VISUAL ASPECTS OF INTERNAL CORRESPONDENCE
AND THEIR IMPACT ON COMMUNICATION EFFECTIVENESS

DISSERTATION

Presented to the Graduate Council of the University of North Texas in Partial Fulfillment of the Requirements

For the Degree of

DOCTOR OF PHILOSOPHY

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Denton, Texas
December, 1988

Technologists predict that electronic information dissemination will create a paperless work environment. In spite of such predictions, paper-based internal communication will remain the primary medium for disseminating information in organizations for decades to come. However, electronic technology will have an impact on paper information production that may be more profound than changes following word processing’s introduction. Previously unavailable for everyday production to enhance word meaning, certain graphic techniques now can be used to access readers’ preconditioned symbol meanings to increase comprehension of routine correspondence and information internalization.

This quasi-experimental field study examines interactions among laser-printer graphic treatment and communication variables as contributors to explaining variance in comprehension. Set Multiple Regression/Correlation analysis identifies significant variance explained by conditional relationships between near-typeset quality text and readers’ self-interest and between near-typeset quality text and
text's readability. The conditional relationship of near-typeset quality and self-interest shows increase in reader comprehension at a greater rate than the comprehension increase rate attributed to the reader's self-interest increase alone. This suggests that conditional relationships may be accessing an internal judgment process interpreting greater self-interest in near-typeset printed text. The conditional relationship between near-typeset quality and readability reveals that at more difficult reading levels comprehension is greater for near-typeset text. The significance of this relationship indicates that an internal judgment process is involved rather than the difference being attributed to legibility treatment.

The strength of these conditional relationships suggests that planning for communication policies and practices should be a part of organizational strategic planning in the same ways as are financial analysis, operations planning, or human resource management.
PREFACE

The focus of this dissertation is the impact which technology has on written communication channels in organizations. In spite of technologists’ predictions that business soon will operate in paperless environments, paper will be the primary means for communicating information to employees in most American businesses for decades to come. There are many reasons: (1) resistance to commitment of organizational resources needed to install computer-based communication networks; (2) resistance to change from inertia-bound employees who believe they can’t learn or just won’t take the time to learn a new way to communicate; (3) resistance to change in tradition as the “we’ve always done it this way, so why change” philosophy influences operational implementation.

Recognizing that a shift to electronic technology as the sole means of information diffusion in organizations may be decades into the future, this dissertation explores what the evolutionary implementation of technology might be. Can written material which is produced using the latest production techniques influence message efficacy?

Readers interested in this pragmatic communication question may quickly note an incongruity in the appearance of this text. Although this study explores graphic treatment of
correspondence using some of the newest technology and its relationship to improved comprehension, this dissertation is produced in a fixed-width character typeface that simulates the typewriter face “courier.” Also, tables and figures are produced in traditional format without graphic enhancement. The reason for this is the requirement that dissertations conform to guidelines formulated when the typewriter was the only production tool available to academics. Guidelines regarding use of typeface, underlining, subhead formatting and other visual aspects of production were originally proposed to define an alternative set to typesetting capabilities not available at a reasonable cost to colleges. Technological advancement has now placed near-typeset capabilities within cost feasibility for dissertations and even for term papers. However, preparation guidelines currently do not permit incorporating near-typeset production capabilities introduced by the new technology into final format of dissertations.
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CHAPTER 1

INTRODUCTION

The importance of communication as a tool of business is inescapable. It is one of the most often included variables of study in organizational scholarly literature (Price and Mueller 1986, 84). Business management practitioners and scholars recognize that organizational efficiency depends on coordinating activities to maximize productivity. Communication serves as the primary means for coordinating and controlling organizational activity (Level and Galle 1988, 6).

The existence of communication is inextricably linked to organization functions; however, there are no standards for communication effectiveness in the same way that there are performance standards measurable by financial ratios. Rather, the degree of communication effectiveness becomes a variable in the organization’s overall effectiveness. High levels of effective communication are essential to efficient internal process and procedure adaptation necessary within the organization’s structure (Level and Galle 1988).

In spite of evidence that two-way communication provides the most efficient mutual understanding between communicants (Leavitt and Muller 1951; Gibson et al. 1982, 397), an over-
whelming amount of written internal communication is linear (Swindle 1980, 4). That is, the communicator (origination source) has a message he or she wishes to disseminate to others—upward, downward or lateral in the structure. In many instances, there is no desire for feedback.

Professional and technical occupations spend as much as 30 percent of work time writing (Faigley 1982, 568). Managers spend 15 percent to 20 percent of their time writing internal and external communication correspondence (Rader and Wunsch 1980, 38). Business managers have suggested that miscommunication among organization members cost organizations as much as 25 percent to 40 percent of operating budgets (Haney 1979, 6). And, as much as 60 percent to 80 percent of poor management decisions are attributed to errors in communication (Level and Galle 1988, 7).

Improving content has been the focus of many discussions of techniques to improve comprehension by communication receivers (Level and Galle 1988; Tucker and Derelian 1988; Michel et al. 1984; Himstreet 1981; Haney 1979; Lesikar 1979; Swindle 1980; Seigle 1978; Tortoriello et al. 1978; Thayer 1968). The potential of text’s graphic treatment as an aid to improve comprehension has largely been overlooked.

All written communication correspondence communicates messages through visual appearance experienced by the audience. Receivers consciously or subconsciously derive
meaning from correspondence appearance (Michel et al. 1984, 153). Even though the written word is an extension of oral communication, communicating through written text is affected by the loss of meaning enhancement through the use of non-verbal communication tools such as facial expressions, intonation, inflection and gestures. Written communication must use visual means to insert meaning enhancements (Turnbull and Baird 1975, 4).

The visual aspects of communication are relegated to broad descriptions of the advantages of white space (Seigle 1984), or the physical structuring of paragraphs or passages of text (Michel et al. 1984, 153; Lesikar 1979, 485). These viewpoints may be from a perspective limited by the graphic treatment applicable from then standard office production equipment. The introduction of new computer and typesetting technology may permit the incorporation of techniques and principles formerly reserved for traditional typesetting as graphic designers’ tools for enhancing communication.

Statement of the Problem

This study investigates the relationship among six independent variables and one dependent variable. The independent variables are: (1) the correspondence form, (2) content of message, (3) readability of text, (4) employees' perception of the message source's credibility, (5) employees' perceived self-interest in message content, and
visual appearance of an organization's internal correspondence. The dependent variable is the receiver’s comprehension of messages contained in the correspondence measured as the individual’s ability to reconstruct specific text passages. Figure 1 illustrates the proposed relationship.

\[
\text{Dependent Variable} = \text{Ind. Var. (X_1)} + \text{Ind. Var. (X_2)} + \ldots + \text{Ind Var. (X_n)} + \text{Other}
\]

\[
\text{Cloze Score} = \text{Form} + \text{Content} + \text{Readability} + \text{Source} + \text{Self-interest} + \text{Visual Aspects} + \text{Other}
\]

Fig. 1. Dependent variable relationship to independent variables.

Research Problems

Investigating the relationships illustrated in Figure 1 poses two research problems.

The First Research Problem. The first research problem is to determine the impact of visual aspects of internal communication correspondence on receiver comprehension. Visual aspects of correspondence are defined as near-typeset quality text and graphic design. Comprehension is measured as Cloze scores for specific passages from internal communication.

The Second Research Problem. The second research problem is to determine the existence and effect of conditional
relationships on receivers' comprehension. Interaction terms are independent variables comprised of correspondence's visual aspects interacting with other independent variables on cloze scores.

**Hypotheses**

The following hypotheses are suggested based on the two research problems:

1. Near-typeset quality internal correspondence will result in significantly higher cloze scores for internal memo format correspondence.

2. Near-typeset quality internal correspondence will result in significantly higher cloze scores for information contained in intra-organization letters.

3. Near-typeset quality internal correspondence will result in higher cloze scores for information contained in internal reports.

4. Near-typeset quality internal correspondence will result in significantly higher cloze scores for reports than for other types of internal correspondence.

5. Near-typeset quality internal correspondence interacting with self-interest will result in greater explained variance than either near typeset-quality or self-interest by themselves.
Limitations of the Study

In designing a study to investigate the relationships of the variables of interest, there are general limitations which must be recognized.

The First Limitation. The first limitation is that subjects are employees of a major hospital in the Southwestern United States. Generalizations may be limited to large, multi-leveled service institutions. Further, the research population is a sample of convenience. The control and treatment groups, however, are randomly selected from the research population.

The Second Limitation. It is possible that experimenter effects may account for differences that are found.

The Third Limitation. The third limitation is that only internal memos, reports and internal letters are used in this study. Generalizations to other forms of internal communication may be limited.

Assumptions

There are four general assumptions upon which this research is based.

The First Assumption. The first assumption is that the symbolic interaction paradigm from sociology (DeFleur and Ball-Rokeach 1982) is applicable to communication in the organizational setting.
The Second Assumption. The second assumption is that the cognitive paradigm from psychology (DeFleur and Ball-Rokeach 1982) is appropriate for the organizational setting since it is a social structure (Reitz 1977).

The Third Assumption. The third assumption is that there are no extreme differences in personality among the members of the groups being tested.

The Fourth Assumption. The fourth assumption is that the behavior of the professionals in each of the treatment and control groups does not differ except in those areas distinguished by treatment.

Definitions and Operational Terms

There are several terms with focused meanings used in this study which might be confused with common usage of the same words. Although the terms are more completely developed in later chapters, the following definitions for operational terms are used consistently.

Cloze Score. This is the score obtained from the Cloze procedure section of a questionnaire representing the subject's ability to reconstruct text passages of specific internal correspondence.

Form. Internal correspondence may be identified among several categories: (1) internal memo format, (2) internal formal letter format, (3) report format, (4) electronic mail, (5) support materials for oral presentations.
Content. The subject of internal correspondence is characterized as: (1) personal matters, (2) personnel matters, (3) salary or benefit matters, (4) job-specific information, (5) operational policies, (6) operational procedures, or (7) announcements.

Readability. The sentence structure and word selection encoding the message contained in internal correspondence comprise the readability measure. It is determined through application of Flesch’s readability formula.

Self-interest. This is the perception of the message receiver regarding his or her self-interest related to the subject of the internal correspondence. It is determined by summing the responses to Likert-scale statements in the questionnaire which relate to Self-interest.

Source Credibility. This is the receiver’s perception of the message originator’s intelligence, knowledge, qualification to hold a position in the organization and attractiveness of social association. It is determined by summing the responses to Likert-scale statements in the questionnaire relating to Source Credibility.

Visual Aspects. This is the physical appearance of the internal correspondence. There are two potential sub categories: (1) text and line art appearance (Hand written, typewriter, typeset quality) and (2) graphic design (element layout).
Importance of the Study

Since Lasswell first proposed his model "who says what through what medium to whom with what effect," each element in the process has been the focus of study in an effort to understand the relationships between variables. In general, written communication has been found to be more effective than oral communication for linear information flow. In addition, variables such as sentence length, word length, complexity of subject, organization of information, paper characteristics, format variations and type style have been found to affect readers' comprehension. This study's interest area is the impact that visual aspects of internal correspondence, including its organization, format variations and type styles, have on communication's efficacy.

Electronic publishing is predicted to have a more profound effect on American business than did word processing when it was applied to office automation (Micro Digest 1986). Its market is projected to reach $5 - $7 billion by 1990 even though it was not introduced to the marketplace until 1980 (McKissock 1986). The clarion that has captured the interest of business has been a call to create written materials previously produced on standard typewriters or word processors connected to typewriter-like printers using characteristics associated with commercial typesetting equipment. The justification for such expense is production oriented, "Now
you can produce professional looking print for everyday correspondence and newsletters and eliminate the middle man, the typesetter" (Romano 1987).

The rush to add new technology to the capabilities of corporate America has been based on the production capability it represents. Purchase of desktop systems, ranging from $10,000 to $20,000 each, may be entirely a function of the desire of the purchaser to add a perceived look of professionalism and attractiveness to correspondence (Romano 1987). Unfortunately, it appears that no one is actively researching whether or not the expense of adding technology is justified by its effect on communication to the audience which the correspondence is intended to reach. Determination of technology's contribution to communication effectiveness and efficiency potentially means more to improvement in productivity for American business than does decrease of production costs (Level and Galle 1988). The purpose of this study is to question the impact of the near-typeset quality printed materials on readership previously receiving written communication produced by standard office production equipment.

Preview

This dissertation is divided into five chapters. Chapter 1 is a broad introduction to the research. The problem statement, research problem, hypotheses and the study's rationale are discussed. Chapter 2 provides a survey
of the literature including a brief history of communication, the paradigms significant to this study, the role of symbols in meaning interpretation, and communication in business. Chapter 3 describes the methodology of a quasi-experimental field study to gather data to address the research problems and the Multiple Regression/Correlation procedure used to analyze the data. Chapter 4 reports the results of analysis of data collected. Chapter 5 contains a discussion of theoretical and practical implications of this study's results. Appendix A shows the questionnaire used to gather the data used in analysis. Appendix B illustrates examples of treated and nontreated correspondence. Appendix C shows tables of complete Multiple Regression/Correlation analyses and analyses of variance. Finally, the Selected Bibliography includes all sources cited in this dissertation as well as sources which provided helpful information in the dissertation's conceptual or production formulation.
References


CHAPTER 2

REVIEW OF THE LITERATURE

Communication - the transmission of information and understanding through the use of common symbols.

Gibson, Ivancevich, Donnelly
Organizations: Behavior, Structure, Processes

Historical Perspective

Human beings have been communicating among themselves since a time before the development of written or oral language (Langer 1942). Early forms of ritual, repetitive gestures to symbolize some event in human life served as the primary communication form until man began to establish a set of symbols and signs with commonly accepted interpretations to represent events in the environment (Langer 1942). During a long era in man's history, the principal communicating form was oral exchange of common symbols. Slowly man realized that visual symbols to represent oral symbols could be produced in pigment on cave walls to relate stories about hunts, disasters or other significant events for which man wanted to create a more permanent record (DeFleur and Ball-Rokeach 1984, 4).

The communication form called writing developed at different times and in different places in the world. The earliest writing forms were pictograms painted on cave walls.
Beyond these pictograms, writing developed into elaborate systems of glyphs carved into stone or pressed into clay tablets. It became apparent over time that knowledge based on the records contained in the writings gave man a tremendous power over nature and other men. But the power was constricted by the permanence of text and limited portability of documents (DeFleur and Ball-Rokeach 1982, 3-4).

The innovation of papyrus in ancient Egypt provided a major technological breakthrough that permitted lighter, more portable records to be kept. The result was growth of Egyptians' power because of their ability to commit information to readily usable forms (Lowery and DeFleur 1983). As technology progressed, paper was introduced that was easier and less costly to manufacture than papyrus. In large quantities, it permitted copying documents and books so that information could be disseminated more widely. However, prior to the fifteenth century, the reproduction of these books and documents was limited to a handful of highly trained scribes who painstakingly reproduced each document by hand. The result was documents that were works of art, but necessarily limited in distribution because of the time and effort required to create each copy (Seybold 1984). Literacy among the people remained low because the primary repositories of books and documents were in scribes' hands. Possession of this information made scribes an extremely
powerful segment of the social and cultural structure of civilization (DeFleur and Ball-Rokeach 1982).

In the 1450s, Gutenberg’s development of movable type and the associated technology for appropriate inks ushered in a new era in information dissemination. Although slow by today’s standards, the Gutenberg press and inks permitted mass production of books and documents that were affordable to people (Seybold 1984, 6). The result was literacy growth as people sought the new books and the power engendered by the information they contained (Lowery and DeFleur 1983, 12). The expansion of the ability to read and comprehend using a highly portable and inexpensive-to-reproduce vehicle opened vast possibilities among individuals for communication. It was possible to invent many products ranging from newspapers to a postal system to carry individuals’ letters among friends and coworkers (DeFleur and Ball-Rokeach 1982).

Scholars were quick to recognize the impact that written communication’s spread had on society and culture. As early as 1690, John Locke was analyzing communication’s importance in human life. He proposed a relationship among words, internal meanings and the role of language as the basis of both mind and society (Hoiler 1954). More recently, human communication and peoples’ resulting behaviors have been studied from five perspectives:
1. Communication is a semantic process; it is dependent upon symbols and rules for the symbols’ use that have been selected by a given language community.

2. It is a neurological process in which meanings for particular symbols are recorded in memory functions of individuals. Thus, the central nervous system plays a key role in the storage and recovery of internal meaning experiences.

3. It is a psychological process; meanings of words or other symbols to a given individual are acquired through learning. Such meanings play a central role in perceiving the world and responding to it.

4. Human communication is a cultural process; language is a set of cultural conventions. That is, the language of any society is a set of postures, gestures, symbols, and their arrangements that have shared or agreed-upon interpretations.

5. Communication is a social process; it is the principal means by which human beings are able to interact in meaningful ways. Thus, through symbolic interchange, human beings can play roles, understand norms of a group, apply social sanctions and appraise each other's actions within a system.
of shared values (DeFleur and Ball-Rokeach 1982, 116-17).

Studies from these perspectives have produced several paradigms as assumptions basic to research in communication. Among these, the symbolic interaction paradigm is particularly relevant to this study. The paradigm is a result of the work of George Mead based on the earlier philosophy of Locke. The paradigm can be simplified to four assumptions:

1. Society can best be thought of as a system of meanings. For individuals, participation in the shared meanings linked to the symbols of a language is the interpersonal activity from which emerges stable and commonly understood expectations that guide behavior into predictable patterns.

2. From a behavioral point of view, both social and physical realities are labeled constructions of meanings; as a consequence of people individually and collectively participating in symbolic interaction, their interpretations of reality are both socially conventionalized and individually internalized.

3. The bonds that unite people, the ideas they have of others and their beliefs about themselves are personal constructions of meanings emerging from symbolic interaction; thus, the subjective beliefs
people have of one another and of themselves are the most significant facts of social life.

4. Individual conduct in a given action situation is guided by the labels and meanings people associate with that situation; thus, behavior is not an automatic response to stimuli of external origin but is a product of subjective constructions about self, others and the social requirements of the situations (DeFleur and Ball-Rokeach 1982, 20-22).

This symbolic interactionist viewpoint is relevant for two reasons. First, it emphasizes the importance of the role of meanings attributed by individuals to symbols encountered in the environment. Meanings are internally held. But, each individual’s meaning interpretation results from previous personal experience with the encountered symbol. The result is the potential of different meanings for similar symbols. Second, it proposes that one substantial factor in meaning interpretation is the self-interest held by the individual related to the meaning of the symbol.

