4	0.460
Composure	13.3	8.9	2.1810*
Extroversion	14.3	16.5	1.8428
Sociability	12.8	11.0	1.2879

* $p < .05$ ($t=2.101$, $df=18$)

H_5: A significant difference will be observed on the attitude variable between the high entropy message, high credible source condition and the low entropy message, high credible source condition.

The t value obtained for H_5 ($t=0.7341$, High Message Entropy Mean=30.3, Low Message Entropy Mean=33.3) resulted in non-significant findings ($p < .05$, $t=2.101$, $df=18$). On this basis, the null hypothesis could not be rejected.

H_6: A significant difference will be observed on the attitude variable between the high entropy message, no source condition and the low entropy message, no source condition.

The t value obtained for H_6 ($t=1.6150$, High Message Entropy Mean=26.9, Low Message Entropy Mean=33.5) was not significant ($p < .05$, $t=2.101$, $df=18$). Therefore, the null hypothesis could not be rejected.

Discussion

Three of eighteen hypotheses were confirmed. Considering the exploratory nature of this study, those results provide support for the continued exploration of message entropy as a message variable.

Significant findings occurred in the composure and extroversion dimensions of source credibility when a low credible or no credible source was used. A high entropy message appears to increase composure ratings and decrease extroversion ratings when contrasted with a low entropy message. The direction of this effect was consistent, though not statistically significant, throughout the study. This resulted in a counterbalancing effect toward an overall credibility rating. The dimensions of the credibility scale are slightly confusing. Traditionally, the high credible source is assumed to have high ratings on all dimensions. However, composure and extroversion (the names arbitrarily assigned to two dimensions of credibility) do not appear to be complementary qualities. While some extroverts may be perceived as composed, relatively few composed individuals would appear to be extroverts. This point of view would indicate that entropy does not have inconsistent effects, but indeed is producing an effect which draws the underlying qualities of composure and extroversion into a common focus. When drawing the relationship between composure and extroversion, the assumption that verbal quality is an integral

part of composure and verbal quantity an integral part of extroversion is prima facie realistic. While verbal quality and quantity are not mutually exclusive categories, nor could they be placed at opposite ends of a continuum, the general connotation of "quality versus quantity" may be operative through entropy analysis.

When viewing message entropy as a measure of the potential uncertainty on the part of an audience and ultimately the information provided to the audience by the occurrence of an event, i.e., a word, it is not surprising that high entropy messages produce ratings indicating high verbal quality. The resolution of high uncertainty may be considered as an essential portion of a sequence and thereby rewarded with a high quality rating. In other words, when high potential uncertainty is reduced, verbal quality is perceived as high. In addition, when low potential uncertainty (one knows what is to follow before the occurrence of that event) is reduced, verbal quantity is perceived as high. In the latter case, little information is gained; therefore, the occurrence of that event may be perceived as unnecessary.

It should be stressed that "composure" and "extroversion" are simply names assigned to factors of credibility. It is entirely possible that the particular factors which received these names are actually measuring some other aspect of credibility. If this were the case the preceding discussion could be totally, or in part, erroneous. Additional research is

required to verify this interpretation. Regardless, in responding to the research question which generated this study, message entropy did have a significant effect on two dimensions of source credibility.

The significant findings indicated above did not occur in the high credibility condition. This, in addition to the remaining non significant hypotheses, may have been, in part, due to methodological inadequacies. The methodological area which stands out as having the most potential for contribution to Type II error is that of message selection. The manner of selecting messages to be submitted to entropy analysis may have reduced the potential for a meaningful difference in entropy levels. The population from which the random sample was selected may have been confined by such demographic variables as education or intelligence. Utilization of this population may have limited the range of message entropy scores. Future research should certainly concern itself with this issue. Also, a concern should be indicated for the entropy analysis method, particularly the systematic deletion of words. A question remains as to whether the method yields a message entropy value representative of the true entropy value.

Regarding the nonsignificant findings in the high credibility condition, an overriding effect of high credibility may have occurred. The credibility of the source,

when high, may have been so strong a factor that the effect of message entropy levels was washed out. This may have contributed, in part, to the lack of significant attitude differences. Such interpretations have been applied to the relation between credibility and opinionated statements (Miller and Baseheart, 1969).

Despite the above-mentioned questioning of methodology, it is difficult to envision the impact of message entropy levels on such variables as character and competence dimensions of source credibility, particularly to the point of overriding established credibility levels of public figures. However, with the information garnered from the composure and extroversion variables, and the evident relationship between composure and extroversion and sociability, it was slightly disappointing that no effect was observed on the sociability dimension.

The rationale by which hypotheses were generated was based on the assumption that different levels of initial source credibility produced expectations of different message entropy levels. When expectations were violated, a strain toward consistency was suggested. This study was not designed to specifically test that rationale. On the basis of obtained results, no evidence as to the viability of that rationale can be offered.

Summary

This chapter has presented and discussed the results of the statistical procedures used to test the hypotheses of this study. In response to the research question which precipitated this study, it can be said that message entropy level does have a significant effect upon subject perception of the composure and extroversion dimensions of source credibility. In the next chapter, we will summarize the study, and itemize a research procedure based on the findings of this study.

Chapter IV

Summary and Suggestions for Future Research

This chapter presents a summary of the study described in this report. In addition, suggestions are offered for future research based on the results of this study.

Summary

The purpose of this study was to investigate the effects of different message entropy levels on perceived source credibility and attitude change. High and low entropy within messages was measured through a clozentropy technique (Darnell, 1970). The messages with the highest and lowest total entropy scores were presented to subjects under the conditions of no initial source credibility, low initial source credibility and high initial source credibility. Hypotheses were constructed to predict differing effects on perceived source credibility and attitude change as a function of the message entropy level.

Significant results were found in the composure and extroversion dimensions of source credibility. The high entropy message produced significantly higher ratings of composure than the low entropy message, within both the low and no initial credibility conditions. The low entropy

message produced significantly higher ratings of extroversion than the high entropy message within the low credibility condition.

The apparent contradictory effect of entropy levels was explained relative to an underlying assumption of the two dimensions. High entropy messages, reflecting a high level of uncertainty, may have resulted in a perception of the source as a deliberate individual who was careful and concise in the selection of words and the structure of those words. Low entropy messages, reflective of little uncertainty, may have resulted in a perception of the source as an excessive talker. In this study subjects may have dichotomized verbal quantity and verbal quality relative to low and high entropy respectively.

It was concluded that differing message entropy levels may be a significant message variable having an effect upon the receiver's perception of the source.

Suggestions for Future Research

The suggestions which follow are made in light of gathering information relative to the effect of entropy levels on the functioning of messages in the communication event. The procedures which verify and expand the findings reported in this study should be indicative of a logical sequential search for information relative to the structure and nature of the message entropy variable, and the antecedent and consequent conditions of that variable.

Prior to examination of the consequent or antecedent conditions, investigation of the structure and nature of message entropy should occur. Technical aspects of the deletion process need to be brought under scrutiny. For example, does the "tenth word" deletion process provide data representative of total message entropy? Successive deletion procedures which ultimately result in the deletion of all words could be used in response to this question. Research describing the distribution of entropy scores within and across messages, relative to levels of message entropy, should be conducted. The delineation of levels of message entropy in some way other than relative to one another would be a substantial contribution.

Specification of the relationship between perceived message entropy and other acknowledged variables such as comprehension, readability, organization and structure may provide indices as to the nature of message entropy. The decoder's perception of entropy should be investigated relative to questions concerning an audience-specific parameter. In other words, do different audiences perceive different levels of entropy? If so, does a relationship exist between the decoder's perceived entropy and demographic or psychological variables? In a similar vein, descriptions of the encoder aspect of message entropy levels may be examined relative to organismic variables. For instance, do individuals with certain levels

of education or of certain ages compose messages of consistent entropy levels? Do high and low dogmatic individuals compose messages of different yet consistent entropy levels? Is sex a factor in message entropy production? These areas of investigation should lend credence to the selection of control variables when examining the cause-effect relationships of message entropy levels.

In addition, research should be concerned with the verbal aspect of the communication process in light of verbal deletion procedures and the relationship between written message entropy and oral message entropy.

Once the nature and structure of the message entropy variable have been ascertained, undertaking investigation of the effects and causes of message entropy may proceed with more clarity and insight than was available in this study.

Further substantiation and exploration of the effects described in this study are essential. Replication utilizing both oral and written messages is preferable. Particular attention should be paid to the operationalization of the dependent variables. Due to the subjective nature of titling the dimensions of source credibility, utilization of tests designed specifically for such variables as composure, extroversion and sociability may be desirable.

Manipulation of message entropy levels should be conducted to determine their effect on other dependent variables such as anxiety, motivation, attitude and overt behavior.