*Signs, Symbols and Meanings*

There is considerable disagreement among linguists, psycholinguists, symbolic interactionists, semanticists and others regarding definition, function and interrelationship among signs, symbols and meaning. In general, a sign is something that stands for a physical thing or commonly
understood concept. A sign is a manifestation that evokes the referent to the observer's mind (Francois 1977, 23). For example, raindrops on a sidewalk are a sign that it is raining. Signs can be either verbal (written or oral words) or non-verbal (facial expressions, body movements, handshakes).

There is clouded difference between signs and symbols. One suggested distinction is that symbols are not proxies for their objects, but are vehicles for conceptualizing complex ideas or objects. It is when the referent is not in the presence of the observer that the concept of symbol is evoked (Langer 1942). For example, if a stylized design of an eagle appears on a football stadium's wall, it is a sign of the university team that plays there. If the same stylized eagle is placed on an automobile's window, then it becomes a symbol of a school and a person's relationship to it.

Symbol-making may be a basic need of man. Ritual actions preceded language as a communication device (Langer 1942). Sensory data is constantly being shaped into symbols and manipulated by reasoning until complex ideas result. This ability to use symbols to communicate complex ideas beyond the scope of the symbol itself provides tremendous power to its users (Langer 1942).

Signs and symbols have been studied in psychology and logic. The role of symbols in the logic and communication
processes is not well understood because application of symbols is an internal process to each individual. Symbols can be powerful in evoking meaning, or the same symbols may carry little or no meaning depending on the individual's experience, education and emotional relationship with the symbol. When symbols represent approximately the same meaning among many individuals, then interpersonal communication is possible (Francois 1977).

Meanings are internal to individuals. The communication process is one where the communicator is attempting to evoke meanings internal to the communicant through the use of symbols believed to transmit the desired message (Francois 1977). Communication barriers include the possible differences in meaning associated with a particular symbol between the communicator and communicant (Haney 1979).

The most fundamental symbolic interactionists believe that what a person sees or hears is limited by language and knowledge. This is compounded by the role each individual plays in society. The roles dictate what we see or hear in the environment. For example, a policeman observes activities and hears sounds in the daily environment that a teacher would not. People's knowledge is relative to their roles in culture (Whorf 1956).

Not only do we see or hear what our interests, beliefs and values determine that we shall see or hear, but we are
uneasy about the unknown. Individuals actively seek meaning in order to reduce the internal tensions caused by experiencing the unknown. This process is called "cognitive structuring" (Fearing 1962).

One characteristic of cognitive structuring described by Fearing (1962) is the creation of demand character for some elements of the environment. This means that selected elements of the environment acquire a stimulus value which is unrelated to their specific intensity. This stimulation may be attractive or repellent. In either case, the symbols created by cognitive structuring exert tremendous influence over individual behavior (Fearing 1962). For example, watch the reactions in a group of people when a yellow jacket is spotted flying around a room. In actuality, other than minor discomfort, the medical seriousness of a wasp sting is relatively small to all but a few people.

Fearing also describes that the need-value-belief system of an individual makes him or her susceptible to some elements in the environment and not to others (similar to symbolic interactionists' view of role determination of sensory perception). The individual may be vulnerable to aspects of the environment that are, or appear to be, relevant to the needs and values dominant at that point in time. This is sometimes called "interest" (Fearing 1962). This interest, or self-interest, is a significant factor in
setting an individual's agenda as the elements in the environment deemed to involve interest take priority over those environmental elements not perceived as having interest to the individual.

The Communication Process

There have been several significant concepts added to Lasswell's original linear communication model shown in Figure 2 (McQuail and Windahl 1981). First, the addition of a feedback loop (Wiener 1948) and, second, encoding and decoding processes internal to the communicator and receiver respectively (Shannon and Weaver 1955). These concepts helped explain more accurate, mutual understanding between the communicator and the receiver. The process was further refined as suggested in the circular model (Osgood and Schramm 1954) and helix model (Dance 1967), where the sender's and receiver's positions are exchanged as often as necessary until a mutually agreed upon message interpretation is obtained.

As illustrated in Figure 2, the communication process begins with a source selecting a message from all the messages which would be possible to communicate. The transmitter operates on the message to produce a signal suitable for transmission through a channel. The receiver is the destination for the signal and performs his or her own operation on the signal received. The dimensions of this
operation contribute to the success of the communication act, that is, creation of understanding between the communicants (Shannon and Weaver in Severin 1979, 47).

In the Shannon-Weaver information theory, there are two elements to information contained in any communication effort: "entropy" and "redundancy" (Schramm 1955, 132). Entropy is defined as a state of uncertainty or disorganization in a situation. The higher the entropy, the less communicative is the message. Redundancy is the measure of certainty or predictability. The more redundancy contained in a message the more communicative the message is. However, less information is imparted in a given amount of time or space (Severin 1979, 47).

*Communication in Business*

Communication is one of the most often included variables in studies of organizations (Price and Mueller
Business management practitioners and scholars recognize that organizational efficiency depends on coordinating and controlling activities to maximize productivity. And, communication among organizational members is the primary controlling and coordinating activity (Level and Galle 1988, 6).

Although definitions of organizations rarely contain specific references to communication, it is, nevertheless, an implied part of organization structure. Assembling people to perform some task that each could not perform alone requires that communication, verbal or non-verbal, be exercised. The existence of communication is inextricably linked to organizational functions (Gibson et al. 1982, 394). However, communication does not have effectiveness indicators in the same way that financial ratios define organizational performance. The degree of communication effectiveness becomes a relational variable in the organization’s overall effectiveness.

Communication provides essential linkage between organizational elements to facilitate adaptation of people and processes necessary within the organization’s structure (Mintzberg 1979). Managers and administrators in business today have never before been faced with as great a challenge in the use of communication skills (Stiegler 1977, 14). Professional and technical occupations spend as much as 30
percent of work time writing (Faigley 1982, 568). Managers spend 15 percent to 20 percent of their time writing internal and external communication correspondence (Rader and Wunsch 1980, 38). Business managers suggest that miscommunication among organization members cost organizations as much as 25 percent to 40 percent of operating budgets (Haney 1979, 6). And, 60 percent to 80 percent of poor management decisions are attributed to errors in communication (Level and Galle 1988).

Improving communication effectiveness has been researched from many different viewpoints (Price and Mueller 1986, 84). Considerable research has been done on the impact of new technology in the distribution of information and communication networking in organizations (Rogers 1986). However, research into the understanding of individuals in the communication process will come more slowly because of the individual variables involved (Haney 1979, 6).

Within organizations, four dimensions are suggested for communication: formal and informal, vertical or horizontal, personal or impersonal and instrumental and expressive (Price and Mueller 1986, 83-84). In each case, the common symbols used in the communication process may be either verbal or non-verbal (Tortoriello et al. 1978, 11; Gibson et al. 1982, 395). Verbal communication can be divided into two groups: written and oral. Meetings, telephone conversations and oral
presentations constitute the body of oral communication. Written communication takes the forms of internal memos, formal letters, reports and written elements of presentations.

**Linear Internal Communication**

In spite of evidence that two-way communication provides the most efficient mutual understanding between communicants (Leavitt and Muller 1951; Gibson et al. 1982, 397), an overwhelming amount of written internal communication is linear (Swindle 1980, 4). That is, the communicator (origination source) merely has a message he or she wishes to disseminate to others—upward, downward or lateral in the structure. Linear communication in organizations might take one of two forms: oral communication or internal correspondence.

**Oral Communication.** Linear oral communication in organizations includes presentations made by organizational members to groups comprised of people internal or external to the organization. The intent of this communication form is to disseminate information to a large number of people at the same time in a manner that attempts to ensure that the message is formed in consistent symbols presented to receivers (Newsom and Carrell 1986).

Oral presentations might be used to present information about new processes or procedures. Presentations provide
oral transmission of information resulting from development of various kinds of reports or to sell ideas or products (Level and Galle 1988). As important as oral linear communication is, this study focuses on written communication.

Internal Correspondence. Paper-based linear communication is defined as "internal correspondence." Internal correspondence may be divided into four categories: (a) interoffice memorandum (called the memo), (b) report, (c) letter to internal personnel, and (d) support material for oral presentations. These forms of internal communication may be used to traverse all directions in an organization.

There have been five categories of use suggested for downward internal correspondence. First, it can be used to pass job instructions. This includes details of performing the job expected of the communication receiver. Second, it details job rationale—information designed to provide the receiver with a better understanding of his or her job. Third, it introduces or clarifies policy or procedure. This might included information that completes the description of worker's role from relationships with other departments to information about salary, benefits, vacation, sick leave, rewards and sanctions. Fourth, it offers feedback providing information to the receiver about the level of performance in the job. And fifth, it provides indoctrination to the
organization culture, either on a departmental or organizational level (Katz and Kahn 1966, 238-241).

Horizontal and diagonal correspondence most often is used for information involved in coordinating activities between units in the organization. These units may be individuals in the same operational department or in different departments (Katz and Kahn 1966, 243).

Upward correspondence can be used for many purposes. These purposes may be reduced to four broad categories. First, the communicator may want to pass on information about himself or herself, his or her performance or his or her problems. Second, information about others and their performances may be the subject. Third, the subject may address organization policies and practices. And fourth, the communicator may want to inform the upper levels about what needs to be done and/or how it can be done (Katz and Kahn 1966, 245).

The memo is the most often used form of internal correspondence within the firm's structure (Swindle 1980, 4). It normally can be used to traverse all directions within the organization's structure. Although two-way oral communication comprises the majority of internal communication, memos are the tool selected most often when an audience is large in numbers or a permanent, written record of the subject is desired (Swindle 1980, 130).
As many as six different uses are described for memos:

1. **Bulletin Memo** — usually has a sense of urgency and is terse.

2. **Essay Memo** — a great deal more descriptive than the bulletin memo and is used for a "let's talk it over" discussion.

3. **Informative Memo** — a detailed descriptive piece designed to transmit specific information from one party to another such as description of actions taken or to be taken.

4. **Action Memo** — describes action taken or planned; it differs from the informative memo by including a specific call to action requiring the receiver to respond.

5. **Summary Memo** — a detailed descriptive memo in essay or outline form with actions organized under specific topic headings such as minutes from a meeting.

6. **File Memo** — written for permanent file record only of action, plans or opinions regarding activities within the organization (Newsom and Carrell 1986, 368).

The report is the most often used form of upward communication correspondence. This category includes many different types of reports from many segments of a company. Sales reports, production reports, quality control reports, profit/loss reports, inventory reports and shipping reports are just a few examples (Swindle 1980, 7).

Generally, letters are reserved for external communication; however, they are sometimes used for internal communication when the subject to be communicated is formal or bears particular significance for an individual. For example, letters may be used to communicate with internal
personnel when promotions, terminations, salary increases or special awards are announced (Newsom and Carrell 1986, 370).

Support materials for presentations may include the visual aids supporting an oral presentation, any handouts prepared as a summary of the presentation contents, agenda, reports or other printed material designed to provide clarity, explanation or illustration of topics presented.

**Graphic Communication**

In general, business communication texts and popular books emphasize content in an effort to improve communication effectiveness of internal communication correspondence (Level and Galle 1988; Tucker and Derelian 1988; Newsom and Carrell 1986; Michel et al. 1984; Himstreet 1981; Swindle 1980; Haney 1979; Lesikar 1979; Seigle 1978; Tortoriello et al. 1978; Thayer 1968). The visual aspects of communication are relegated to broad descriptions of the advantages of white space (Seigle 1984), or the physical structuring of paragraphs or passages of text (Michel et al. 1984, 153; Lesikar 1979, 485). These viewpoints may be from the perspective of the graphic treatment from standard office production equipment then available. The introduction of new computer and typesetting technology may permit the incorporation of techniques and principles formerly reserved for traditional typesetting as graphic designers' tools for enhancing communication.
**Traditional Techniques.** Traditional techniques for producing written internal communication material in business have relied on handwritten notes, typewriter-produced material and, to some extent, typesetting.

*Office Equipment.* Typewriters pervade society. They are accepted, taken-for-granted furnishings of almost any business operation. It is difficult to imagine what business would be like today without the impact that the introduction of the typewriter had on business communication (Seybold 1984, 13). Prior to the typewriter’s widespread use, business depended on handwritten correspondence for communication. The process was slow, tedious and generally made it difficult to reproduce copies for wide distribution (Seybold 1984).

Following the issue of a patent to Philo Remington in 1873, the first practical typewriter went into production with one thousand machines per month rolling off the assembly line (Bliven 1954, 56). The “Remington” typed upper-case characters only. The use of lower-case and a shift key to differentiate between upper- and lower-case was not introduced until 1878. By 1910, there were more than two million typewriters in use in the U.S. (Bliven 1954, 102).

The introduction of the I.B.M. Selectric typewriter in 1961 was the first revolutionary advance in typewriter technology. The ability to change the typing element to vary
type font allowed previously unavailable flexibility in correspondence production. The photocopying process, introduced at about the same time, further enhanced the flexibility of correspondence, as well as the ability to generate identical-appearing multiple copies that were more attractive than possible with duplicating stencil or carbon paper processes (Seybold 1984, 15).

The late 1970s and 1980s heralded more capability with the introduction of the electronic typewriter with small internal memory that could be used for text correction and text movement. Dedicated word processors and microcomputers running word processing software could interface with daisy-wheel or high-production laser printers to produce letter-quality type (type that appeared produced on state-of-the-art electronic typewriters). Computer word processors could also interface with less expensive dot-matrix impact printers which used small pins arranged in a pattern to produce characters by pressing through a ribbon to the paper. In general, output from dot-matrix printers was not considered acceptable for business correspondence. Daisy-wheel printers used one of the printing technologies found in electronic typewriters, but the quality was offset by a reduction in printing speed. By the late 1980s, dot-matrix printers were incorporating technology that used 24 or more pins in the matrix allowing for characters to be generated using much
smaller and less obvious dots. The result, near-letter quality, became acceptable as a typewriter replacement in all but the most demanding application. The dot-matrix printer permitted the use of multiple fonts, sizes and styles in producing office correspondence.

Typesetting. Between Gutenberg’s innovation of movable type in the 1450s and the introduction of the Mergenthaler Linotype and Lanston Monotype machines, type had to be set by hand, placing individual letters, symbols or spaces into position in a frame. The cumbersome process produced printed output that was still considerably easier to reproduce and read than manuscripts copied by hand.

From the turn of the century until about 1970, the Linotype process served as one of the most widely accepted methods of typesetting. These machines cast entire lines including appropriate spaces for justification. A good hand caster could compose about two thousand characters per hour. A Linotype operator could cast about six thousand characters per hour (Seybold 1984).

Phototypesetting first appeared in public in 1950. The growth of phototypesetting depended on the adoption of offset printing techniques over letterpress techniques. Letterpress required raised letters, or plates made from pressing letters into a lead plate, to produce characters by transferring ink to paper using the impression of the character as a vehicle
for the ink. The offset process used a photographic process to produce character images that, in turn, were the vehicle for transferring inks (Seybold 1984, 72-73).

Third generation phototypesetting used images generated on a cathode-ray tube (CRT) from which a photo was made of the character or characters. Although this sounds like a cumbersome process, it had advantages in the electronic manipulation of the CRT images to provide variety and special effects (Seybold 1984, 114).

Digital machines did not rely on the CRT to produce characters. Instead, they used the computer language process of converting information to a binary system for the image’s definition. Each character was produced by a series of vertical strokes during which electronic impulses were turned “on” or “off” to expose photo paper. The finer the dot pattern produced, the sharper was the image (Seybold 1984, 123-24).

Laser Printing. In 1980, IBM introduced the first commercial laser printer. Designed as a high-output, near-typeset quality printer, the machine was very expensive; however, it provided a never-before available flexibility in character generation. It even permitted the production of a logo and line art at the time the correspondence was produced. Laser-printing technology produced character generation, called near-typeset quality, that approached the
quality of phototypesetting machines. Canon, a Japanese electronics manufacturer, introduced a small photocopier print engine in 1983 and marketed it as a "personal copier." It used a xerography process where a photocell converted an original document's image to electrical impulses that registered on a turning drum. The charge generated on the drum was transferred to paper and a stream of oppositely charged toner was sprayed over the paper, adhering in the shape of the charged characters. Heat served to bond the toner to the paper. Apple Computer used the Canon print engine to produce the first commercially successful laser printer, the LaserWriter. An on-board computer received digital signals from the word processing microcomputer and directed a laser imaging device to charge the drum to create characters and graphics.

Laser printers produced images using three hundred dots per inch (DPI) resolution to fifteen hundred DPI. Because of the high cost of the high resolution machines, the three hundred DPI devices (Apple LaserWriter, Hewlett-Packard LaserJet II and others) have become readily accepted in business applications because of the attractiveness of the near-typeset quality and the perceived cost savings over standard typesetting for business printed material.

Since its introduction, laser printing technology has plummeted in cost. Laser printers that interface with
microcomputers can be purchased for as little as $1,300, although cables, software and training increase the cost of unit installation. Regardless, the electronic publishing technology, as the microcomputer-software-laser printer interface is called, is predicted to be a $5 to $7 billion industry by 1990 (MicroDigest 1986).

Graphic Aspects of Communication. The written word is an extension of oral communication. Translating thoughts from oral to written word is hampered by the loss of the ability to enhance meaning through the use of non-verbal communication tools such as facial expressions, intonation, inflection and gestures. Written communication must use visual means to insert meaning enhancements in an effort to make communication more efficient (Turnbull and Baird 1975, 4).

Regardless of whether or not the business communicator is conscious of the effect, all written communication correspondence sends a graphic message to the audience and a receiver will derive meaning from it (Michel et al. 1984, 153). As Michel, Cespedes, Byker and Raymond noted:

Graphics strengthen your communication because they take advantage of the audience’s ability to interpret spatial relationships and form as well as words (Michel et al. 1984, 152).

The message in correspondence involves the use of symbols to impart meaning in the receiver’s mind. Symbols are cues to meaning. In print, these cues convey their meaning through the sense of sight as the message receiver
sees not only words which are symbols of meaning, but also such cues as paper quality, type quality and cleanliness of the printed material (Turnbull and Baird 1975, 9). Although words and graphic content are inseparable as elements of message presentation, the interaction tends to vary as the characteristics of the elements vary. For example, an audience may want information so much that they overcome even the most difficult graphic treatment to get desired information. Employment want ads in newspapers are good examples. On the other hand, it is possible that graphic treatment of a printed piece may overwhelm the message intended and the impression left in receivers' minds is "how attractive" as opposed to comprehension of the message (Turnbull and Baird 1975, 4).

The visual aspects of correspondence have three objectives: (1) to attract attention, (2) to present information so it is easily read and understood, (3) to make an impression (Turnbull and Baird 1975, 5).