The variables upon which message entropy may have an effect will be largely determined by the results of research dealing with the structure and nature of message entropy.

When investigating the causes of message entropy levels, such variables as stress, reward and punishment are suggested. The scope of antecedent conditions should initially be limited only by the results of studying the nature and effect of message entropy and by logical extrapolation of prior research concerned with related variables.

Research should also be concerned with the joint effect of message entropy and selected affective variables. A partial list of affective variables would include inoculation, source credibility, compliance and motivation. The research strategy indicated above should provide a basis for selecting additional affective variables. A specification of control variables should also emerge from research on the structure and nature of message entropy levels.

The thrust of these suggestions for future research has emphasized the investigation of the structure and nature of the message entropy variable prior to investigation of its cause-effect relationships. Once descriptive data relative to the structure, creation, and perception of message entropy has been collected, the cause-effect sequence of research can be determined with a solid base for specification. The general nature of suggestions for research in the antecedent and

consequent areas was necessary due to the relative unknown qualities of the message entropy variable.

While this study has confined itself to a message entropy variable, conceptual and experimental applications of the remaining concepts of information theory to the process of human communication are encouraged. The implication between information theory concepts and human communication suggested by Darnell and Broadhurst (1965) has been partially supported by this study. Future research holds the answer as to the significance of that implication.

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APPENDICES

APPENDIX A

Topics for Pretesting

1. Local school boards should continue to have primary control over public elementary and secondary schools.
2. Individuals who chose not to answer the draft during the Vietnam War should be granted amnesty.
3. The Federal Government should establish mandatory birth control laws.
4. The United States should isolate itself from Indo-China affairs.
5. The all volunteer army will provide an adequate defense of the United States.
6. Students should have control over curriculum.

Sources for Pretesting

1. Bud Wilkinson
2. Fred Harris
3. Ed Edmondson
4. Paul Sharp
5. David Hall
6. Curtis Harris

APPENDIX B

University of Oklahoma
Speech Communication Research Laboratory
Norman, Oklahoma

Do Not Write
In This Space

Subj. No. _____

Group No. _____

Project No. _____

Test 1 _____

2 _____

3 _____

4 _____

5 _____

6 _____

The University of Oklahoma's Speech Communication Research Laboratory is conducting an exploratory study on characteristics of communication related phenomena. This booklet contains a message and two short blocks of questions. You are requested to read the message carefully and then proceed to respond to the questionnaire.

Please remember there are no right or wrong answers. You are asked to give your frank and honest opinion at this time. The University administration is not sponsoring this survey, and neither the administration, the instructor, nor anyone not associated with the research laboratory will have the usage of this information. At a later date, a University of Oklahoma research staff member will return to answer any questions you might have about the project.

Please do not open this booklet until you have received appropriate instructions from the project leader. Thank you for your cooperation.

APPENDIX C

On the following pages is a speech delivered by _____ on _____, 1973.

Please read the speech carefully and then proceed to the two short questionnaires.

APPENDIX D

High Entropy Message

In this country the present public educational system is made up of many school systems that are organized and governed on a local basis. The groups that govern these local public school systems are the local school boards. These school boards have control over the public elementary and secondary schools in their particular area. They control most everything related to those schools. School systems need local control and the local school boards provide governing systems. The local school boards should continue to have primary control over the public elementary and secondary schools.

The control the local school boards have over the local school systems is well deserved because the members on these school boards are elected by the general public in elections held on a local basis. This shows that the members are representative of the people in the communities which include, of course, the taxpayers and parents. Since the members of these local school boards are elected they deserve the power and control their positions give them.

The local school board is representative of its community and therefore is qualified to control the curriculum in its public elementary and secondary schools. A good control is needed over the curriculum to keep the subjects

that are available well proportioned and the local school board provides that control. The school board controls the quality of the books that are used. This is very important since some books can be potentially dangerous to young students' minds. Also the control that the school board has over the extra-curricular activities is needed so the activities will be good for the students and not take up too much of the student's time. The school boards should continue to have this control over the curriculum since the control is representative of the parents' wishes.

The school board also has control over the appropriating of the money to the schools which is very important to the schools' overall success. The money should be appropriated to the sections of the schools that are most deserving and this is determined by the school board. The school board also determines the wages of the teachers. This has much effect upon the quality of the teachers that can be acquired. Since the appropriating of the taxpayer's money is so important to the school system, the people most qualified to do this job are the members of the local school board who are representative of the taxpayers in the community.

Even though the job of appropriating money is important, the job of keeping the quality of the teaching faculty high is a more important task for the school board. It is the school board's job to give the final decision as to the hiring and firing of the faculty and appropriately so. Since the school

board is representative of the community it is well qualified to determine what the standards of the faculty should be. Without this representative control the schools would be in danger of a specific person or group of persons in the school system gaining the power to control the school and the students, thus resulting in fulfilling a small minority's wishes and not the community's wishes as a whole.

The control the local school boards have over the public elementary and secondary schools is very important in determining the success of these schools. The success of these schools is not only determined by the school board's control of curriculum and appropriation of money, but also by their control of things that directly affect the students' feelings toward the schools such as dress codes and disciplinary measures. The local school boards control many, many facets of the public elementary and secondary schools and being representative of the local communities should continue to do so.

APPENDIX E

Low Entropy Message

Should local school boards continue to have primary control over public, elementary, and secondary schools? I say yes, now, tomorrow, and forever.

From the very beginning in the United States, each community or group of communities organized and managed it's own schools. These schools were usually under the supervision of a board of education. So this thing is not just popping up as of late. Even though it has received one hell of a lot of rebuke as of late.

Most of these people that are rebuking it say that federal or at least state control would improve its quality. I feel that you must be a fool to give the federal government any more power than it has now. They are so inefficient now let's not overburden them anymore. How about state control then? Most state politicians are home town stars that ran for office and were elected because they ran forty touchdowns in high school. They are only glory seekers as back in high school, not a responsible legislator that you should trust with your child's education from the first grade through high school.

I know the feeling all you football fans are reeling with. "We elect school board members just like we elect state

and federal office holders." This is just not true. I don't care how liberal you are when you dress, talk, and vote in normal elections when you vote for a school board member he must be a conservative. Picture this, a suspected drug pusher or an alcoholic is running in a school board election. His opponent is a Jesus Freak. The alcoholic is an exsuperstar from the high school. The town is not too cool on God and the election is held. I am willing to bet large sums that the "Jesus Freak" won hands down. Not because he was a "Freak" but because he was a conservative.

Now to deal with other main problems that would face us without a local school board. Let me do this by making this statement. In most states, the local school board has considerable independence in employing and paying teachers, in providing buildings, and as of late, in giving protection to students when needed.

Let me explain this to you by an example. Suppose that we would not have had a local school board when we had racial trouble at the Olkahoma City public school. First, we, the local people would have to understand the problem to some extent in order to capsule it down to tell our state or federal school board. Then the state or federal school board must act on it, send out a group to evaluate the problem. The group reports back and then the board applies for fundings to find and impose a plan to solve the problem. This could take from six months to six years and the problem still

exists or the school closes down and your child fails hopelessly behind other children of his age.

I plead with you, don't subject your and my children to this sort of experience. Support your local officials and vote in leaders that can keep our dreams alive. Please don't vote for puppets that have cruel foolish leaders to sway their votes. If you want the next generation to excell as your and my generation has, then they too must have a local school board to guide them along.

APPENDIX F

INSTRUCTIONS FOR COMPLETING SCALES

On the following pages are several "semantic differentials" which is a type of attitude scale. You are asked to evaluate each concept in terms of the bipolar adjectives below the concept. For example, if you were to evaluate the concept, "President Nixon" in terms of his attractiveness, and you think he is very attractive, you would mark an X as below:

PRESIDENT NIXON

BEAUTIFUL : X : ___ : ___ : ___ : ___ : ___ : ___ : UGLY

If you feel that he is quite unattractive, of course, your X would be placed near the "Ugly" pole.

The middle space should be considered "Neutral". Check this space if you feel that neither adjective applies to the concept, or if you feel that both adjectives apply equally to the concept.