To accomplish these objectives, graphic communication has five forms with which it can graphically treat written correspondence. First, there are shapes such as geometric shapes incorporated into layout design to provide eye direction to reading content. For example, blocks of copy might be screened with shades of gray to make them stand apart from other elements on the page. USA TODAY, the Gannett
newspaper, is a good example. Second, there are symbols such as bullet points, arrows, dingbats and other conventions to install highlights as clues to important points in the message. This category, too, may contain the symbols interpreted by the receiver that may or may not have been intended by the sender. For example, if a receiver is conditioned that typeset, serif type is found only in expensive, important communication, then seeing the same type style in other contexts may evoke a symbol resulting solely from the conditioning. Third, there are images which include photos, illustrations and graphs. Fourth, there are abstractions such as schematics of models used to show relationships between abstract elements. And last, there is text format which is the least understood of the elements (Michel et al. 1984, 113). Text format relates to the placement of type, shapes, symbols, images and abstractions on the page. Although many studies have been performed to determine the best possible arrangement of elements on a page to maximize the achievement of the three objectives (Michel et al. 1984, 113; Lesikar 1979), the conclusions remain shrouded in generalities, perhaps because of the influence of receiver perception in the meaning process.

A message contained in internal correspondence will be totally ineffective in achieving its mission if the correspondence does not attract the reader's interest.
Although correspondence's graphic aspects may be the initial attraction for a reader, additional elements immediately come into play to confirm the reader's interest including a judgmental validation of the relevance, credibility, appropriateness and truth of the message (Thayer 1968, 147). This process takes in much more than the mere contents of a message. Physical characteristics of the correspondence as well as environmental situational variables present at the time of exposure play an important part in the overall message the receiver gets from the correspondence (Thayer 1968, 165).

Readability and Legibility

Although readability and legibility are concepts closely linked in the literature, sometimes being used as interchangeable terms, they should be distinctly different issues (Tinker 1963). Readability relates to the words and syntax used in constructing a message. Legibility relates to the physical appearance of the letters, whether they are handwritten, typeset or typewritten; the contrast of darkness and light between the letters and the medium upon which they are printed; and illumination, the amount of light cast on the letters (Easterly 1984, 22).

Legibility. Legibility is a widely researched variable in its relation to typography in books or newspapers. Type should be aesthetically pleasing (Turnbull and Baird 1975,
This characteristic relates to the type face purposefully being chosen and its arrangement on a page designed to attract and sustain attention. Legibility and comprehension are closely linked. Comprehension is a function of information processing, and may be defined as units of understanding per unit of time (Turnbull and Baird 1975, 62). If comprehension and all other factors remain constant, then type that can be read faster may be termed more legible. A number of other factors contribute to legibility including the face design, boldness, leading, line length, margins, ink, paper, presswork, lighting and the motivation of the reader (Turnbull and Baird 1975; Tinker 1963).

In selecting a typeface for increasing legibility, one criterion for selection is the familiarity that the subject has with the face. In general, the more familiar a typeface is to the reader, the more legible the face will be judged (Hvistendahl 1974; Biggs 1968, 10; Zachrisson 1965, 85-90). Roman typefaces (serifed faces such as used in this text) have been preferred over Gothic or "new faces" without serifs (Burt 1959, 7; Zachrisson 1965, 128-31; Robinson, Albbamonte and Evans, 1971). Regardless of typeface selected, a mixture of capitals and lower case is preferred to all upper case characters (Paterson and Tinker 1940, 23). Although bold-facing and italics work well in emphasizing highlight points,
text set solidly in these variations of typeface are usually judged to be less legible (Burt 1959, 10).

Two other variables in legibility are the leading between lines and the length of the typeset line. Typographers use a rule of thumb that one or two points of leading are adequate for ordinary text characters. There seems to be a diminishing return turning to negative influence as leading is increased to four points or more (Burt 1959, 14). Maximum legibility for type lines corresponds to two to three lengths of alphabet (Burt 1959, 14). A length of alphabet is defined as the letters "a" through "z" typed consecutively with no extra spaces between letters. When leading is used between lines, the body size of the character plus the leading is used to determine the point size for the length of alphabet measurement. For example, for a 10-point type set with two points leading, the length of alphabet for maximum line length should be based on the equivalent of a 12-point size of the same face (Turnbull and Baird 1975, 67). Lastly, the effect of justified line length or ragged-right (uneven right margin) has shown to be negligible on legibility (Zachrisson 1965, 145-55).

There are other potential variables for legibility. Ink color, paper color and paper type (enamel or matte finished) are among the most significant (Turnbull and Baird 1975, 69). In general, black ink on a white background is more legible
than white on a black background (Tinker 1963, 151). Black ink on tinted paper (light tints) is probably an unimportant difference regarding legibility (Tinker 1963, 140). The legibility of different colors of ink on different colors of paper varies widely. The best combinations are a dark ink on light colored paper. The glare produced by light on enamel-coated paper stock may reduce legibility (Turnbull and Baird 1975, 69).

Readability. Studies focusing on readability and comprehension of text material generally have found high correlations between the ease of reading text (readability) and the ability to recall the passage's content as a comprehension measure (Klare 1984, 479). Although readability enjoys these correlations with comprehension, it is only one of the variables related to reader performance (recall) suggested by Klare's model shown in Figure 3.

![Fig. 3. Klare's model of reader performance effectiveness.](source.png)
Among the most noted researchers into readability are Flesch, Gunning and Dale-Chall. Their research resulted in measurement formulas which attempted to predict the comprehension probability of written text passages. In general, the characteristics contributing to making text readable were identified as closely related and, for the most part, non-significant in their separate contributions. Combining characteristics into more general groups continued until three macro categories remained as readability dimensions—the average sentence length, the average word length and the motivation of the reader.

Dale-Chall's formula is one of the most difficult to apply because it depends on a 3,000-word list comprised of words known to at least 80 percent of U.S. fourth graders. Gunning's formula is the simplest to apply and measures reading difficulty (Gunning 1968). It is determined by counting the number of words in a passage and dividing by the number of sentences in the passage to obtain an average sentence length. The number of long words, those of three syllables or more not including proper nouns, words with -es, -ed or compound words derived from common smaller words such as manpower, is added to the average sentence length. The result is multiplied by 0.4 to arrive at a score that, supposedly, approximates the grade reading level of the written passage (Gunning 1968). Flesch's formula is designed
to determine reading ease (Flesch 1948). First, the average sentence length (asl) is derived in a similar fashion to Gunning’s process. It departs from Gunning by calculating an average word length (awl) by dividing the number of syllables in the passage by the number of words. The averages are then plugged into the formula:

$$RE = 206.835 - (84.6 \times awl) - (1.015 \times asl)$$

The result is an index number between 0 and 100 that indicates the relative ease of reading the passage. In general, the higher the index number is, the easier the passage is to read (Flesch 1948). In addition, Flesch attempted to address the self-interest factor in comprehension by adding the calculation of a human interest factor. Since the formula is derived from the use of personal words such as you, we and our, rather than including an analysis of content, it is questionable whether or not it comes close to measuring reader self-interest in the message.

Although little in the literature suggests that one method is more accurate than another in measuring readability for purposes of correlating to comprehension, Flesch’s formula appears to be a little more positive in its philosophy as a measure of reading ease rather than reading difficulty.
Comprehension and Recall

Comprehension. One of the most difficult issues in communication research into effectiveness is the measurement of comprehension, perhaps the ultimate objective of communication (Bowers 1970, 65). Comprehension might be defined as "the ability to know," "the capacity to grasp things" or "understanding" (Kibler 1970, 30). However, the real difficulty in measuring or interpreting comprehension in research is the abstractness of the concept. The problem is defining comprehension of what (Williams 1970, 268)?

Comprehension is usually treated as a function of learning and is defined by some researchers as potential ease in understanding a communication message (Lynch 1970, 321).

One measurement technique of comprehension as a dependent variable involves observing subjects' behavior and stipulating the behaviors required by a subject to qualify as indicating comprehension or no comprehension. For example, the behavior demonstrating comprehension might be defined as the ability of a subject to repeat instructions for some activity to another person. Comparing the similarity between the original instructions given the subject and the instructions given by the subject to the other person would indicate a level of the subject's comprehension. Likewise, the fidelity with which a subject follows instructions could also define the level of comprehension (Kibler 1970, 31).
Paper-and-pencil comprehension tests usually involve a subject reading a text passage, then responding to related questions with response accuracy indicating comprehension level. One style of questioning uses a series of multiple choice statements where a subject is asked to respond with the statement that most closely represents the text read (Lynch 1970, 320). For example, a comprehension measurement item might be:

The wind wanted a man to take off his coat. The wind blew and blew, but the man held his coat closer and closer about him. The sun wanted the man to take off his coat. The sun smiled and smiled, and the man gladly took off his coat.

1. The wind a) hid; b) was wise; c) smiled; d) blew.
2. What smiled? a) man; b) sun; c) wind; d) coat.
3. This story is about the a) sun and man; b) sun and wind; c) sun, wind and man; d) wind and man (Lynch 1970, 320).

This concept has served as the basis for many comprehension tests used in reading education and standardized testing. Although it is far more sophisticated than this example, the method used by Educational Testing Service in its generally accepted, standardized testing is based on this procedure for establishing reading and comprehension levels (Lynch 1970, 320).

Taylor's Cloze Procedure (1953) originally was suggested as a readability measure after studies comparing it to
Flesch's (1946) and Dale-Chall's (1948) readability formulas found it to rank reading passages in the same order as the readability formulas (Taylor 1952). Since then, however, it has had many diverse applications in communication research (Williams 1970, 267). Briefly, the cloze procedure consists of preparing a duplicate of the original text passage with words deleted at random or systematically selected and replaced by equal-appearing underlines. A subject is then asked to replace the missing words. The number of exactly correct responses results in a cloze score.

A study by Taylor (1957) administered to Air Force personnel using the cloze procedure before and after training on subjects from the Air Force manual produced four suggested findings. First, poststudy scores were higher than pretest scores. Second, there were high correlations between cloze scores and a recall-type comprehension test. Third, there were significant positive correlations between the cloze scores and scores on the Armed Forces Qualification Test for the subjects. And fourth, the results generally prevailed regardless of the deletion scheme used in the cloze procedure, although the nth-word deletion scheme seemed to provide more "stable, reliable and discriminating" scores than either elimination of all hard words or all easy words (Taylor 1957, 26). Taylor interpreted these results as evidence that the cloze scores measured comprehension and
aptitude, defined as the ability to understand (Williams 1970, 267).

Depending on the circumstance of the testing with cloze procedure, the variable actually being measured may be something other than comprehension or, even, readability. Taylor himself categorized three elements in the message context. First was the redundancy of the content. High cloze scores reflected the level of redundancy in content as words are predicted based on the subject’s familiarity with the subject or the passage of text. Second, misdirection was the use of the same substitution for exact words made by a significant number of subjects. The ability of several subjects to substitute the same word into the passage of text indicated their interpretation as decoders as it differed from the intent of the encoder. And third, randomness or, in terms of information theory, entropy was the response rate of words that were random in appearance. Entropy serves as a measure of the uncertainty of the word selection to complete the text passage (Taylor 1954). These three components reflect the total possible response components represented by the cloze procedure.

Another aspect of cloze procedure measurement is one labeled “redundancy utilization” and is described as the predictability level of the passages of text because of the reader’s ability to take advantage of redundancy to select
words. Comparing this factor with one called “verbal comprehension” and one called “rote memory, flexible retrieval,” Weaver and Kingston suggested that cloze procedure measured aspects of reading behavior that were not measured by more standard comprehension or readability tests (Weaver and Kingston 1963).

Flesch’s, Gunning’s and Dale-Chall’s readability formulas predicted from 50 percent to 100 percent comprehension on the McCall-Crabbs Test Passages (McCall and Crabbs 1950). Again, the McCall-Crabbs procedure uses multiple-choice questions administered immediately following a subject’s reading test passages. Differences were related to which of the formulas were applied. Cloze scores predicted from 35 percent to 55 percent comprehension on the same test passages (Klare 1984, 493). The variance in prediction success may result from the readability formulas being a mechanical measure applied by the researcher and cloze scores a judgment by the subjects influenced by additional variables. Regardless, the usefulness of readability and cloze scores revealed in the literature is their ability to rank and correlate reading passages consistently (Klare 1984, 489).

Recall. The ability to recall details from specific text passages has generally been applied as a measure of comprehension by the reader. As noted earlier, Klare suggested that the ability to recall information is a
function of five variables. The individual's memory system plays a significant role in the ability to recall information. Psychologists have identified three domains within the structure of the brain that lead to three distinctly different, but associated, processes. The visual short term memory (Visual STM) is a physiological process where impressions of visual stimuli are held in a very short term memory in the brain before transmission to other areas of the brain for processing. In the few milliseconds that the impression is held, the brain will recall the images even if the image is no longer in the field of vision (Sperling in Turnbull and Baird 1975, 24). The best example of this is the mechanical process by which television creates the impression of a continuously moving picture. In fact, television is comprised of a series of still pictures traced on a screen. The Visual STM holds the image seen on a TV screen long enough for the next image to appear to create the impression of continuity.

The second physiological process is short term memory (STM). When the images are transmitted to the brain and register, there are three possible actions. First, the image may be wholly or in part forgotten. Second, significant portions may move to STM where they are held until the brain can further process them. Third, any portions of information determined to be potentially useful in the future are stored in Long Term Memory (LTM) (Turnbull and Baird 1975, 25-26).
Storage in VSTM, STM or LTM relates to comprehension of the message. Specifically, storage in LTM constitutes internalization of the message.

Communication Variables: A Summary

Communication is a process. As such it is an ongoing, ever-changing entity. In order to research a process to better understand it, the process must be frozen in time. Each of the variables comprising the overall process must be held constant or controlled so the particular variable of interest can be manipulated and analyzed for effect (Tortoriello et al. 1978, 9). The difficulty arises when the process is arrested for study. By freezing the process, the potential arises that some dimensions and relationships are changed.

Lasswell’s model is primarily useful as a broadly-scoped communication paradigm. It oversimplifies the complex process of information exchange and understanding (McQuail and Windahl 1981, 10). However, it seems to characterize potential communication variable categories.

Who. The communicator or message originator is a significant variable as shown by several studies relating to source credibility and comprehension (Aronson et al. 1963; Lerbinger 1972; Stenthal et al. 1978; O’Reilly and Roberts 1976). Research measuring source credibility has depended on Likert five-point scales or semantic differential scales with
scores derived from adding the expressed values as being a valid measure of the respondent’s opinion toward the credibility of the source (Bowers 1970, 65). In general, the greater the perception of the source’s credibility, the more efficient is communication in its effect on alterations in message comprehension or receiver behavior.

**Message.** The message produced in communication processes has been widely researched through content analysis in various organizational settings. Usually, studies relevant to message comprehension use readability as a primary variable. As early as 1935, Gray and Leary discussed sixty-four different aspects of printed prose affecting readability (Newsom and Carrell 1986, 415), although Tinker distinguished legibility as a different issue (Tinker 1963, 5). Among the variables that may affect readability are reader motivation (reader self-interest), conceptual difficulty (content), organization, format variations and print type style (visual aspects) (Mendelson 1987, 5). Sixty-four variables affecting readability made creation of a predictive device almost prohibitive, so most researchers, including Flesch, Gunning and Dale-Chall, concentrate on two readability aspects, sentence length and word length, as primary measurement dimensions (Newsom and Carrell 1986, 415). Studies using these formulas find that specific measurement ranges, achieved by calculating ratios between
word length and sentence length, identify printed material that is easier to read. In general, little appears in the literature concerning the effect that visual elements of correspondence have on readability, comprehension and internalization of meaning.

Medium. Medium effectiveness in contributing to comprehension has been studied from different aspects including the differences between oral and written communication (McGuire 1969), finding that written communication achieves better comprehension than oral communication (Newsom and Carrell 1986, 27). However, studies have shown that written material is easier to read when it is of a consistent, regular font rather than a mix of fonts, cases and sizes (Sanocki 1987, 268). Previous studies have used experimental designs to isolate the legibility or readability of type faces. In general, legibility investigations have been made using speed of perception, perception at distance and perception in peripheral vision as methods of investigation (Tinker 1963). Readability investigation has tested text administered to readers with comprehension examined immediately following reading passages (Flesch 1948; Gunning 1968; Dale-Chall 1952). This technique is widely used in education for determining reading levels of students and in testing by Educational Testing Service in Princeton, New Jersey (Lynch 1970, 320). But there is little attempt to
relate ease of reading to internalization of content beyond generalizations and assumptions. In general, with the exception of work done specifically on type fonts, little appears in the literature concerning the selection of a medium to carry the information and, specifically, the visual tools available within the medium’s limitations.

One of the few allusions to visual tools was made by Duddy and Freeman (1936) when they acknowledged that attention-getting appearance to gain the reader’s attention was important to ensure the reader reached a point to make a judgment about interest in the content. Attention, they suggested, was a function of form, although interest is a function of the message itself (Duddy and Freeman 1936, 160).

Specifically, they suggest:

The physical appearance the form is to assume, the use of photographs or drawings, the arrangement of type and pictures in a pleasing layout, the breaking of typed matter into paragraphs which catch the reader's eye and be easy to read, the use of subheads and sideheads, the choice of attractive quality papers and styles of type, the use of colored inks — the problem is one of sending one's ideas out in the best clothes one can afford for them (Duddy and Freeman 1936, 164).

**Audience.** The audience or receiver is an important variable because individual perceptions of the source, previous experience held in memory and education level each contribute to perceptions of self-interest. Higher levels of these perceptions seem to relate to higher levels of
comprehension among receivers (Simon and March 1955; Gerbner 1956). Readability of type fonts may depend on internalized knowledge and what each individual perceives that letters and words should look like based on the task the letters are performing (Sanocki 1987, 271). The response of an individual to written correspondence, then, is a result of complex reaction to internal and external stimuli and the receiver's perception as illustrated in Figure 4 by Simon and March's model.

Fig. 4. Simon and March's model illustrating the internal influences experienced by individuals during the learning process.

Effect. Communication effects have been studied most of all, including from the viewpoint of attitude change (McGuire 1973; Watts and McGuire 1969; Fitzsimmons and Osburn 1968) and behavior change (Cantril 1940; Fitzsimmons and Osburn
1968; Frederick and Stein 1985). In general, attempts to experiment with communication variables can be placed into two categories. First is the effects of personal and oral environmental variables on messages produced by the sender. Second is the effects the messages have on the receiver (Bowers 1970, 65). The first type of research requires content analysis of the message while holding the environmental variables under control. It is the type referred to in the message section of this proposal. The second category requires some measurement of the internalization of the message by the receiver. Comprehension has been an extremely difficult variable to measure. According to Bowers, most methods have positive attributes as well as drawbacks, although the easiest procedure to administer while remaining as valid as any other is Taylor’s Cloze Method (Bowers 1970, 65). In spite of Bowers’ acceptance of cloze procedure, major assumptions must be adopted if cloze procedure is to serve as a surrogate for comprehension (Williams 1970, 271).