Inexpert	: ___ : ___ : ___ : ___ : ___ : ___ : ___ :	Expert
Competent	: ___ : ___ : ___ : ___ : ___ : ___ : ___ :	Incompetent
Undependable	: ___ : ___ : ___ : ___ : ___ : ___ : ___ :	Dependable
Dishonest	: ___ : ___ : ___ : ___ : ___ : ___ : ___ :	Honest
Nice	: ___ : ___ : ___ : ___ : ___ : ___ : ___ :	Awful
Just	: ___ : ___ : ___ : ___ : ___ : ___ : ___ :	Unjust
Anxious	: ___ : ___ : ___ : ___ : ___ : ___ : ___ :	Calm
Nervous	: ___ : ___ : ___ : ___ : ___ : ___ : ___ :	Poised
Relaxed	: ___ : ___ : ___ : ___ : ___ : ___ : ___ :	Tense
Silent	: ___ : ___ : ___ : ___ : ___ : ___ : ___ :	Talkative
Extroverted	: ___ : ___ : ___ : ___ : ___ : ___ : ___ :	Introverted
Verbal	: ___ : ___ : ___ : ___ : ___ : ___ : ___ :	Quiet
Unattractive	: ___ : ___ : ___ : ___ : ___ : ___ : ___ :	Attractive
Good-Natured	: ___ : ___ : ___ : ___ : ___ : ___ : ___ :	Irritable
Cheerful	: ___ : ___ : ___ : ___ : ___ : ___ : ___ :	Gloomy

APPENDIX G

INSTRUCTIONS FOR COMPLETING SCALES

On this and the following pages are several "semantic differentials" which is a type of attitude scale. You are asked to evaluate each concept in terms of the bipolar adjectives below the concept. For example, if you were to evaluate the concept, "President Nixon" in terms of his attractiveness, and you think he is very attractive, you would mark an X as below:

PRESIDENT NIXON

BEAUTIFUL :_X_:___:___:___:___:___:___: UGLY

If you feel that he is quite unattractive, of course, your X would be placed near the "Ugly" pole.

The middle space should be considered "Neutral". Check this space if you feel that neither adjective applies to the concept, or if you feel that both adjectives apply equally to the concept. Take your time and be sure to consider each set of adjectives separately.

Right :___:___:___:___:___:___:___: Wrong

Negative :___:___:___:___:___:___:___: Positive

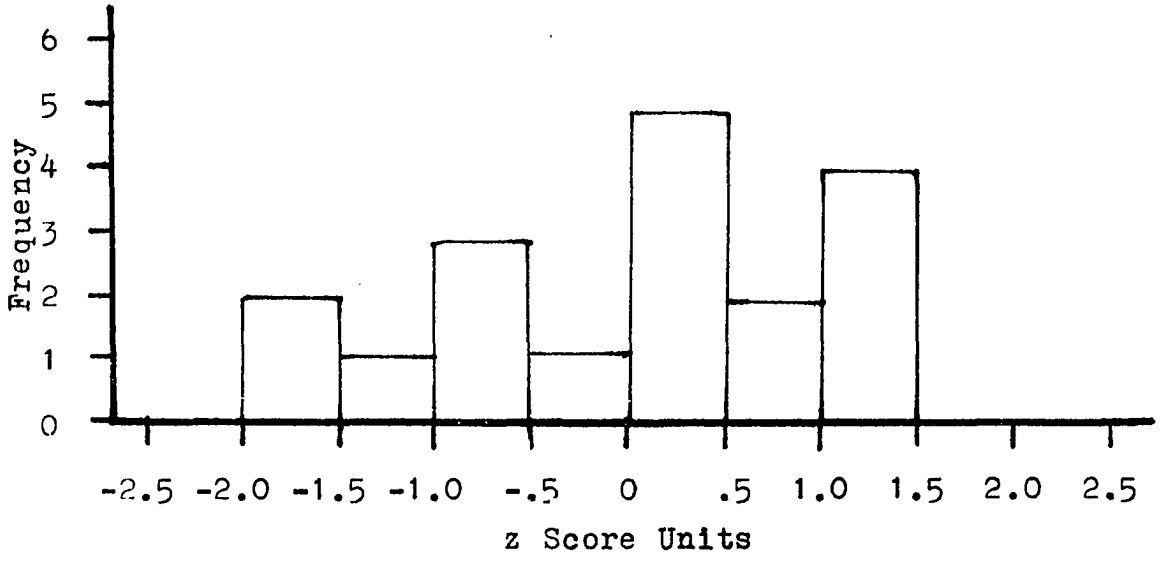
Foolish :___:___:___:___:___:___:___: Wise

Beneficial :___:___:___:___:___:___:___: Harmful

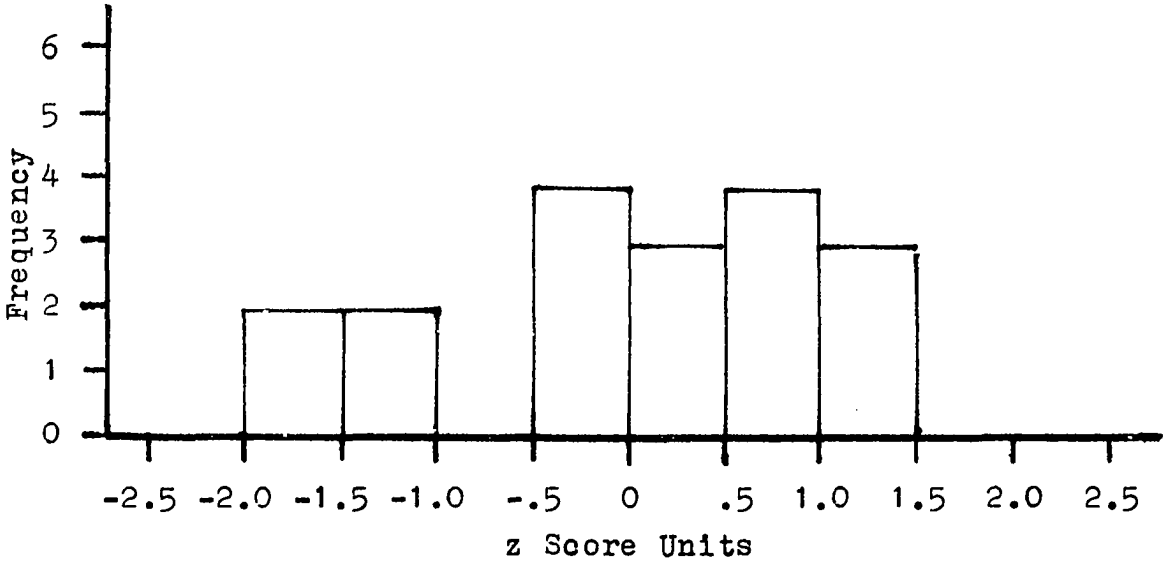
Good :___:___:___:___:___:___:___: Bad

Unfair :___:___:___:___:___:___:___: Fair

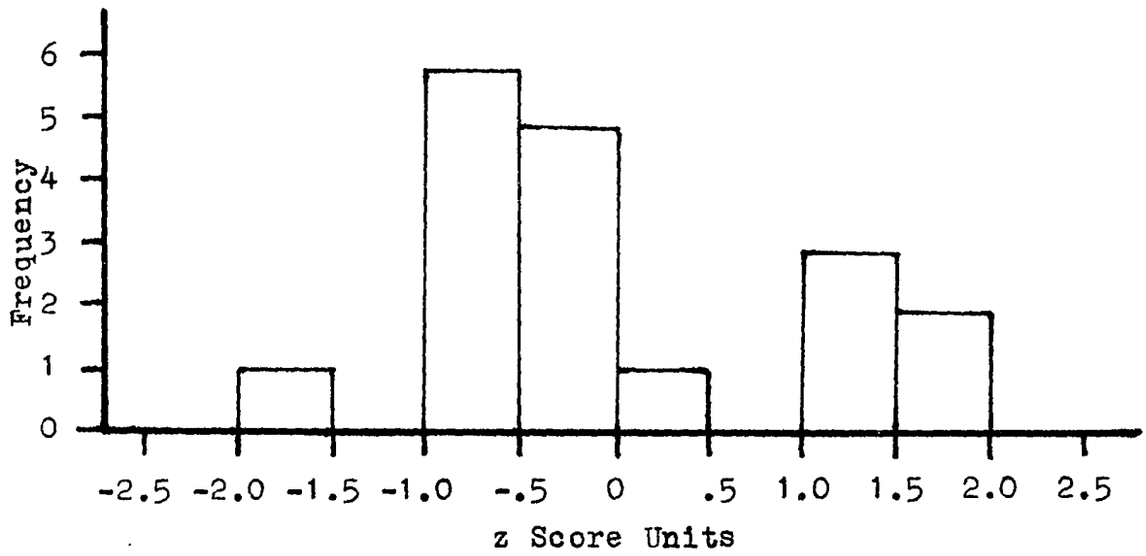
APPENDIX H