Methods of Inquiry into Communication

Three basic categories of testing readability and legibility are suggested in the literature. First, eye movement studies use sophisticated mechanical, electronic and computer technology to determine which attributes of printed material are most often the determinant for eye attraction (Reynolds 1984, 193). Tachistoscopes, binocular rivalry test
and "eye cameras" are used in these tests (Turnbull and Baird 1975, 63). Second, rate of work testing examines the amount of text that can be read in a given amount of time as a surrogate for ease of reading and/or legibility of characters (Reynolds 1984, 193). Difficulties in using this method involve the relative insensitivity in measurement discrimination of reading passages aloud and the difficulty of accurately measuring silent reading rates without some form of comprehension testing. For legibility testing, which primarily seeks to determine perception of letters or words, comprehension, requiring internal levels of reading ability, introduces unwanted variables (Reynolds 1984, 194). Third, reader preference has been used to determine the legibility of typefaces. In general, this method may have introduced spurious variables such as individual's meaning associated with appearance of type faces. In one case, respondents preferred type styles that made words easier to recognize as units (Tinker 1963). And in another, subjects preferred type styles which they were comfortable with because of long-term exposure dating to early reading primers (Burt 1959).

The variables of interest in this study are shown in Table 2. The type of variable, independent variable (IV) or dependent variable (DV), and the measurement technique to be used are also shown.
### TABLE 1

RESEARCH METHODS IN COMMUNICATION

<table>
<thead>
<tr>
<th>Author</th>
<th>Date</th>
<th>Method</th>
<th>Variables</th>
<th>Features of Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hartley et al</td>
<td>1975</td>
<td>Rate of Work</td>
<td>Legibility</td>
<td>College Students</td>
</tr>
<tr>
<td>Poulton</td>
<td>1969</td>
<td>Rate of Work</td>
<td>Legibility</td>
<td>College Students</td>
</tr>
<tr>
<td>Tinker</td>
<td>1963</td>
<td>Time-Comprehension</td>
<td>Legibility/readability</td>
<td>College Students</td>
</tr>
<tr>
<td>Burt</td>
<td>1959</td>
<td>Time-Comprehension</td>
<td>Legibility/preference</td>
<td>College Students</td>
</tr>
<tr>
<td>Sanocki</td>
<td>1986</td>
<td>Short Exposure</td>
<td>Legibility</td>
<td>College Students</td>
</tr>
<tr>
<td>Flesch</td>
<td>1948</td>
<td>Time Comprehension</td>
<td>Readability</td>
<td>College Students</td>
</tr>
<tr>
<td>Taylor</td>
<td>1952</td>
<td>Time Comprehension</td>
<td>Readability/comprehension</td>
<td>College Students</td>
</tr>
<tr>
<td>Taylor</td>
<td>1957</td>
<td>Time Comprehension</td>
<td>Readability/comprehension</td>
<td>Military Personnel</td>
</tr>
</tbody>
</table>

### TABLE 2

VARIABLES OF INTEREST IN THE COMPREHENSION PROCESS

<table>
<thead>
<tr>
<th>Variable</th>
<th>Type</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source Credibility</td>
<td>IV</td>
<td>Single Source/Likert Scale</td>
</tr>
<tr>
<td>Form</td>
<td>IV</td>
<td>Categorize</td>
</tr>
<tr>
<td>Content of Message</td>
<td>IV</td>
<td>Categorize</td>
</tr>
<tr>
<td>Readability of Message</td>
<td>IV</td>
<td>Flesch's Readability Index</td>
</tr>
<tr>
<td>Self-Interest</td>
<td>IV</td>
<td>Likert Scale</td>
</tr>
<tr>
<td>Visual Aspect</td>
<td>IV</td>
<td>Categorize and Likert Scale</td>
</tr>
<tr>
<td>Cloze Score</td>
<td>DV</td>
<td>Cloze Procedure</td>
</tr>
</tbody>
</table>
The Model of Receiver Comprehension

The variables identified as substantially contributing to comprehension might be arranged into a hierarchical order to represent their contributions to comprehension. Since the arrangement relates to comprehension processes internal to the correspondence receiver, it is called the "Model of Receiver Comprehension of Written Communication" and is illustrated in Figure 5.

![Diagram](image)

Fig. 5. Suggested model of variable interaction in reader comprehension of written correspondence.

The Model of Receiver Comprehension of Written Communication is characterized with four domains. First, Attraction, comprised of the lowest order variables in the process, is the domain where the reader becomes aware of the correspondence and is attracted to focus attention on the
material in preparation to read it. Second, Detection, comprised of the next higher order of variables in the process, is the perception by the reader of the written material's mechanical components. Third, Motivation, comprised of the highest order variables in the process, is the reader's internal dimensions that provide interpretation and meaning to the symbols, semantic and graphic, that transmit the intended, or unintended meaning, of the correspondence. Fourth, Outcome is the result of the comprehension process.

Attraction. One of the earliest allusions to attraction was made by Duddy and Freeman when they acknowledged that attention-getting appearance to gain the reader's attention was important to ensure the reader reached a point to make a judgment about interest in the content. Attention, they suggested, was a function of form (Duddy and Freeman 1936, 160).

A recent inquiry of workers indicated additional characteristics of written communication contributed to attraction. Some workers were more attracted to some categories of correspondence than they were to others. For example, memo format seemed to draw less immediate reader attention than did a formal letter or a telegram. In this model, the format categories with their attraction ability have been called the form of the correspondence in order to include other form characteristics such as impersonal
addressing, stereotyped production and preconceived status of written material. The visual appeal of the written correspondence has been segregated from form and includes legibility of the text, graphic appeal of the text layout and physical characteristics of the piece's production including paper type, condition and reproduction quality. These variables may be significant in their own right; however, they may have their greatest significance in interaction with higher order variables in the model.

Detection. This domain covers the mechanical production of the content of the written material and its relationship to the ability of the reader to interpret meaning from the correspondence. In general, the primary objective of this domain is to reduce potential resistance from the reader to experiencing the information. Subject refers to the content of the correspondence. Is it something personal about the reader? Is it information he or she needs to perform a job task? Readability covers two concepts. First, it deals with the complexity of the subject. Highly technical information written using limited technological jargon may be too complex for even moderately trained readers to have a sufficient understanding of symbols from which to derive meaning. Second, it deals with sentence construction and word selection of symbols to encode meaning. Graphic Treatment refers to the use of techniques and capabilities introduced
by new office-based printing technologies to enhance meaning through the use of graphic symbolization. Foremost among these techniques are graphic representation of information instead of traditional paragraphs of text. Additionally, use of typesetting technology to create written material usually produced using standard office equipment may access symbolization in readers' minds associated with previous experience with specific "looks" of correspondence. For example, if a reader is used to seeing typeset, serifed type on expensive, well executed marketing pieces, positive symbols of information transmission may be accessed if the same appearance is used for memos or letters. Again, each of these variables may make its own contribution to the outcome domain; however, it is more likely that each variable as an interaction term with higher order variables may be highly significant contributors to information transmission effectiveness.

Motivation. In this domain, the psychological aspects of the decoding process come into focus. Once the reader's attention has been attained and resistance to receiving the information has been reduced, the reader then begins to make judgments about the information that determines the ultimate effect of the information dissemination process. The perception of Self-interest on the part of the reader contributes greatly to whether or not the information is
disregarded or filed in the mind for future use. The greater the degree of Self-interest, the more likely the reader is to assimilate the information. Source Credibility refers to the reader's perception of the competence, trustworthiness and dependability of the person who originated the correspondence. Although these variables by themselves make significant contributions to variations in reader comprehension, as shown in the literature, interaction between the motivation domain variables and lower order variables may prove to explain even more significant variations in readers' long-term comprehension of written correspondence. In particular, recent technological advances permit treatment of information in correspondence with graphic symbolization previously reserved for very expensive and time consuming production processes. Readers' previous conditioning in interpreting these graphic symbols may serve in interaction with self-interest or source credibility to enhance the effect these variables normally have on comprehension.

**Outcome.** The outcome domain is the bottom line of the model. The desired results of written communication are for the reader to alter Behavior or to Internalize information for future use. The interaction of the Attraction, Detection and Motivation domain variables may initialize preconditioned symbol interpretation that enhances the self-interest and
source credibility variables in explaining individuals’ increased internalization and subsequent behavior.

Summary

This study’s interest is the impact that using new technology has on communication effectiveness. The importance of symbols as vehicles for meaning interpretation and transmission is evident. Communication effectiveness is a result of the efficiency of symbols in transferring meaning from one individual to another. Word selection is one of the most obvious symbol-encoding processes through which a message sender communicates to a receiver. However, the visual aspects of written correspondence are subject to interpretation as significant symbols depending on the receiver’s experience with the visual elements. The objective of this inquiry is to investigate whether or not the interpretation of visual symbols enhanced using new computer technology can be used to increase communication effectiveness.
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CHAPTER 3

THE METHODOLOGY

This study investigates the relationship between visual enhancements of written correspondence and variations in comprehension among internal communication receivers. In order to investigate this relationship, the objective of data gathering is to meet the needs of analysis while permitting generalization to business situations.

The Data

The data resulting from this research are of two types: primary and secondary.

Primary Data. Primary data gathered for this study include that resulting from using Taylor's Cloze Procedure for determining subjects' cloze scores for comprehension, redundancy utilization and knowledge recall for text passages. Data generated using Likert 5-point scales are used to determine source credibility and respondents' self-interest in the messages being treated. These data are categorical, although they are treated as interval data for the purposes of analysis. A third type of primary data is the content of written communication serving as the subjects of the questionnaire. Based on content analysis, these data are nominal. Although each data category is represented by different units of
measure, each is maintained consistently throughout the analysis so that interpretation of results is in original units. The Multiple Regression/Correlation procedure permits incorporation of original unit data for the purposes of analysis (Cohen and Cohen 1983, 385).

Secondary Data. Data from previous research and dissertations and that contained in books and texts constitute a type of secondary data. These data are significant in the isolation of variables and the theoretical construct upon which this investigation is based.

The Criteria for Admissibility of the Data

Only data resulting from the responses by control and treatment group members are admissible for analysis. Members defined at the beginning of the measurement period are maintained throughout the measurement term. Only data produced in accordance with the instructions in the questionnaire are used for analysis.

The Research Methodology

One of the primary concerns in designing this study is the moderate to low correlation between independent variables, such as attitudes, and a dependent variable, such as behavior, in most social science research (Lodge 1981). Reasons suggested for such results include the use of self-administered questionnaires using survey methodology for
gathering attitude data (Lodge 1981), lack of control of intervening variables (Cliff 1973, 497) and research designs that offer little control over validity threats (Dawson 1982, 173).

The Design. In general, most communication research using comprehension as a dependent variable has used either an experimental, posttest or pretest/posttest design in an effort to establish control over external validity threats to data (Hoveland et al. 1953; Tinker 1963; Burt 1959). Most sample populations consisted of students at various reading levels to permit near-laboratory conditions in the experiment design structure. Although these designs and conditions allow for spurious variable control, they severely limit generalizations that might be made from conclusions generated by the experimentation.

This research is a modification of a quasi-experimental design called “interrupted time series with a non-equivalent, no-treatment control group time series” (Cooke and Campbell 1979, 214), “a multiple time series design” (Campbell and Stanley 1963, 55) or “control group time series design” (Leedy 1985, 215). It is represented schematically as illustrated in Figure 6.

This design is selected for the control it introduces over most threats to internal validity of the data (Campbell
Fig. 6. Modified time series quasi-experimental design.

and Stanley 1963, 56). Of concern are threats to external validity, the most potentially contaminating of which is the interaction of the treatment and the fact that the treatment group is being tested (Campbell and Stanley 1963, 56; Cooke and Campbell 1979, 216). The advantage of this design is that the treatment's effect potentially is demonstrated twice—once between control and treatment groups and again between pretreatment and posttreatment in the treatment group. The design is also selected to reduce the potential of experimenter effect in cloze score measurement. It is conceivable that, following the treatment's introduction, respondents would be more sensitive to changes in internal communication than they might otherwise experience. Measurements over time may serve to mitigate the effect so that the treatment is accepted as a standard operating procedure.

The Questionnaire. The most difficult issue in selecting instrumentation is gathering data on comprehension (Bowers 1970, 65). Subjects' ability to recall specific information has been used in experiments where subjects were exposed to oral or written messages followed immediately by
question administration. Such techniques are questioned as valid internalization measurements since the primary domain of measurement is comprehension associated with Short Term Memory (STM). Since questions would have to be written for every item of correspondence included in this study, the question technique is discarded in favor of Taylor's Cloze Procedure (Taylor 1953) where the specific messages to be included in the study are reproduced with every nth word deleted. Subjects are asked to fill in the missing words. The number of correctly filled in words is the subject's cloze score. Administration of the questionnaire is made more than twenty minutes after subjects' exposure to the message to ensure that the cloze measurement stands a better chance of representing internalization of message content into Long Term Memory (LTM).

Additionally, the questionnaire contains sections to establish a score for source credibility and subjects' self-interest level regarding the message. Likert 5-point scales are used to determine scores for these variables. An example of the questionnaire is included as Appendix A.

The Procedure

**Institutional Setting.** Previous studies have used college campuses or other locations where populations of students were available to the researchers (Tinker 1963; Sanocki 1987). These settings limit the generalizations that can be
made from generated data. Some researchers have used students as data gatherers to interview business people. However, the students were left to define their own subjects in both identification and number (Turnbull and Baird 1975).

This quasi-experiment is performed at a major hospital in the Southwestern United States. The hospital employs more than 6,000 people at five locations in North Texas, although this study concentrates on a population comprised of the unit and departmental directors at the main facility.

Subjects. Previous studies investigating similar relationships to those of interest to this study have relied on sample populations comprised of students at various reading levels and ages. Legibility experimentation has used samples ranging from college freshmen to graduate students (Tinker 1963). Readability experimentation relies heavily on college students, presumably because of ready availability of large numbers of subjects and the ability to install mechanical controls over spurious variables (Sanocki 1987; Simon and March 1955; Tinker 1963; Burt 1952; Klare 1984). The greatest concern for such sample populations is that the ability to generalize to application populations is jeopardized for the sake of mechanical controls over external validity. For this reason, the sample population for this study are workers in an operating firm. The conclusions drawn from data generated from this sample may be more generalizable to broader
applications. The subjects for this study are 104 full-time hospital employees, in mid- and upper-management positions. Sources of internal communication are selected as originators for all internal correspondence included in the study. Regular audiences for internal correspondence are identified and considered the population "pool" for the purposes of this study. The population pool is used as the source for randomly selecting subjects for observation. Observations are continued until approximately 150 pretreatment and 150 post-treatment observations are obtained as the sample for analysis.

As noted previously, one major concern in the suggested quasi-experimental design is the threat to external validity introduced by subject's informal determination that some kind of testing is occurring. This may result in contamination of the experimental effect by a possible order effect (Robson 1974, 26). Counterbalancing is one method used in an attempt to overcome order effect (Robson 1974, 27). The order effect occurs when the task to be performed in an experiment contains the possibility that scores may improve merely by the fact that the procedures are repeated and subjects become more familiar with the task or the experiment. Simple order effect can be reduced by assigning half of the subjects to one procedure and the other half to a second procedure with the intent that the additional procedure will eliminate any
spurious effect on the dependent variable (Robson 1974, 27). An alternative to counterbalancing is randomization (Robson 1974, 28).

Randomization is the technique that selects a sample in such a way that "the characteristics of each of the units of the sample approximates the broad characteristics inherent in the total population" (Leedy 1980, 147). A truly random selection from a population produces a sample that retains its characteristic relationships with the population, regardless of how many samples are drawn over time (Leedy 1980, 148). In order to accomplish this, every combination of elements in a sample of specific size must have an equal chance of selection (Van Matre and Gilbreath 1980, 175).

For this research, the names of 104 employees identified as the population pool are arranged alphabetically and numbered sequentially providing the essential systematic numbering procedure (Leedy 1980, 148). Each time a piece of correspondence is released for distribution, one hundred random integers are generated and the names corresponding to the first ten nonrepeated integers comprise the sample for that correspondence distribution. Following fifteen correspondence issuances, the population pool is randomly divided into treatment and control pools from which random samples of five treatment and five control individuals are
selected at each correspondence issuance. This procedure continues through fifteen correspondence issuances.

Treatment. The study is designed to measure the impact of some of the visual elements of written internal communication. The hospital's employees produce considerable numbers of written memos, reports and other internal correspondence. The usual method of producing these printed materials is on a standard office typewriter or output on a dot matrix printer attached to a word processing computer. The treatment consists of producing usual types of internal correspondence intended for a regular audience on near-typeset quality printing equipment. Visual aspects manipulated as an independent variable are the type font and the use of boldface and italics as emphasis to major points of the message. The equivalent technique for emphasizing typewriter-produced material is underlining.

Some visual aspects are standardized to control for other variables that have been found to influence readability, legibility and comprehension. All treated and untreated correspondence is produced on 8 1/2 X 11 bond paper used by the organization as standard correspondence paper. All type characters are produced in black ink on white paper. Typewriter type for control correspondence is produced on an IBM Selectric typewriter using prestige elite type. Treated correspondence is produced using near-typeset quality
characters generated by a laser printer that is a part of an electronic publishing configuration. The resident font called Times (equivalent to Times Roman) in 12-point size is the standard type used. Both treated and untreated correspondence use a 6-inch line length, well within the limits for maximum legibility for both typefaces.

**Dependent Variable.** In this research there is one dependent variable: internalized information. The surrogate variable for internalization is cloze score, the number of replaced words deleted from text passages. The Cloze Procedure, originally suggested as a readability measure, has been found to access a number of characteristics related to the recall process. Although Cloze procedure measures clusters of variables, including verbal comprehension, rote memory/flexible recall and redundancy utilization, its value to this study is its ability to rank and correlate reading passages consistently over time and test administrations (Weaver and Kingston 1963; Klare 1984, 489). In the cases of Flesch's, Gunning's and Dale-Chall's formulas, the readability formula is a mechanical process applied to a reading passage by the person wanting to determine the passage's reading level and applied as a predictor of subjects' comprehension of text passages. In the case of cloze scores, judgment is determined by the subject who is asked to reconstruct a reading passage. It is assumed that
readability scores and cloze scores will result in consistent rankings across the sample as long as all other variables remain unchanged. Changes in cloze score rankings may be interpreted as revealing a manipulated variable’s contribution effects on the comprehension elements that cloze procedure measures, if they are found between treated and untreated written correspondence. It is assumed for this study that cloze scores resulting from exposure to text passages beyond the threshold for long term memory activation represent internalized processes regarding the subject matter. Subjects’ random assignments to treatment and control groups control for redundancy utilization and prior knowledge variables in cloze scores. It is assumed that random selection results in random assignment of subjects with previous knowledge of the subject material or with greater ability to predict word use in text passages. The total number of accurately replaced words results in a cloze score to be used as the dependent variable in analysis.