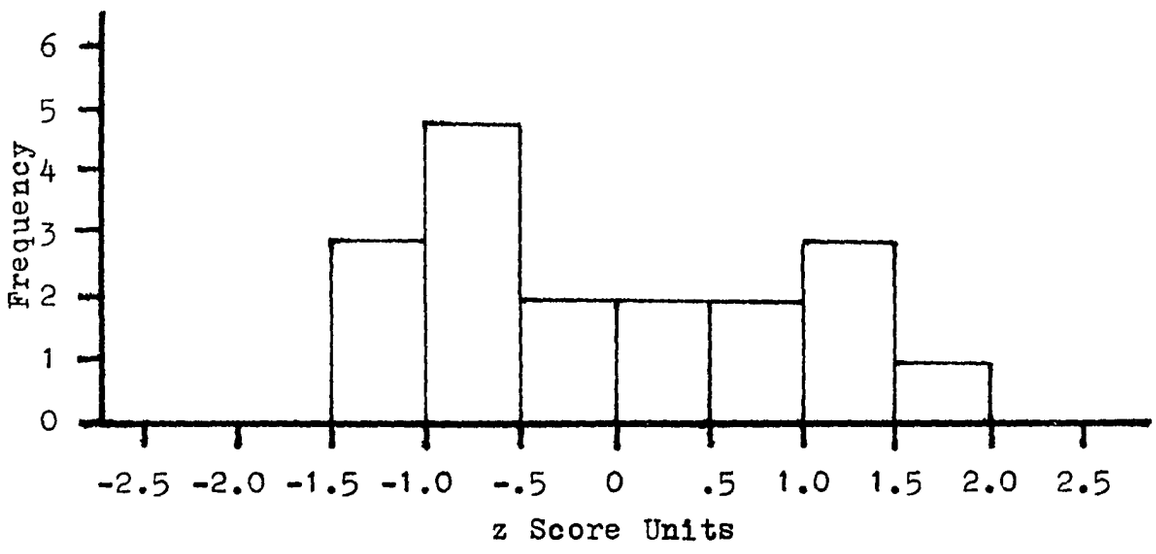
Students should have control over curriculum.



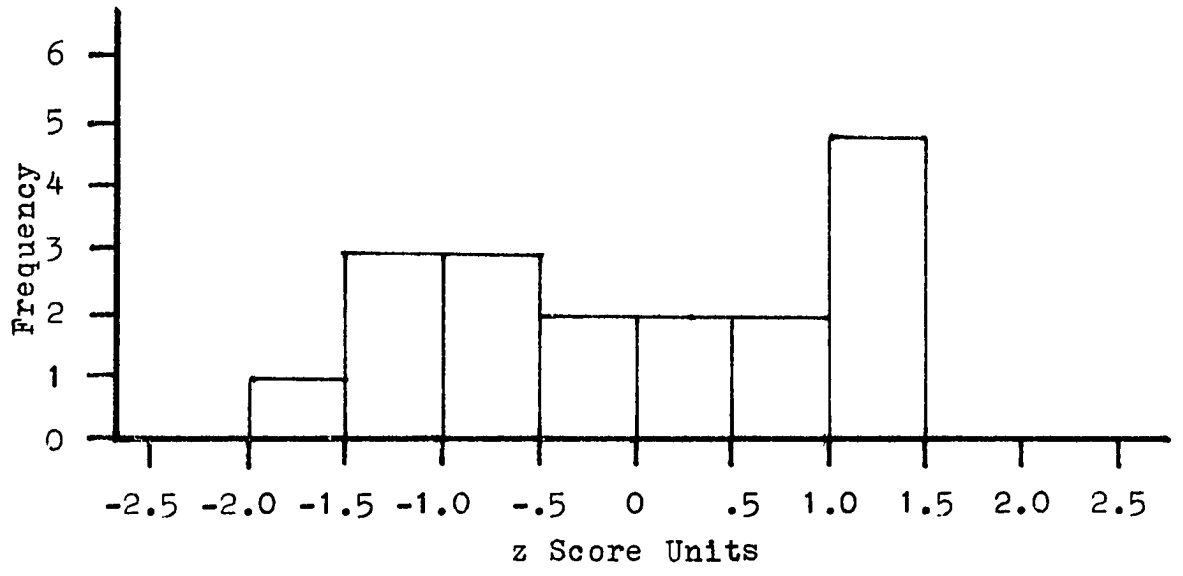
Local school boards should continue to have primary control over public elementary and secondary schools.