**Independent Variables.** The independent variables are:

*Form.* The form for the internal correspondence is categorized at the time it is released by the source for production and distribution to receivers. Form is defined as one of the following categories: (1) internal memo, (2) internal letter, (3) internal report or proposal, (4) electronic mail, and (5) printed material to support oral presentation.
These categories were selected after personal interviews with representatives from a number of business firms who were asked to identify the types of internal communication correspondence relevant to their organizations. These five are the general categories describing the types of correspondence identified by the workers. For the purposes of this study, only the first three types of internal communication are included in the study materials.

Message Content. The content is characterized in the following categories: (1) personal matter, (2) personnel matter, (3) salary or benefits matter, (4) job-specific information, (5) operational policies, (6) operational procedures, and (7) announcements.

Katz and Kahn identify five categories of downward internal communication: job instruction, job rationale, policy or procedure, feedback and indoctrination. They suggest that horizontal and diagonal communication are used primarily for coordination of organizational activities. Upward communication, generally, is used by an individual to inform superiors about himself or herself, his or her activities or problems, about others and their problems, about organizational policies and practices, and about needs and actions required (Katz and Kahn 1966, 239-45).

Communication content of internal communication, then, may be characterized into seven categories regardless of
communication flow direction. The first category is personal matters. This category includes any communication where the worker is the topic of the communication. Job instructions, feedback or reporting personal activities relating to the organization's activities are characterized here. Second is all communication relating to broader personnel matters such as memoranda or letters to or from a manager regarding personnel in his or her unit. This category also includes personnel matters such as parking lot regulations, lunch-break time assignment and the like. The third category, salary and benefits matters, includes any topics relating to salary and benefit issues that are of general interest to organization members. For example, these may include addition of dental benefits or cost-of-living wage increases. These topics do not address the communication receiver specifically, but rather as a member of the whole. Any specific salary or benefit topics (a raise or specific vacation time) are categorized as personal matters. The fourth category, job-specific information, relates to information used by the receiver in job performance such as research reports, marketing reports, budget reports or other types of data. The fifth category, organizational policies, includes communication regarding the administrative policies of the organization. This category includes such policies as, "The company will adopt a 'no comment' philosophy in all
contact with news media." The sixth category, organization procedures, includes communication directing activities on an organization or department level such as, "your department will now route all residual contract compliance orders for approval to the lease rentals department instead of to district managers." The seventh category includes all announcements not relating to other categories such as promotions within the organization, non-job influencing acquisitions, retirement announcements, company picnics and the like.

Readability. The readability score is characterized by a score determined through application of Flesch's readability formula (Flesch 1974):

Reading Ease = 206.835 - (84.6 x awl) - (1.015 x asl)

where:
awl = average word length in a 100-word sample (the number of syllables in the sample divided by the number of words in the sample)
asl = average sentence length (the number of words in the sample divided by the number of sentences in the sample)

Of the three primary readability measures receiving the widest use in communication research, Flesch's method is the most positive in philosophy as a reading ease measurement represented by an index number. Although Gunning's formula is easier to apply, the philosophy that it measures reading difficulty seems negative in its approach to measurement. In
addition, the attempt to compare the results calculated from Gunning's formula to grade levels potentially is misleading, especially if conclusions relating to education levels are included. The human interest calculation included by Flesch is discarded for this study because it originally was applied to text in newspaper readability studies. Since this form of text is irrelevant to the current study, the human interest calculation is not perceived to contribute any useful information.

Source Credibility. The source credibility score is defined as the sum of the scores of source credibility statements in the questionnaire. These statements determine the subject's perception of the knowledge, competence and ability of the correspondence originator. The eleven statements comprising this section were selected using item analysis technique to establish reliability (Emory 1985, 252). An original pool of one hundred statements, half of which were worded negatively toward source credibility and half positively, was reduced by asking fifty-nine students (juniors and seniors) at North Texas State University to respond to the statements using university administrators as communication source. Each statement's responses were summed and divided into quartriles. The high and low quartriles for each question were analyzed to determine those with the highest t-scores. High t-scores were assumed to assure
nonredundancy among the statements reflecting a single concept. The ten statements with the highest t-scores were selected for the questionnaire. A tie at number eight suggested that eleven statements would comprise this section.

Self-interest. The self-interest score represents the perception of the respondent related to the level of reader motivation toward the content. In addition to interest in specific content, reader motivation potentially results from a number of variables including whether or not the correspondence is personally addressed to the receiver, the type of paper it is printed on, the type of mailing label used to address carriers (such as standard mail envelopes or interoffice mail envelopes) or the amount of postage used to mail it through U.S. Postal System. The self-interest score is determined by summing the self-interest related statements in the questionnaire. Again, the item analysis technique was used to select the ten statements included in the questionnaire from a pool of one hundred.

Other Variables. Some of the other variables that could contribute to explaining variance in the dependent variable are controlled by randomly assigning subjects to control and treatment groups and by standardizing some visual aspects of correspondence production. The standardized visual aspects are detailed in the treatment section. Two other variables used as controls are whether or not the measurements are
pretreatment or posttreatment sets and the number of days elapsed since the subject received the referenced internal correspondence.

**Instrument.** The data-gathering instrument is an original questionnaire. A 150-word passage from the original message is reproduced in the questionnaire with every fifth word deleted, beginning with a randomly selected word. This cloze procedure, selected because it eliminates the need to validate question sets for each item included in the study, indicates the subject’s ability to reconstruct specific message content as a measure of information internalization. Statements using Likert 5-point scales for responses and selected using the item analysis technique (Emory 1985) are used to determine the respondent’s opinion of the source’s credibility, perception of self-interest in the subject and opinion about the visual appearance of the correspondence. The statements comprising the source credibility and self-interest sections were reviewed to determine which, if any, could be stated either positively or negatively. The statements so identified were worded either positively or negatively at random determined by flipping a coin. The statements were then numbered sequentially. A set of random integers was generated using the uniform random integer subroutine in the Systat statistical analysis package. The statements are ordered in the questionnaire to reflect the
random order generated. Categorical data are used to identify the form of the correspondence, the subject matter and whether or not the correspondence is treated or untreated. A sample questionnaire is in Appendix A.

**Reliability.** Reliability of the internal correspondence form and subject categorizing is determined by submitting the categories' operational definitions to a judging panel who use the definitions as the basis for categorizing correspondence randomly selected from those included in the study. The correlations between the categories applied by the researcher and those determined by the judging panel indicate the reliability of the categorization.

Reliability of the constructs in the questionnaire are measured using the internal consistency method called "Cronbach's alpha" (Carmines and Zeller 1979, 43-44). This method establishes correlation between responses for all items relating to a specific construct within the questionnaire. For example, all items in the questionnaire relating to self-interest are analyzed using Cronbach’s alpha, as are all items relating to source credibility. The alpha is calculated using the formula:

\[
\alpha = \frac{N \bar{\rho}}{1 + \bar{\rho}(N-1)}
\]

where:

- \(\alpha\) = the Cronbach alpha correlation
- \(\bar{\rho}\) = mean correlation of all items
- \(N\) = number of items in the questionnaire relating to the construct
Cronbach's alpha is selected to eliminate potential weakness in reliability measurement found in other methods, such as split halves method, retest method and alternate forms method (Carmines and Zeller 1979).

Specific Treatment of the Data

Problem One. The first problem is to determine the impact of internal correspondence visual appeal, defined as near-typeset quality text and graphic appearance, on cloze scores for message content in specific communication material.

The Data Needed. The data needed for meeting this problem are (a) the names of personnel receiving internal correspondence from the selected source, (b) the responses from these subjects to the cloze procedure section of the questionnaire, (c) the responses from the subjects to the self-interest and source credibility sections of the questionnaire, (d) the form, reading ease and content of the internal correspondence and, (e) whether or not the correspondence was treated.

The Data Location. The personnel identification data are located in the files of the selected source. Examination of these files indicates who receives regular internal correspondence from the source.
The responses from the subjects to cloze procedure, self-interest and source credibility statements are gathered from the individuals in the treatment and control groups.

The form, readability, content and treatment data are located in each internal communication document issued by the selected source.

Means of Obtaining the Data. The identification data are requested from the selected source. The cloze score, self-interest and source credibility response data are determined through questionnaire administration during personal interviews with randomly selected subjects.

The form, content and readability data are determined at the time the source releases the text for production prior to distribution.

Treatment of the Data. Multiple Regression/Correlation (MRC) analysis is selected because it not only calculates an analysis of variance (ANOVA) among all variables, but also measures the magnitude of the relationship of independent variables to the dependent variable, including their partial relationships. MRC is a particularly useful analytical tool for two reasons. First, it detects the portions of explained variance in the DV that are unique to each IV. Second, it detects redundancy and suppression among the IVs as they interact with the DV (Cohen and Cohen 1983, 3). MRC's general model is:
\[ y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \ldots + \beta_k x_{iK} + \epsilon_i \]

where:

- \( y_i \) = value of the dependent variable for the \( i \)th observation;
- \( x_{i1} \) = value of IV number 1 for the \( i \)th observation;
- \( x_{iK} \) = value of IV number \( K \) for the \( i \)th observation;
- \( \beta_0, \beta_1, \ldots, \beta_k \) = Parameters;
- \( \epsilon_i \) = value of the error term for the \( i \)th observation.

(Van Matre and Gilbreath 1980, 387)

Specifically, hierarchical analysis is the primary analytical strategy. Here, \( k \) IVs enter analysis cumulatively in a prescribed sequence with the \( R^2 \) (explained variance) and semipartial coefficients (\( sr \); unique contribution to the DV for the IV) calculated as each IV enters. A full hierarchical analysis is, in fact, a series of MRC calculations. The hierarchy (sequence of IV introduction) is specified to meet the purposes and logic of the research. Criteria for determining the sequence include causal priority, removal of confounding or spurious relationships and research relevance (Cohen and Cohen 1983, 120).

Further, in a pretest/posttest structure for data gathering to detect change over time introduced by the treatment, hierarchical analysis produces the equivalent of an Analysis of Covariance (ACV) if the posttest score is used as the dependent variable and the pretest score is entered into the analysis as the first IV. When subsequent IVs are
entered, their partial correlation coefficients will reflect relationship to the DV with the prescore influence removed (Cohen and Cohen 1983, 122).

**Interpretation of the Data.** For purposes of determining significance for statistical procedures applied in this analysis, the significance level tested is:

\[ \alpha = 0.05 \]

**Significant correlations.** The first point of interpretation is to apply Bartlett’s chi-square test to the data’s correlation matrix to determine if enough correlations are significantly different to justify continuing the analysis (Gorsuch 1974, 136-37). It is possible that there are no significant differences in the correlation matrix. This test is to rule out such a possibility. Additionally, if attempts to define a determinant for the matrix fail, then the matrix has no solution and any further analysis is fruitless.

Bartlett’s chi-square formula is:

\[ \chi^2 = (-n - 1 - \frac{2v+5}{6}) \log e |R_{vv}| \]

where:

\( \chi^2 \) = chi-square distribution comparable to a chi-square table for significance at the appropriate degrees of freedom.

\( n \) = sample size

\( v \) = number of diagonal elements in the matrix
\( R_{vv} = \) the determinant of the correlation matrix

Degrees of freedom are calculated:

\[ df = v \frac{v - 1}{2} \]

In the event that the degrees of freedom exceed the limits of chi-square tables, the result may be transformed to a t statistic (Guilford in Gorsuch 1974, 137):

\[ t = \sqrt{2\chi^2} - \sqrt{2df - 1} \]

**Overall significance.** The analysis of variance is the second significant data interpretation point. The MRC calculates an overall ANOVA and the F-test for significance. If the F-test does not meet the preset significance criterion, then the analysis of each variable may be discontinued. Any significance of variation attributed to individual variables would be variation explainable by chance (Cohen and Cohen 1983).

**Analysis of residuals.** The third point of interpretation is to examine the residuals of the analysis. The estimated values’ residuals provide a way to evaluate the DV/IV model. The residuals’ mean, correlation with DV and the predicted value of the DV all equal zero. Their variance is minimized by the least-squares solution for regression constants. The residual’s distribution in relation to the DV or other values reveals flaws in the regression model that
may be corrected with additional mathematical techniques. (Cohen and Cohen 1983, 126).

If a pattern is revealed in plotting the residuals, then potential threats to data interpretation may be detected. For example, if the residuals plot with negative values for low and high values of the estimated value for the DV, then curvilinearity may be indicated for one or more of the IVs. Likewise, a different pattern may indicate heteroscedasticity in the variables. MRC provides procedures for detecting which of the IVs may introduce the residual patterns and for adjustment to remove the data influencing effects (Cohen and Cohen 1983, 125-30).

**Points of interpretation.** If the ANOVA indicates overall significance and Bartlett's test indicates that the matrix has significant correlations, then the individual IV analysis using the hierarchical procedure is done. The following are the points of interpretation.

The $R^2$ on the analysis printout represents the total explained variance in the dependent variable related to the effect of all the independent variables entered into the analysis to that point in time.

The $R^2$ Change is the amount of change introduced by the entering of the independent variable in that step in the hierarchical analysis. This indicates the amount of
explained variance attributed to the entering independent variable.

The F Change is the significance level of the change in R. This indicates whether or not the IV makes a statistically significant contribution to the change in explained variance.

The Beta and the Correlation permit interpretation of redundancy or suppression among the IVs in the analysis. Comparing Beta with Correlation provides the following indications:

1. If Beta is smaller than Correlation, then redundancy is present. This means that the IVs have an overlap in the explained variance. Each IV carries information about relationship to the DV that is also being supplied by other IVs (Cohen and Cohen 1983).

2. If Beta is larger than Correlation, then suppression is evident. This means that an IV has a suppressing effect on the relationship between another IV and the DV (Cohen and Cohen 1983).

**Problem Two.** The second research problem is to determine the impact of the visual aspects of internal communication correspondence in interaction with each of the other independent variables on cloze scores for message content for specific internal correspondence.
The Data Needed. The data needed to address this research problem are (a) the cloze scores from the questionnaire, (b) the responses from the self-interest portion of the questionnaire, (c) the type, reading ease and content of the internal correspondence, (d) whether or not the internal correspondence was treated or untreated, and (e) interaction calculations for sets of independent variables.

Location of the Data. The data for a, b, c, and d are the same data used to address problem one. The data for e must be calculated using the data a, b, c and d.

Means of Obtaining the Data. The data a, b, c, and d are already entered into analysis using the hierarchical strategy. The interactions of IVs are determined using sets of IVs constructed from data previously entered into the analysis (Cohen and Cohen 1983, 133). Since the primary IV of interest is the visual aspects of the test correspondence, it becomes one of the elements in the interaction terms. Interaction terms created for entry into analysis are shown in Table 3.

It is theoretically possible for there to be significant interactions among combinations of three or more of the variables; however, even in hierarchical analysis, interpretation of IVs calculated from three or more IVs would be highly suspect in interpretation credibility (Cohen and Cohen 1983). For this reason, interaction analysis is limited to two IVs.
Treatment of the Data. Analysis of Covariance (ACV) is accomplished using MRC by entering the independent variables in appropriate sets (Cohen and Cohen 1983, 379). The Covariate Set is comprised of all covariate independent variables. The Main Effect Set is comprised of the measurements representing membership in correspondence control or treatment populations. The Interaction Set is comprised of all interaction terms created as identified in Table 3.

<table>
<thead>
<tr>
<th>Interaction Terms</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Aspects X</td>
<td>Self-interest</td>
</tr>
<tr>
<td>Visual Aspects X</td>
<td>Source credibility</td>
</tr>
<tr>
<td>Visual Aspects X</td>
<td>Readability</td>
</tr>
<tr>
<td>Visual Aspects X</td>
<td>Content</td>
</tr>
<tr>
<td>Visual Aspects X</td>
<td>Form</td>
</tr>
<tr>
<td>Visual Aspects X</td>
<td>Days since receipt</td>
</tr>
<tr>
<td>Visual Aspects X</td>
<td>Pretest/Posttest</td>
</tr>
</tbody>
</table>

For set hierarchical analysis, the DV is first regressed on the Covariate set. The Main Effect set is entered into the hierarchical analysis. Finally, the Interaction set is entered into the hierarchical analysis (Cohen and Cohen 1983, 381).
Interpretation of the Data. First, the incremental increase in $R^2$ ($\Delta R^2$) is noted for the step when the Interaction set was entered into the analysis. If the $\Delta R^2$ reveals significance (shown as $F$ Change on the print out) at the prescribed level, then an analysis of covariance on the individual IVs is invalid (Cohen and Cohen 1983, 381). At that point only the interaction terms carry information that may be interpreted meaningfully. In addition to the full range of information, including semipartial and partial coefficients, this procedure of determining the overall significance of $\Delta R^2$ for the set provides protection from Type I errors. This control over Type I errors means that both the $F$-test and the subsequent $t$-tests performed on each interaction term become relatively powerful tools in inferring meaning from the statistics (Cohen and Cohen 1983, 173).

If the $\Delta R^2$ for the Interaction set is non-significant at the prescribed level, then the $\Delta R^2$ for the step when the Main Effect set was entered is noted. If $F$ change meets the significance criterion, then analysis of explained variance can center on the Main Effect variables. In the event that the Interaction and Main Effect sets' $\Delta R^2$s are non-significant, then the assumption can be made that this inquiry did not find significant variance explained by the variables of interest. However, any conclusion that there is no
relationship between the independent variable of interest and the dependent variable would not be appropriate (Cohen and Cohen 1983, 381).

Summary

This quasi-experimental field study is designed to investigate the relationship among visual enhancement of text in written communication and variations in comprehension among correspondence receivers. The focus of this inquiry is on determining the magnitude of variation among the variables of interest. Set strategy multiple regression/correlation analysis is selected to not only provide a method to determine the amount of variance explained by each of the variables of interest, but also because it provides the equivalent of an Analysis of Covariance if a variable representing pre- or posttreatment intrusion is included as the first variable in the covariate set. More important, Set MRC permits detection of conditional relationships among independent variables which may contribute significantly to variation in comprehension.
References


CHAPTER 4
THE RESULTS

This quasi-experimental field study’s implementation required almost six months of observation at the research site. The purpose of the research was to determine the effect of near-letter quality text in internal correspondence on receivers’ comprehension. To accomplish this, normal written communication flow between internal correspondence originators and a specific research population was monitored. Such a real-time situation required adjustments to the research design to ensure that data collected met research needs.

Adjustments to Research Design

The situation encountered at the research site required six adjustments to the research design from the design described in the methodology section. These adjustments were made to enhance the reliability of the data gathered and their subsequent analysis.

First, all correspondence issuances included in the observations were limited to memo format. No other types of internal correspondence were produced during the observation period and directed to the target population.
Second, because correspondence distribution frequency to
the target population was less than originally expected,
correspondence source was expanded to include all organiza-
tional administrators who directed information to the target
population. An additional independent variable was
introduced to categorize the correspondence originators.

Third, shortly after observation began, the organiza-
tion’s chief executive officer discussed at a weekly
administrators’ staff meeting the need to communicate more
effectively with subordinates. To control for possible
effect, an additional independent variable was included to
define whether correspondence was issued prior to or after
this administrative meeting’s intrusion.

Fourth, obtaining appointments to interview all ten sub-
jects included in the each randomly selected sample meant
that the time delay between correspondence issuance and sub-
ject interview varied. An additional independent variable
was included to record the number of days elapsing between
correspondence issuance and subject interview. This variable
assumed additional potential importance because the delay
between correspondence issuance and subject interview was
sometimes protracted when correspondence was issued on Friday
and interviews could not begin until Monday.

Fifth, after the monitoring of communication flow began,
it was discovered that some issuances of internal memos to
the study population were addressed using stick-on labels. In some instances, memos were taken to the mailroom in bulk and distributed on a number-per-unit/department system. This procedure variation required redesign of the randomization process to ensure that the integrity of treatment and control groups remained intact and that the experiment intrusion did not alter the normal communication flow. Department names were alphabetized and numbered sequentially. Random numbers were generated and the corresponding departments were assigned to control and treatment groups. Address labels were then created for subjects in each department. This procedural change introduced potential threat to study validity because some departments had as many as thirty-five receivers while others had as few as one. These differences in unit sizes may endanger the effectiveness of the randomization procedure as a control for confounding variables. The control group consisted of twenty-six departments with fifty-eight subjects. The treatment group consisted of sixty departments with sixty-five subjects. The change to ensure that all correspondence distributed used personal address labels may have an impact on self-interest among receivers. One statement in the questionnaire asks if any physical characteristic indicated to the receiver that the correspondence was or was not more or less important to read. This statement, included in the Self-interest measurement,
may control for the potential impact of individual addressing of all correspondence.

Sixth, low correspondence distribution frequency meant that externally imposed time constraints required terminating the experiment before observing the full number of issuances planned in the experiment's design. Instead of fifteen pretreatment and fifteen posttreatment issuances, fifteen pretreatment and ten posttreatment issuances were included in the study. A total of 250 observations are available for analysis.

**Gathering the Data**

Following issuances of internal communication, questionnaires were prepared incorporating appropriately selected text passages from the correspondence into the cloze section. A random number list provided the word count for the first word replaced by a seven-space blank line in the cloze passage. Every fifth word following was replaced by a seven-space blank line. A total of thirty blank words were contained in each of the 150-word text passages.

Appointments were made with subjects selected using the random selection procedure outlined in the methodology section. At the onset of each interview, the subject was asked to sign a consent form for participation. A statement concerning the anonymity of responses and disclaimer of any affiliation with the research site management was made. The
subject was then asked to reconstruct the text passage in the cloze section by replacing the exact words deleted. Upon completion, the subject was given a copy of the correspondence and asked to respond to statements read by the data gatherer using one of five responses: strongly agree, agree, no opinion, disagree and strongly disagree. Lastly, the subject was asked to respond to some demographic questions. No difficulty was encountered in collecting data from the subjects randomly selected for each memo issuance.

Categorical data such as pre/posttreatment, treated/control, subject, readability index, days since issuance, and author were determined and entered on the questionnaire. Completion of these steps resulted in one observation.

Preparation for Analysis

The data were entered to computer files by the researcher as the research progressed. At convenient times during the data gathering period, all observations entered since the previous data editing session were checked against the questionnaires to ensure that data were transcribed accurately. Any errors were corrected to reflect the data shown in the questionnaires. By the end of the data

---

1 All statistical procedures and random number generation were performed using routines in Systat: The System for Statistics operating on a Macintosh Plus computer with one megabyte of memory and a twenty megabyte hard disk. Some data plotting including stem and leaf plots of variables and residuals and plotting of residuals and estimates was done using Mystat: The personal statistics package.
gathering period, all data files had been double-checked against completed questionnaires for accuracy.

Prior to Multiple Regression/Correlation analysis, all categorical data were transformed into dummy variables (Cohen and Cohen 1983, 181) and stored in a file separate from the primary data file. Dummy variables used in MRC permit categorical data to be used as continuous data for full regression analysis. This provides a full array of numerical data available from MRC for use in interpreting meaning from the data.

Reliability

There are two primary reliability issues addressed. First is determining the reliability of the self-interest and source credibility statements. Second is determining the researcher's consistency in categorizing data requiring judgments using operational definitions.

Self-interest and Source Credibility. Cronbach's alpha (Carmines and Zeller 1979) is used to determine the reliability of the ten-statement set relating to self-interest and the eleven-statement set relating to source credibility. Self-interest statements exhibit $\alpha = 0.734$. Source credibility statements show $\alpha = 0.870$. Both alphas indicate relatively high confidence in the reliability of the statements as measuring the construct (Carmines and Zeller, 1979).
Categorical Variables. Categorizing the form of the correspondence offers no interrater reliability problem. All correspondence monitored conforms to the organization’s standard operating procedures regarding internal memos and, therefore, are classified as memos. Likewise, whether the correspondence is pretreatment or posttreatment, preintrusion or postintrusion, treated or untreated and the respondent’s gender are observable, physical characteristics requiring little, if any, judgment on the researcher’s part as to appropriate category.

The subject of each memo was classified at the time of correspondence issuance using one of the seven subject categories defined in the methodology section. Following the data gathering period’s end, ten memos were randomly selected from those used in the study and submitted to a five-person panel for classification. The panel was provided category definitions as defined in the methodology section.

Correlations of the panel’s classifications are compared to determine if correlation among judges on ten memos produces reasonable belief that the classifications are consistent. Cronbach’s Alpha for the judges’ categorizations is \( \alpha = 0.994 \). Table 4 shows the correlations among the judges. The table shows that there is high confidence in the consistency of subject category assignment using the operational definitions in Chapter 3.
### TABLE 4

INTERRATER CORRELATIONS FOR CLASSIFICATION JUDGMENTS  

\( (N=10) \)

<table>
<thead>
<tr>
<th></th>
<th>Judge 1</th>
<th>Judge 2</th>
<th>Judge 3</th>
<th>Judge 4</th>
<th>Judge 5</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Judge 1</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Judge 2</td>
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<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Judge 3</td>
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<td>1.000</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Judge 4</td>
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<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Judge 5</td>
<td>0.888</td>
<td>0.888</td>
<td>0.888</td>
<td>0.888</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>Data</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>0.888</td>
<td>1.000</td>
</tr>
</tbody>
</table>

### Data Inspection

All continuous independent and dependent variables are examined using stem and leaf plots to detect anomalies in the data's location and spread (Hartwig and Dearing 1979). Each of the plots is evaluated on four characteristics important in determining location and spread of the data: skewness, outliers, gap and multiple peaks (Hartwig and Dearing 1979).

First, the dependent variable, Cloze, shows slight skewness from a normal frequency distribution. The plot, shown in Figure 7, reveals that the data’s median of nineteen and mid range of five indicate a relatively narrow range of distribution. Although the plot shows skewness, the skewness
does not appear severe enough to threaten normal distribution assumptions by the MRC analysis. The single outlier in the plot also seems no threat to impose undue influence on the analysis. For this reason, the outlier is retained in the data set for all analyses. The gap appears to result from the outlier and no true multiple peaks are interpreted.

<table>
<thead>
<tr>
<th>MINIMUM IS:</th>
<th>10.000</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOWER HINGE IS:</td>
<td>17.000</td>
</tr>
<tr>
<td>MEDIAN IS:</td>
<td>19.000</td>
</tr>
<tr>
<td>UPPER HINGE IS:</td>
<td>22.000</td>
</tr>
<tr>
<td>MAXIMUM IS:</td>
<td>29.000</td>
</tr>
</tbody>
</table>

Fig. 7. Stem and leaf plot of Cloze scores.

Second, the Flesch scores are plotted. A more severe skewness is revealed with a wider gap between the majority of data values and the outlier. The outlier, however, is a score resulting from an organizational standard operating procedure requiring all names be preceded by appropriate
title—Mr., Ms., Mrs., Dr.—causing inflation of the average word length used to calculate the Flesch score. The outlier is retained in the analysis because it results from an organizational procedure policy which may cause the same anomaly to recur. Otherwise, the plot shows a narrow mid-range and fairly consistent normal distribution except for the skewness introduced by the heavy outlier.

Third, Source Credibility and Self-interest are plotted. Self-interest plots a wide mid-range with no apparent outliers, gaps or true multiple peaks. The distribution appears slightly skewed above the median; however, the skewness does not appear severe enough to invalidate normal distribution assumptions. Source Credibility plots a narrow mid-range around a median that is high on the possible score range. Although the plot appears to be a slightly-skewed, normal distribution as shown in Figure 8, a bimodal distribution may be revealed by a second peak around the lower hinge. One concern introduced by this pattern may be that there are two dimensions at work. First, the peak around the lower hinge might be the median if responses to Source Credibility statements reflect true opinions of respondents. The second peak centered on the upper hinge might be a reflection of artificially inflated Source Credibility scores resulting from undue influence by organizational culture that dictates that anyone who works
for the organization must be a wonderful human being, well qualified for the position he or she holds.

Hierarchical Analysis

The set approach is used in this hierarchical analysis to determine each variable set's significance in contributing to the variance in the dependent variable (Cohen and Cohen 1983, 133). The set structures place covariate independent variables in Set A, the effect variable defining whether or not the correspondence is treated or untreated in Set B and the interactions between the treatment variable and independent variables in Set C. Table 5 shows the variables assigned to each set.

The MRC is run with all three sets to produce an overall regression analysis. Then, Set C is removed from the
TABLE 5
VARIABLE SETS FOR SET HIERARCHICAL ANALYSIS

<table>
<thead>
<tr>
<th>Variable Set</th>
<th>Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>SET A</td>
<td>Pre/Posttreatment, Pre/Postintrusion, Days since issuance, Gender of respondent, Education level of respondent, Service length of respondent, Author of correspondence, Flesch Index Number, Source Credibility, Self-interest</td>
</tr>
<tr>
<td>SET B</td>
<td>Untreated/treated correspondence</td>
</tr>
<tr>
<td>SET C</td>
<td>Treated<em>Flesch, Treated</em>Source Credibility, Treated*Self-interest</td>
</tr>
</tbody>
</table>

regression equation and the MRC is run again. Finally, Set B is removed and MRC again run. Table 6 shows F-Ratio and its corresponding P value, $R^2$ or total explained variance, and $\Delta R^2$ or change in explained variance as each set enters analysis.

TABLE 6
EXPLAINED VARIANCE OF RECEIVER’S COMPREHENSION
(N=250)

<table>
<thead>
<tr>
<th>Variable</th>
<th>ANOVA</th>
<th>$R^2$</th>
<th>$\Delta R^2$ as %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F-RATIO</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Set C</td>
<td>17.607</td>
<td>0.000</td>
<td>0.707</td>
</tr>
<tr>
<td>Set B</td>
<td>18.476</td>
<td>0.000</td>
<td>0.692</td>
</tr>
<tr>
<td>Set A</td>
<td>10.351</td>
<td>0.000</td>
<td>0.547</td>
</tr>
</tbody>
</table>
Overall F-test

The F-test for the overall analysis of variance in the MRC analysis shows an F-ratio of 17.607 which is significant at the $p > .000$ level, far exceeding the preset criterion of $\alpha > .05$ for significance. This significance for the overall analysis provides protection against potential Type I errors for the hierarchical analysis of the interaction set, effects set and covariate set (Cohen and Cohen 1983, 173).

Analysis of Residuals

The residuals of the full regression are analyzed to evaluate for any heteroskedasticity or curvilinearity in the data. The plot of the residuals and estimated values of $Y$, shown in Figure 9, does not show any perceivable pattern and seems randomly distributed. This is confirmed by a stem and leaf plot which reveals residual values' normal distribution.

![Figure 9](image_url)

Fig. 9. Plot of residuals and estimates for full regression.
Significance of $\Delta R^2$ for Set C

If the $\Delta R^2$ for Set C is not significant, then the analysis may continue by examining the effect set, Set B. If the $\Delta R^2$ for Set C is significant, then the set contains substantial information and becomes the primary focus of the analysis. More important, if the $\Delta R^2$ for Set C is significant, then Analysis of Covariance for covariate variables in Set A is invalid (Cohen and Cohen 1983, 381).

The significance of $\Delta R^2$ is evaluated using a formula based on the overall explained variances of each set (Cohen and Cohen 1983, 145):

$$F = \frac{(R^2_{Y*BC} - R^2_{Y*B})/K_C}{(1 - R^2_{Y*BC})/(n - K_C - K_B - 1)}$$

where:
- $R^2_{Y*BC}$ = the total explained variance for all variable sets
- $R^2_{Y*B}$ = the total explained variance for Sets A and B
- $K_C$ = the degrees of freedom for Set C
- $n - K_C - K_B - 1$ = the degrees of freedom of residuals

Substituting values into the formula:

$$F = \frac{(0.707 - 0.692)/3}{(1 - 0.707)/(219)} = 3.737$$

shows significance above the $\alpha = .05$ level for $df = 3$ and 219 when compared to $F = 2.65$ for $df = 3$ and 200 on an $F$ value table (Cohen and Cohen 1983, 524). Accordingly, the analysis focuses on the interaction terms.
Analysis of Interactions

Table 7 shows the coefficient, beta coefficient, t-value and its corresponding probability for each of the interaction terms entering the regression equation. Since the interaction terms Treat*Flesch (tFlesch) and Treat*Self (tSelf) enter the regression at a level exceeding the preset criterion of $\alpha = .05$, then the analysis proceeds on the assumption that these interactions carry substantial information in explaining variance in comprehension.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coeff.</th>
<th>Beta Coeff.</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treat*Flesch</td>
<td>0.131</td>
<td>0.744</td>
<td>2.015</td>
<td>0.045</td>
</tr>
<tr>
<td>Treat*Source</td>
<td>-0.002</td>
<td>-0.067</td>
<td>-0.025</td>
<td>0.980</td>
</tr>
<tr>
<td>Treat*Self</td>
<td>-0.274</td>
<td>-0.883</td>
<td>-2.639</td>
<td>0.009</td>
</tr>
</tbody>
</table>

Regression equations for interaction terms and associated independent variables are formulated using the adjusted $Y$ intercept for the overall regression, calculated by collapsing the coefficients for all independent variables back into the $Y$ intercept (Cohen and Cohen 1983, 386). This is accomplished using the formula:
\[ A' = A + \Sigma B_i m_i \]

where:
- \( A' \) = adjusted Y intercept
- \( A \) = Y intercept of the overall regression
- \( i \) = variable from Set A
- \( B \) = coefficient of the variable
- \( m \) = mean of the variable

The variable means and regression coefficients are shown in Appendix C.

The adjusted Y intercept is used to calculate the regression equation for each of the interaction and effect variables (Cohen and Cohen 1983, 386):

\[ \bar{Y}' = B_j X_j + A' \]

where:
- \( \bar{Y}' \) = adjusted sample expected value
- \( j \) = IV from Set C
- \( B \) = coefficient of the IV
- \( X \) = value of the IV

Values are substituted into this formula. The IV coefficients are taken from the MRC analysis for each interaction term as it enters analysis. Full MRC analysis tables are shown in Appendix C. The resulting regression equations for the interaction variables are:

\[
\text{Cloze} = -9.290 \text{Treat} - 0.058 \text{Flesch} + 0.131 t \text{Flesch} + 22.753 \\
\text{and,} \\
\text{Cloze} = -6.844 \text{Treat} + 0.429 \text{Self} - 0.274 t \text{Self} + 19.395
\]

Since the Effect Set B is measured as "one" for untreated and "zero" for treated group membership, these values substitute into the regression equation:
For Untreated = 1, then

\[
\text{Cloze} = -9.290 \text{Treat} - 0.058 \text{Flesch} + 0.131 \text{tFlesch} + 22.753
\]

and, for Treated = 0, then

\[
\text{Cloze} = -9.290(0) - 0.058 \text{Flesch} + 0.131(0\text{tFlesch}) + 22.753
\]

The results are two linear representations that plot, shown in Figure 10, to illustrate the effect of interaction.

![Graph showing the conditional relationship of treatment and Flesch scores on the dependent variable.](image)

Fig. 10. Conditional relationship of treatment and Flesch scores on the dependent variable.

The same procedure is used for Self-interest, treatment and their interaction:

For Untreated = 1, then

\[
\text{Cloze} = -6.844 \text{Treat} + 0.429 \text{Self} - 0.274 \text{tSelf} + 19.395
\]
\[ \text{Cloze} = -6.844(1) + 0.429\text{Self} - 0.274(1\times\text{Self}) + 19.395 \]

\[ \text{Cloze} = 12.551 + 0.155(\text{Self}) \]

and, for Treated = 0, then

\[ \text{Cloze} = -6.844(0) + 0.429\text{Self} - 0.274(0\times\text{Self}) + 19.385 \]

\[ \text{Cloze} = 19.395 + 0.429(\text{Self}) \]

These linear equations are plotted, shown in Figure 11, to illustrate the conditional relationship between treated correspondence and perceived self-interest of the respondent.

Fig. 11. Conditional relationship of treatment and self-interest scores on the dependent variable.

The Hypotheses

Five hypotheses are offered in Chapter 1.

Hypothesis 1. Near typeset-quality internal correspondence will result in significantly higher cloze scores for internal memo format correspondence.
Hypothesis 1 is confirmed through interpretation of four points:

1. Cloze scores associated with treated, or near-typeset quality, text are significantly different from cloze scores associated with untreated correspondence. Table 6 shows that the treatment uniquely accounts for 14.5 percent of the explained variance in cloze scores. The F-test illustrated on page 115 with appropriate values for Set B regression substituted, reveals this change in explained variance is significant beyond the $\alpha = .05$ level. The $F$-value for the change is 104.51 for $df = 1$ and 222. The $F$-value for $\alpha = .05$, $df = 1$ and 200 is 3.89 (Cohen and Cohen 1983, 524).

2. The treated/untreated variable, Set B in Table 6, enters the regression analysis as highly significant, above the $p = 0.000$ level.

3. The negative regression coefficient, -5.269, describes a regression line slope associated with a move from untreated correspondence, coded “1,” to treated correspondence, coded “0.”