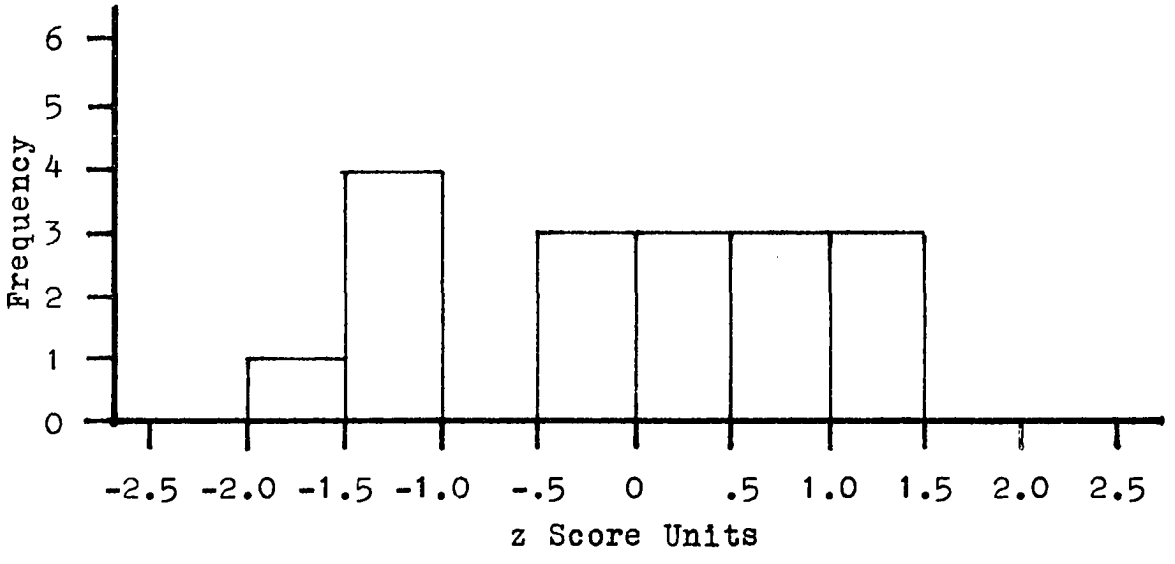
The United States should isolate itself from Indo-China affairs.



The Federal Government should establish mandatory birth control laws.



The all volunteer army will provide an adequate defense of the United States.



Individuals who chose not to answer the draft during the Vietnam War should be granted amnesty.

APPENDIX I

Summary: 2x3 Analysis of Variance of Character Scores

Source	S.S.	d.f.	M.S.	F	p
Between	136.405	5	27.281		
Entropy	0.271	1	0.271	0.0234	0.8736
Credibility	127.902	2	63.951	5.5201	0.0068
Interaction	8.232	2	4.116	0.3553	0.7077
Within	625.590	54	11.585		
Total	761.995	59			

Summary: 2x3 Analysis of Variance of Competence Scores

Source	S.S.	d.f.	M.S.	F	p
Between	137.245	5	27.499		
Entropy	1.357	1	1.357	0.0889	0.7642
Credibility	104.538	2	52.269	3.4225	0.0387
Interaction	31.596	2	15.798	1.0344	0.3636
Within	824.688	54	15.272		
Total	961.933	59			

Summary: 2x3 Analysis of Variance of Composure Scores

Source	S.S.	d.f.	M.S.	F	p
Between	367.155	5	73.431		
Entropy	176.819	1	176.819	8.9529	0.0044
Credibility	165.100	2	82.550	4.1797	0.0200
Interaction	25.234	2	12.617	0.6388	0.5365
Within	1066.500	54	19.750		
Total	1433.655	59			

Summary: 2x3 Analysis of Variance of Extroversion Scores

Source	S.S.	d.f.	M.S.	F	p
Between	121.140	5	24.228		
Entropy	86.404	1	86.404	12.1253	0.0013
Credibility	28.034	2	14.017	1.9671	0.1478
Interaction	6.702	2	3.351	0.4702	0.6331
Within	384.804	54	7.126		
Total	505.944	59			

Summary: 2x3 Analysis of Variance of Sociability Scores

Source	S.S.	d.f.	M.S.	F	p
Between	190.340	5	38.068		
Entropy	1.670	1	1.670	0.1710	0.6839
Credibility	172.132	2	86.066	8.8122	0.0008
Interaction	16.540	2	8.270	0.8468	0.5623
Within	527.418	54	9.767		
Total	717.758	59			

Summary: 2x3 Analysis of Variance of Attitude Scores

Source	S.S.	d.f.	M.S.	F	p
Between	313.945	5	62.789		
Entropy	170.039	1	170.039	2.0364	0.1558
Credibility	49.922	2	24.961	0.2989	0.7470
Interaction	93.984	2	46.992	0.5628	0.5782
Within	4508.892	54	83.498		
Total	4822.837	59			