4. The mean of the cloze scores associated with untreated correspondence is 19.160. The mean of cloze scores associated with treated correspondence is 25.060. Confirmation of this hypothesis from these results means that the subjects who received near-typeset quality
correspondence were able to more exactly recreate the cloze
section text passages from which words had been deleted than
were the subjects receiving correspondence produced by
typewriter. Since subjects were randomly assigned to control
and treatment groups to control for prior knowledge about
topics (rote memory/flexible recall) and the ability to guess
words (redundancy utilization), the significant difference in
the cloze scores between groups is attributed to the
differences in information internalization by the subjects
(verbatim comprehension).

Hypothesis 2. Near typeset-quality internal
correspondence will result in significantly higher
cloze scores for information contained in intra-
organization letters.

During the data gathering period, only memo format
correspondence was distributed to the research population.
This means that there is no variance in the form category
through which to compare differences in cloze scores among
form types. One concern for addressing this hypothesis
generated from the observations of internal correspondence at
the research site is that letters used for internal
communication tend to be directed to individuals rather than
to a group large enough to serve as a research population.
Testing this hypothesis will require an entirely different
experimental design from the one guiding this study.
Hypothesis 3. Near typeset-quality internal correspondence will result in significantly higher cloze scores for information contained in internal reports.

Again, no correspondence that could be classified as a "report" was distributed to the entire research population during the data gathering period. Two incidents occurring during the time on site reveal that a different data gathering method will be required to address this hypothesis. In each instance, information distributed in report format, one dealing with annual budget and the other reporting results of an employee opinion survey, was customized by information relevant to the department(s) accountable to individual associate hospital directors. Reports were then presented by the individual hospital administrator to his or her subordinate unit directors or department heads either in written form or in oral presentation. If this procedure characterizes reporting in organizations in general, then a different research design will be required to obtain data from which comparisons of variations among form types can be made.

Hypothesis 4. Near typeset-quality internal correspondence will result in significantly higher cloze scores for reports than for other types of internal correspondence.
Data used to confirm or refute hypotheses two and three would be used to address this hypothesis. Since there is no variation in form type among correspondence distributed to the research population during the study period, no comparisons can be made to detect differences in cloze scores resulting from those variations.

**Hypothesis 5.** Near typeset-quality internal correspondence interacting with self-interest will result in greater explained variance than either near typeset-quality or self-interest by themselves.

Hypothesis 5 is confirmed through interpretation of three points:

1. The Interaction Set C enters the regression analysis uniquely explaining 1.5 percent of the variation in cloze scores, shown in Table 6. The $F$-test calculated on page 115 shows the change in the explained variance significant above the $\alpha = .05$ level. This significance means that the interaction set becomes the focus of analysis because it carries substantial information in explaining variation in cloze scores while invalidating analysis of covariance of independent variables.

2. The Treatment/Self-interest interaction term enters the regression equation at a highly significant $p = 0.009$.

3. Regression lines for treatment, self-interest and their conditional relationship are calculated using the
adjusted Y intercept. The result, when substituting values of "1" for nontreated and "0" for treated group membership, is two linear representations illustrating the conditional relationship. The plot of the lines, shown in Figure 11, demonstrates that as self-interest increases, the conditional relationship between self-interest and treatment results in cloze scores increasing at a greater rate than do cloze scores for untreated correspondence.

Confirmation of this hypothesis through results from this study means that cloze scores achieved by subjects receiving near-typeset quality correspondence increased at a rate greater than the rate of increase in cloze scores accounted for by increase in the subject's perceived self-interest in the correspondence.

Associated Propositions

The significance of the change in explained variance as Set C, the interaction set, enters the regression analysis has broader implication than the conditional relationship sought to address Hypothesis 5. Potentially, all three of the interactions comprising Set C carry substantial information in explaining variance in the dependent variable. In fact, two propositions associated with Set C interaction should also have been offered as hypotheses. One predicts the conditional relationship between treatment, near-typeset
quality correspondence, and Flesch scores, reading ease of the text. The other predicts the conditional relationship between treatment and the correspondence receiver's perception of the source's credibility.

**Proposition A.** Near typeset-quality internal correspondence interacting with Flesch's Reading Ease Index will result in greater explained variance than either near typeset-quality or Flesch's Reading Ease Index by themselves.

This proposition is confirmed by interpretation of three points:

1. The explained variance accounted for by Set C was significant above the $\alpha = .05$ level.
2. The interaction term treatment/Flesch enters the regression equation significant at $p = 0.045$.
3. The linear representations calculated from the regression equation derived from the adjusted $Y$ intercept and the variables of interest to this interaction plot as shown in Figure 10 and reveal that the conditional relationship accounts for higher cloze scores as the Reading Ease Index goes down, meaning as the passage becomes more difficult to read as measured by the Reading Ease Index.

**Proposition B.** Near typeset-quality internal correspondence interacting with source credibility
will result in greater explained variance than either near typeset-quality or source credibility by themselves.

This proposition is refuted in this study by the interaction term treatment/source credibility entering the regression equation at a level of \( p = 0.980 \), indicating almost no influence at all on differences in cloze scores. The significance of the other two interactions compared to this result suggests the potential of a flaw in the data gathering process. The possible bimodal distribution of source credibility scores, shown in Figure 8, at a level suggesting artificially inflated scores might be interpreted as resulting from the influence of the organization's culture. Such influence on subjects' responses would mask the true effect of source credibility and its subsequent interaction with treated correspondence.

Summary

This study uses set hierarchical strategy for Multiple Regression/Correlation analysis on data collected in a quasi-experimental design. Analysis of data finds that conditional relationships between near-typeset quality text and other communication variables make significant contribution to explaining variance in comprehension among correspondence receivers in the sample population. The significance of the interaction set invalidates Analysis of Covariance for the
independent variables and indicates that the analysis should focus on conditional relationships of the interaction terms.

Among the terms included in the interaction set, two are significant as they enter hierarchical analysis. In the case of Self-interest, the rate of increase in comprehension is significantly greater for the conditional relationship than the increase in comprehension attributed to the increase in Self-interest by itself. For the conditional relationship between near-typeset quality text and text’s readability, the more difficult the text passage is to read, the greater is comprehension for near-typeset quality text. However, at higher readability levels, this advantage in comprehension is reduced until a point is reached where comprehension is not improved by text’s appearance in near-typeset quality.
References


CHAPTER 5

DISCUSSION AND CONCLUSION

Through the results of this quasi-experimental field study, this research effort investigates the effect of near-typeset quality text on comprehension of routine business correspondence. Treatment of correspondence, producing text in near-typeset quality using laser-printing technology, is found to account for significantly different levels of comprehension improvement among correspondence receivers. More meaningful is the finding that the interaction set comprised of treatment/readability, treatment/self-interest and treatment/source credibility accounted for a significant amount of explained variance in comprehension.

The substantial contribution made by these conditional relationships has implication for both theoretical and practical contexts. The finding's theoretical signification is in expanding understanding of the comprehension process by supporting the Model of Receiver Comprehension. The practical signification is the potential for substantially improving organizational communication's effectiveness and efficiency in transmitting mutual understanding using linear communication.
Model of Receiver Comprehension

The Model of Receiver Comprehension introduced in Chapter 2 and shown in Figure 5 suggests that variables identified as contributing to explaining variance in comprehension assume a hierarchical order. Ordering results from the level of significance contributed by each variable to the receiver’s comprehension of communication messages. The model also suggests that variables can be grouped into domains of variables related by their function and similarity of influence on the comprehension process.

Potentially, this study’s most interesting contribution to understanding the comprehension process is finding it significantly influenced by interactions among visually enhanced written text and both detection and motivation domain variables: Readability and Self-interest. The Treatment/Self-interest interaction entering the Multiple Regression/Correlation analysis at a significance level far exceeding the significance level for Treatment/Flesch provides a clue to the relative strengths of influence of interactions between an attraction level variable, visual appearance, and a detection domain variable, Readability, and between attraction domain and a motivation domain variable, Self-interest. If this interpretation is valid, then the potential for understanding the relative influences of interactions between domain variables becomes substantial. More
important, understanding conditional relationships and their impact on comprehension provides communicators with powerful tools for improving communication effectiveness and efficiency in organizations.

Fig. 12. Model of receiver comprehension--domain interaction cube

The potential conditional relationships among the domains are illustrated in Figure 12. The relationships are described by a cube divided into eight cells. The three letter label in each cube segment represents high (H) or low (L) measurement for each domain in order: Attraction, Detection, Motivation. Communication effectiveness has its highest probability of maximum comprehension or information internalization in the HHH cell where Attraction, Detection and Motivation domains have their highest measured levels.
Likewise, in the LLL cell, the probability of comprehension is lowest. Of interest in this model is the result of domain interactions represented by the other six cells in the cube. The linear receiver comprehension model suggests that each of the domains is weighted in its impact on comprehension.

Similarly, the interactions are probably weighted by the domain's contribution to the interaction. For example, the HLL interaction, with high Attraction measurement and low measurement for both Detection and Motivation domains, results in a lower receiver comprehension probability than does the LLH cell, with low Attraction and Detection domains and high Motivation.

These relationships suggest that comprehension can be improved among receivers by carefully planning and executing communication over a long period of time to condition receivers to specific combinations of variables. For example, enhancing higher order domain variables' impact by accessing receivers' preconditioned meanings associated with specific graphic treatment or form of the message may create increased explained variance beyond that explainable by either the lower order or higher order variables by themselves. In written communication this may take the form of a receiver holding a preconditioned response to near-typeset quality print, such as times roman, as appearing only on expensive, important marketing information that is
transferred to enhance the self-interest level or perceived source credibility level of written communication not usually appearing in such a type style.

Implications for Communication in Business

Communication in business now stands at a threshold similar to one experienced in the early 1900s. The methods of producing physical communication media are changing as technological advances accelerate new capability introduction. In the 1900s it was the transition from handwritten to typewritten business correspondence. In the 1980s it is the transition from typewritten correspondence to routine, everyday correspondence appearing to be typeset.

Computer companies and retailers are experiencing a "boom" market as businesses rush to add the capability of making all written material printed in-house appear as though it were produced on typesetting equipment, without the attendant cost of typesetting. The sales logic usually says that the company can have "professional appearing" written material at far reduced production cost. For the most part, the new "electronic publishing" or "document processing" has been reserved for specific projects such as production of company newsletters, project proposals, contracts and other documents traditionally produced by typesetting.

The widespread use of laser-printing technology for production of almost all an organization's written
correspondence is not far off. As more and more business people responsible for production of an organization’s written materials discover the convenience of laser printing over other types of computer output, the laser printer will replace dot-matrix printers and typewriters for all written materials from memoranda to letters to bulletin board notices. Diffusion of laser printing into business will accelerate as the speed of laser printers increases and the cost of installation and maintenance decreases. This adoption of technology will generally be production-need driven.

More important than production cost considerations in deciding whether or not to use laser-printing technology is to evaluate the impact it might have on communication effectiveness. This study asks the question, “What is the impact that adoption of technology to graphically enhance written correspondence have on the communication processes vital to organizational productivity and, even, survival?”

The impact is not only significant, but highly significant. With 14.5 percent of variance in comprehension uniquely explained by written material’s production in near-typeset quality text over typewriter-text, the laser printer can become a tool in improving the communication links which influence the effectiveness and efficiency of coordinating and controlling activities in organizations.
Furthermore, laser printing represents an even more powerful tool for achieving even greater effect because of the conditional relationships between text written in near-typeset quality and other variables in the comprehension process. In this study, the interaction set uniquely explains a significant 1.5 percent of the variance in comprehension. Interactions between near-typeset quality written materials and independent variables such as Self-interest and Readability might be accessing preconditioned meaning interpretations within each individual. Accessing internalized meaning enhancements causes written material to have an impact beyond that which might be accounted for by the independent variables by themselves.

This study finds that as the reader's self-interest in the written material increases, comprehension measured by cloze scores increases. The conditional relationship between Self-interest and near-typeset quality correspondence reveals a significantly greater comprehension improvement rate than the comprehension improvement rate associated with an increase in Self-interest by itself. This finding may reflect that the receiver's internal judgment process interprets that near-typeset appearance associates with information that is more important to the receiver and, therefore, more relevant to the reader's self-interest. Such judgment
is influenced by the reader's previous experience and preconditioning for meaning associated with typeset material.

After reviewing this study, some sceptics might suggest that the findings had nothing to do with accessing internal judgment processes and that the treatment using near-typeset quality printed material was merely treating legibility and readability variables resulting in text that is easier to read and, therefore, easier to comprehend (as the literature has supported since the 1930s). The conditional relationship between near-typeset quality text and readability scores reveals that the variables are significantly related, but not in a manner that would support the argument that near-typeset quality and readability are directly related as contributors to reading ease. This study shows that improvement in reading ease of written material (higher reading ease index number on Flesch's index) results in higher levels of comprehension as traditionalists would predict. If near-typeset quality printed materials were related to reading ease, then their contribution to improvement in comprehension would be at the same rate as the Flesch score's or at a nonsignificant change rate.

Instead, this study found conditional relationship between near-typeset quality text and readability characterized by a negative slope for the regression line. This means that as reading ease increases, it eventually reaches a
threshold point where it is immaterial whether or not the correspondence is near-typeset quality. At that point comprehension will not be improved. However, at the lower levels of reading ease, where a lot of business people tend to write, near-typeset quality text significantly improves comprehension.

In other words, analyzing an organization's correspondence to determine the average reading ease index score for text material provides a key to directions that the organization can take to improve communication effectiveness of written correspondence. The long-term solution involves training personnel in techniques of writing to achieve higher reading ease index scores. These techniques include using shorter, more concrete words and simpler, shorter sentences. The short-term solution involves producing internal correspondence using electronic publishing capabilities to produce near-typeset quality and graphic enhancement of information. Until the reading ease index scores rise to the threshold point, producing correspondence in near-typeset quality will result in more effective communication among organization members.

Limitations of Interpretation

All data interpretation produced in this quasi-experimental field study must be considered in perspective of some limitations to generalization. First, the study was
performed on site at a major, not-for-profit hospital in the Southwestern United States. Changing healthcare marketing conditions and increased public and governmental pressures for service delivery may make the environment in which this study occurred different from other businesses' operating environments. Also, the worker population at a not-for-profit service institution may not be representative of the broader worker population in the United States. Second, intrusion into the communication flow to control distribution for consistency altered standard operating procedures for correspondence issuance. Some of these changes may contribute to some effects found. Third, the data gathering period was sufficiently long—six months—that some threat to validity may exist because of the possibility that the study population discussed among themselves the fact that a study was being conducted.

Another reality of interpretation is related to the timing of business communication production technology transition. Had similar studies to this one been performed during the time that typewriter technology was being adopted at accelerating rates, similar results may have been found. These effects potentially may be attributed to the fact that the treated versions of correspondence are merely "different" from standard correspondence. The difference, then, is the variable that would account for the variance in
comprehension. If the findings of this study have been misinterpreted and the mere difference between old and new styles is the primary reason for variations in comprehension, then a tremendous amount of importance is placed on just attracting the reader’s attention. This, of course, has been an advertising precept for years.

The timing of technological adoption has another impact. Just as the typewriter became a pervasive tool for business correspondence, laser-printing technology may eventually pervade business correspondence production. When communication channels are saturated with near-typeset text and graphic treatment, receivers may become desensitized to the relationships found in this study.

**Future Research**

This study’s completion opens considerable possibility for future research.

First, this study must be replicated in other operational environments. Firms operating in other environments may have different characteristics from those found in this hospital. Organizations have unique internal cultures which exert effects on communication relationships. In fact, redesign of this study should incorporate a measure to control for the potential impact of an organization’s culture on the independent variables Self-interest and Source Credibility. Additionally, new study sites should provide
more form types than found in this study to measure effects across form types including letters, reports and oral presentation support materials.

Second, the potential of saturating communication channels in business with near-typeset quality printed material and the potential of desensitizing receivers to the effects found here should be studied. If current technological transition is paralleling the transition of the early 1900s, then research may be able to document changes in communication effectiveness associated with dissemination of technology.

Third, the potential of other enhancements available through laser-printing technology such as type font variation, font size variation, bolding, italics, display characters and reverse type should be studied for their impact on message delivery in everyday correspondence.

Fourth, laboratory experiments might be appropriate to determine why the effects found here were produced. A study using college students or some other research population which allows for tighter controls for extraneous variables, for example, might test different forms of treated and untreated correspondence followed by questions to establish attitudes and opinions about the appearance. Attitudes and opinions evoked by exposure to different production styles and correspondence forms might provide clues to the
psychological process of meaning interpretation by individuals exposed to printed material. Short of such a structured approach, focus groups such as those used in marketing research might produce data that serve as a general indicator of the attitudes and opinions associated with internal meaning interpretation of the symbols represented by near-typeset quality correspondence.

Conclusion

A better understanding of the conditional relationships existing among communication variables would allow business communicators to purposefully design communication to enhance receivers' comprehension processes. Effective use of such planning can increase communication efficacy. For example, if the communicator recognizes that specific communication has weakness in one of the variable domains, such as potential low Self-interest from the receiver's viewpoint, then other variables such as Readability or Visual Appearance must be increased to improve the message's impact on the receiver's behavior. Currently, the ability to communicate in organizations is seen as a preexisting social grace. However, the significance of conditional relationships in their contribution to increasing communication effectiveness suggests that communication policy in organizations should be another element of the organizational planning process just as are financial, production or human resources planning.
If estimates of costs to American productivity attributed to errors in communication are valid, then any improvement in communication effectiveness represents substantial contribution to improving productivity. With more than 16 percent of the variation in comprehension improvement explained by the use of near-typeset quality text instead of typewritten text, adding electronic publishing technology to current production of routine internal correspondence would make a significant contribution to improving communication networks' effectiveness in linking organizational departments and functions.

In today's business climate, incorporating near-typeset quality print production for any written correspondence, internal or external, is a major key to improved communication between the sender and receiver of the communication message.
APPENDIX A

QUESTIONNAIRE
QUESTIONNAIRE XX

June 28, 1988

VISUAL ASPECTS OF INTERNAL CORRESPONDENCE
AND THEIR IMPACT ON COMMUNICATION
EFFECTIVENESS

Case________
The following text passage is a reproduction of correspondence you should have recently received. Selected words have been deleted and replaced with blank spaces. The length of the blank space has no relation to the length of the word it replaced. Please take a few minutes to try to reconstruct the text by inserting the exact words that appeared in the original correspondence. There is no right or wrong answer to this part of the questionnaire. If you use a word other than the original word, that tells us something too.

The Baxter _____ differs from others in _____ major respects:
1) The agreement _____ all products, not just _____ products or categories, which _____ sells to all System _____.
2) The System gains access _____ management and consulting services _____ no charge or reduced _____.

Many of these services _____ only available to Corporate _____.

Furthermore, Baxter will work _____ individual departments or entities _____ customize solutions for specific _____ or issues. Access to _____ services should enable (deleted) _____ operate more effectively while _____ the System to compete _____ effectively.

In light of _____ agreement, I would ask _____ of you to give _____ consideration to Baxter products _____ on quality, price and _____ criteria. Given the choice _____ a Baxter product and _____ of another vendor, and _____ discernable quality or service _____ exists among them, the _____ of a Baxter product _____ be preferred.

Please _____ Mr. (Name deleted) at extension 8481 with any questions about the agreement and/or its implications.
SECTION 2

In this section, please respond by circling the number that best represents your opinion about the statement. 1 = Strongly Disagree, 2 = Disagree, 3 = No opinion, don’t know or refuse to answer, 4 = Agree, 5 = Strongly Agree.

Please respond to the following statements regarding the internal correspondence you have before you.

<table>
<thead>
<tr>
<th>Statement</th>
<th>SD</th>
<th>D</th>
<th>NO</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Information from this writer is rarely important to me.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>2. This correspondence was not important to me.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3. The correspondence had a sense of importance beyond its content.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4. Recognition of certain characteristics (address label,</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>print style, envelope style, handwriting, etc.) told me this contained</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>information important to me.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. I read this correspondence because I expected the information to be</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>entertaining (silly, inane, trite).</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. The information was important because its impact reaches my home life.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>7. I scanned this correspondence quickly because I didn’t perceive any</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>potential importance in its content.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. In general, I read all correspondence I receive daily.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>9. I could do my work without the information contained in the</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>correspondence.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. I read the first paragraph or two and then didn’t go any farther</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>because the information was not relevant to me.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SECTION 3

In this section, please respond by circling the number that best represents your opinion about the statement. 1 = Strongly Disagree, 2 = Disagree, 3 = NO opinion, don't know or refuse to answer, 4 = Agree, 5 = Strongly Agree.

Please respond to the following statements regarding the writer of the internal correspondence you have before you. Please remember that your answers are completely confidential and cannot be traced to you personally.

<table>
<thead>
<tr>
<th></th>
<th>SD</th>
<th>D</th>
<th>NO</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I can not depend upon this person for factual information.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>2. Generally, I do not find information from this person to be useful.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3. I admire this person as much as any employee in the organization.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4. This person generally knows the subject.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5. If I didn't (don't) work directly with this person, I would not like to work in his or her unit.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>6. This person generally is kind to employees with whom he or she comes into contact.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>7. Compared to others in this organization, this person is more competent in matters relating to the correspondence subject.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>8. I find this person to be fair in dealings with me regarding work.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>9. This person is well trained for the position he or she holds.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>10. This person usually does poorly in communicating his or her thoughts through written correspondence.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>11. I rarely read everything this writer sends me.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>
**SECTION 4**

In this section, please respond by circling the number that best represents your opinion about the statement. 1 = Strongly Disagree, 2 = Disagree, 3 = No opinion, don't know or refuse to answer, 4 = Agree, 5 = Strongly Agree.

Please respond to the following statements regarding the internal correspondence you have before you.

<table>
<thead>
<tr>
<th>Statement</th>
<th>SD</th>
<th>D</th>
<th>NO</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. This correspondence seems to be more professional than is typical of this organization.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2. This correspondence seems easier to read than is typical in this organization.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3. This correspondence seems out of place for what it is trying to communicate.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4. This correspondence was easier to understand than most correspondence in this organization.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5. Don’t ask me why, but I liked it.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Please answer the next few questions by checking the appropriate box.

6. I have been with this organization:  
   - [ ] Less than a year 1  
   - [ ] 1 to 5 years 2  
   - [ ] 6 to 10 years 3  
   - [ ] 11 to 20 years 4  
   - [ ] 20 years or more 5  

7. The highest level of formal education I have attained is:  
   - [ ] Less than High School 1  
   - [ ] High School Diploma 2  
   - [ ] Some College 3  
   - [ ] Bachelor’s Degree 4  
   - [ ] Some Graduate Work 5  
   - [ ] Graduate Degree 6  

8. My gender is:  
   - [ ] Female 2  
   - [ ] Male 1
SECTION 5

Categorical codings for the target correspondence are as follows (to be filled in by the researcher).

<table>
<thead>
<tr>
<th>Form</th>
<th>Content</th>
<th>Readability</th>
<th>Treated</th>
<th>Pre/Post Treatment</th>
<th>Days Since Issuance</th>
<th>Author</th>
<th>Pre Admin Meeting</th>
</tr>
</thead>
</table>

**Form:**
1 = Internal Memo  
2 = Internal Letter  
3 = Internal Report or Proposal

**Content:**
1 = Personnel Matter  
2 = Salary or Benefits Matter  
3 = Job-specific Information  
4 = Operational Policies  
5 = Operational Procedures  
6 = Announcements  
7 = Personal Matter

**Readability**

\[ RE = 206.835 - (84.6 \times \text{awl}) - (1.015 \times \text{asl}) \]

awl = avg. word length  
asl = avg. sentence length

**Treated/Untreated**

1 = untreated  
2 = treated

**Author**

(Name deleted)

**Pre/Post Treatment**

1 = Pretreatment  
2 = Posttreatment

**Pre Admin Meeting**

1 = Before  
2 = After
APPENDIX B

TREATED/UNTREATED SAMPLES
MEMORANDUM

TO: ALL DEPARTMENT HEADS
ALL UNIT DIRECTORS
ADMINISTRATIVE STAFF

FROM: (Name deleted)
Director of Purchasing

SUBJECT: AMERICAN HEALTHCARE SYSTEMS
PURCHASING AGREEMENTS

This memorandum is a follow-up to Mr. (Name deleted)’s Memorandum dated June 27, 1988, announcing the purchase agreement between (Name deleted) and Baxter Healthcare Corporation.

In addition to the Baxter Corporate Agreement, (Name deleted) has committed to the following corporate agreements through American Healthcare Systems:

1. Becton-Dickson and Company
2. DuPont Corporation
3. Johnson and Johnson Company
4. Kendall Company (agreement currently being reviewed)
5. 3M Company

The Corporate Agreements like the Baxter Healthcare Corporation Agreement, provides financial incentives for achieving certain volume levels of purchase, plus long term price protection.

In addition to the Corporate level agreements there are over 200 other purchasing agreements for supplies and equipment. These agreements also provide various incentives and price protection.

(Name deleted) is presently taking advantage of over fifty agreements. Through these contracts, prices have either decreased or have stabilized.
Before purchasing, you are encouraged to contact the Purchasing Office to determine whether there is a contract for the products you plan to purchase. Also, I would be more than pleased to meet with you to review and discuss the many agreements we presently have available. Please call me at any time, Ext. 7794.

BO/nh

Enclosure

cc: Names deleted
MEMORANDUM

TO: ALL DEPARTMENT HEADS
ALL UNIT DIRECTORS
ADMINISTRATIVE STAFF

FROM: (Name deleted)
Director of Purchasing

SUBJECT: AMERICAN HEALTHCARE SYSTEMS
PURCHASING AGREEMENTS

This memorandum is a follow-up to Mr. (Name deleted)’s Memorandum dated June 27, 1988, announcing the purchase agreement between (Name Deleted) and Baxter Healthcare Corporation.

In addition to the Baxter Corporate Agreement, (Name deleted) has committed to the following corporate agreements through American Healthcare Systems:

1. Becton-Dickson and Company
2. DuPont Corporation
3. Johnson and Johnson Company
4. Kendall Company (agreement currently being reviewed)
5. 3M Company

The Corporate Agreements like the Baxter Healthcare Corporation Agreement, provides financial incentives for achieving certain volume levels of purchase, plus long term price protection.

In addition to the Corporate level agreements there are over 200 other purchasing agreements for supplies and equipment. These agreements also provide various incentives and price protection.
(Name deleted) is presently taking advantage of over fifty agreements. Through these contracts, prices have either decreased or have stabilized.

Before purchasing, you are encouraged to contact the Purchasing Office to determine whether there is a contract for the products you plan to purchase. Also, I would be more than pleased to meet with you to review and discuss the many agreements we presently have available. Please call me at any time, Ext. 7794.

BO/nh

Enclosure

cc: Names Deleted
APPENDIX C

DATA TABLES
<table>
<thead>
<tr>
<th>Variable</th>
<th>Coeff</th>
<th>Std Err</th>
<th>Std Coeff</th>
<th>T</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
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<td>4.060</td>
<td>0.000</td>
<td>3.535</td>
<td>0.000</td>
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<td>Pre</td>
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<td>0.689</td>
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<td>-1.549</td>
<td>0.116</td>
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<tr>
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<td>1.014</td>
<td>0.081</td>
<td>1.128</td>
<td>0.261</td>
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<tr>
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<td>0.386</td>
<td>0.067</td>
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<td>0.209</td>
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<td>0.040</td>
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<td>0.208</td>
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<td>1.930</td>
<td>0.055</td>
</tr>
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<td>0.472</td>
<td>0.137</td>
<td>2.279</td>
<td>0.024</td>
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<td>1.516</td>
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<td>-2.321</td>
<td>0.021</td>
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<tr>
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<td>1.206</td>
<td>-0.275</td>
<td>-1.956</td>
<td>0.052</td>
</tr>
<tr>
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<td>-0.263</td>
<td>-1.952</td>
<td>0.052</td>
</tr>
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<td>1.259</td>
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<td>-0.953</td>
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</tr>
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<td>1.536</td>
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<td>0.563</td>
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<td>0.904</td>
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<tr>
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<tr>
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<td>-0.123</td>
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<tr>
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<td>0.081</td>
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<tr>
<td>Source</td>
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<td>0.080</td>
<td>-0.015</td>
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<tr>
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<td>4.281</td>
<td>-0.711</td>
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<td>0.111</td>
</tr>
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</table>

Multiple R = 0.841  Squared Multiple R = 0.707
Adj. Sqd. Multiple R = 0.667  Std Error of Est. = 2.228
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<td>Std Coeff</td>
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<td>--------</td>
<td>---------</td>
<td>-----------</td>
<td>-------</td>
<td>---------</td>
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<tr>
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<td>0.310</td>
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<td>-0.099</td>
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<td>1.103</td>
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<td>0.043</td>
<td>0.427</td>
<td>0.670</td>
</tr>
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<td>-0.116</td>
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<td>0.027</td>
<td>0.304</td>
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</table>

Multiple R = 0.832  Squared Multiple R = 0.692
Adj. Sqd. Multiple R = 0.655  Std Error of Est. = 2.269
### TABLE 11
ANALYSIS OF VARIANCE, REGRESSION FOR SETS A, B
(N=250)

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<tr>
<th>Source</th>
<th>Sum of Sqrs.</th>
<th>DF</th>
<th>Mean Sq.</th>
<th>F-Ratio</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>2567.501</td>
<td>27</td>
<td>95.093</td>
<td>18.476</td>
<td>0.000</td>
</tr>
<tr>
<td>Residual</td>
<td>1142.599</td>
<td>222</td>
<td>5.147</td>
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</tbody>
</table>
### TABLE 12
REGRESSION OF SET A
(N=250)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coeff</th>
<th>Std Err</th>
<th>Std Coeff</th>
<th>T</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>6.024</td>
<td>2.381</td>
<td>0.000</td>
<td>2.530</td>
<td>0.012</td>
</tr>
<tr>
<td>Pre</td>
<td>-4.449</td>
<td>0.744</td>
<td>-0.566</td>
<td>-5.982</td>
<td>0.000</td>
</tr>
<tr>
<td>Intrud</td>
<td>1.512</td>
<td>1.247</td>
<td>0.106</td>
<td>1.212</td>
<td>0.227</td>
</tr>
<tr>
<td>Gender</td>
<td>0.417</td>
<td>0.469</td>
<td>0.046</td>
<td>0.890</td>
<td>0.374</td>
</tr>
<tr>
<td>Days</td>
<td>0.802</td>
<td>0.432</td>
<td>0.184</td>
<td>1.858</td>
<td>0.065</td>
</tr>
<tr>
<td>Ed1</td>
<td>2.337</td>
<td>1.042</td>
<td>0.272</td>
<td>2.242</td>
<td>0.026</td>
</tr>
<tr>
<td>Ed2</td>
<td>1.457</td>
<td>0.997</td>
<td>0.182</td>
<td>1.462</td>
<td>0.145</td>
</tr>
<tr>
<td>Ed3</td>
<td>2.052</td>
<td>0.982</td>
<td>0.248</td>
<td>2.091</td>
<td>0.038</td>
</tr>
<tr>
<td>Serv1</td>
<td>0.258</td>
<td>1.094</td>
<td>0.012</td>
<td>0.236</td>
<td>0.814</td>
</tr>
<tr>
<td>Serv2</td>
<td>-0.000</td>
<td>0.618</td>
<td>-0.000</td>
<td>-0.001</td>
<td>0.999</td>
</tr>
<tr>
<td>Serv3</td>
<td>0.135</td>
<td>0.562</td>
<td>0.017</td>
<td>0.241</td>
<td>0.810</td>
</tr>
<tr>
<td>Sub1</td>
<td>-5.007</td>
<td>1.753</td>
<td>-0.476</td>
<td>-2.856</td>
<td>0.005</td>
</tr>
<tr>
<td>Sub2</td>
<td>-2.035</td>
<td>1.368</td>
<td>-0.237</td>
<td>-1.487</td>
<td>0.138</td>
</tr>
<tr>
<td>Sub3</td>
<td>-3.483</td>
<td>1.641</td>
<td>-0.331</td>
<td>-2.122</td>
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</tr>
<tr>
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<td>-2.721</td>
<td>1.449</td>
<td>-0.329</td>
<td>-1.878</td>
<td>0.062</td>
</tr>
<tr>
<td>A1</td>
<td>0.486</td>
<td>1.670</td>
<td>0.059</td>
<td>0.291</td>
<td>0.771</td>
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<tr>
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<td>2.294</td>
<td>1.685</td>
<td>0.194</td>
<td>1.361</td>
<td>0.175</td>
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<tr>
<td>A3</td>
<td>-6.158</td>
<td>2.371</td>
<td>-0.313</td>
<td>-2.597</td>
<td>0.010</td>
</tr>
<tr>
<td>A4</td>
<td>0.767</td>
<td>1.533</td>
<td>0.054</td>
<td>0.500</td>
<td>0.618</td>
</tr>
<tr>
<td>A5</td>
<td>-1.807</td>
<td>1.572</td>
<td>-0.127</td>
<td>-1.149</td>
<td>0.252</td>
</tr>
<tr>
<td>A6</td>
<td>-0.309</td>
<td>1.334</td>
<td>-0.026</td>
<td>-0.232</td>
<td>0.817</td>
</tr>
<tr>
<td>A7</td>
<td>1.252</td>
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<td>0.064</td>
<td>0.715</td>
<td>0.475</td>
</tr>
<tr>
<td>A8</td>
<td>-1.283</td>
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<td>-0.090</td>
<td>-0.742</td>
<td>0.459</td>
</tr>
<tr>
<td>A9</td>
<td>-2.708</td>
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<td>-1.698</td>
<td>0.093</td>
</tr>
<tr>
<td>Flesch</td>
<td>0.064</td>
<td>0.033</td>
<td>0.250</td>
<td>1.958</td>
<td>0.052</td>
</tr>
<tr>
<td>Source</td>
<td>0.070</td>
<td>0.056</td>
<td>0.113</td>
<td>1.251</td>
<td>0.212</td>
</tr>
<tr>
<td>Self</td>
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<td>0.054</td>
<td>0.542</td>
<td>6.713</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Multiple R = 0.747  Squared Multiple R = 0.557
Adj. Sqd. Multiple R = 0.495  Std Error of Est. = 2.699
### TABLE 13
**ANALYSIS OF VARIANCE, REGRESSION FOR SET A**
\(N=250\)

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Sqrs.</th>
<th>DF</th>
<th>Mean Sq.</th>
<th>F-Ratio</th>
<th>P Value</th>
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<tbody>
<tr>
<td>Regression</td>
<td>2028.897</td>
<td>26</td>
<td>78.034</td>
<td>10.351</td>
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<td>Residual</td>
<td>1681.203</td>
<td>223</td>
<td>7.539</td>
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TABLE 14
MEANS AND STANDARD DEVIATIONS
SETS A, B, C
(N=250)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>0.600</td>
<td>0.491</td>
</tr>
<tr>
<td>Intrud</td>
<td>0.080</td>
<td>0.272</td>
</tr>
<tr>
<td>Gender</td>
<td>0.232</td>
<td>0.423</td>
</tr>
<tr>
<td>Days</td>
<td>2.228</td>
<td>0.887</td>
</tr>
<tr>
<td>Ed1</td>
<td>0.280</td>
<td>0.450</td>
</tr>
<tr>
<td>Ed2</td>
<td>0.360</td>
<td>0.481</td>
</tr>
<tr>
<td>Ed3</td>
<td>0.320</td>
<td>0.467</td>
</tr>
<tr>
<td>Serv1</td>
<td>0.036</td>
<td>0.187</td>
</tr>
<tr>
<td>Serv2</td>
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<td>0.491</td>
</tr>
<tr>
<td>Serv3</td>
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<td>0.493</td>
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<tr>
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<td>0.160</td>
<td>0.367</td>
</tr>
<tr>
<td>Sub2</td>
<td>0.280</td>
<td>0.450</td>
</tr>
<tr>
<td>Sub3</td>
<td>0.160</td>
<td>0.367</td>
</tr>
<tr>
<td>Sub4</td>
<td>0.320</td>
<td>0.467</td>
</tr>
<tr>
<td>A1</td>
<td>0.320</td>
<td>0.467</td>
</tr>
<tr>
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<tr>
<td>A3</td>
<td>0.040</td>
<td>0.196</td>
</tr>
<tr>
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<td>0.272</td>
</tr>
<tr>
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<td>0.080</td>
<td>0.272</td>
</tr>
<tr>
<td>A6</td>
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<td>0.326</td>
</tr>
<tr>
<td>A7</td>
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<td>0.196</td>
</tr>
<tr>
<td>A8</td>
<td>0.080</td>
<td>0.272</td>
</tr>
<tr>
<td>A9</td>
<td>0.080</td>
<td>0.272</td>
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<tr>
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<td>5.802</td>
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<td>tFlesch</td>
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<td>21.902</td>
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<tr>
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<tr>
<td>tSelf</td>
<td>22.776</td>
<td>12.450</td>
</tr>
</tbody>
</table>
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Papers and Dissertations


Purdue University, 1982). *Dissertation Abstracts International*, 43/06-A, AAD82-25786, p 1748.

**Publications**


