



DISASTER-STORM AHEAD



DISASTER-STORM AHEAD

J. A. RILEY, *Chief*

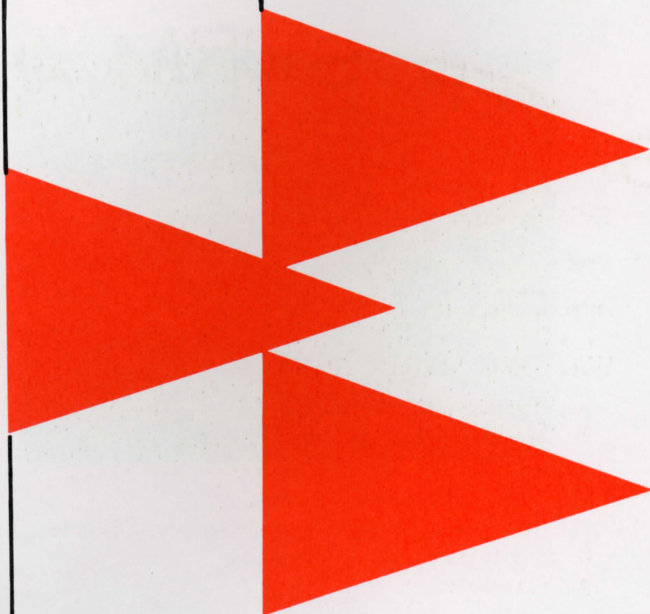
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NOAA National Weather Service

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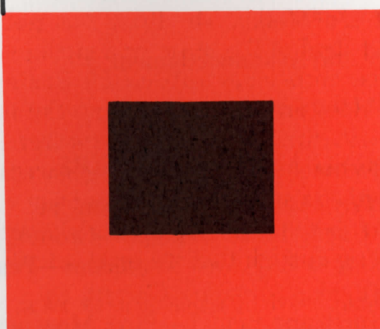
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EDITOR'S NOTE

DISASTER . . . STORM AHEAD, an account of storm warning reaction, was printed in time for the dedication of the Harry Estill Moore Disaster Study Collection. Basing much of his study on the pioneer work of Dr. Moore, Mr. Riley has pulled together and organized a great deal of literature on reactions to disaster.

In addition, the author has written his findings in a sprightly manner. Seldom does any author combine the thoroughness of a research scholar with the flair of a creative writer.

The present account is a rule-proving exception. Mr. Riley's reporting of a study in storm warning reaction reads well. When he was requested to send in biographical information, his statement was intriguing enough that we print it in its entirety:

Weather forecasters tend to move around a lot. Ostensibly, we learn our art from exposure to a variety of local climates. Some say it is because "the weather in the last place didn't agree with us."

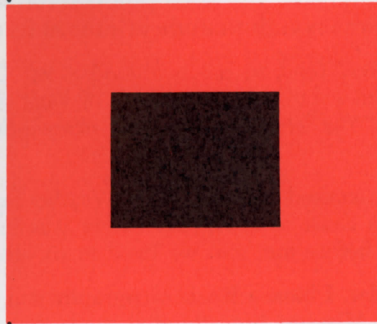
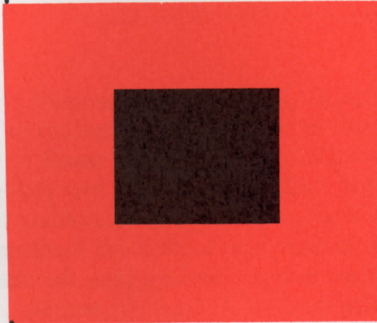
I am 48 and have worked in the National Weather Service 28 years in 11 states from coast to coast. My father was in the Weather Service 40 years before me, and we lived in six other states.

Education is similar. I have a BA in Geography and Geology from the University of Missouri but attended graduate school in seven other universities without staying long enough to get a graduate degree. I studied meteorology at MIT and mathematics, physics, and a variety of physical sciences at Iowa State University, Drake University, the University of Chicago, the University of Maryland, and Memphis State University. TCU gave me a taste for the behavioral sciences, and I attended night school two years enrolled in the public administration program but dropped out when my daughter graduated from Texas Tech and asked why I was still in school.

My career with NWS has been divided into three parts: operational forecasting, research, and administration. The two associated events that gave me the most pride up until this paper were: Award of the Department of Commerce Silver Medal in 1962, and publication of an article on pesticides, co-authored by Dr. W. L. Giles, president of Mississippi State University.

It is a pleasure to the Hogg Foundation staff to be the publishers of this timely document.

Bert Kruger Smith



PREFACE AND ACKNOWLEDGMENT

REASON FOR DEVELOPING THIS STUDY

It was a beautiful Sunday night in Fort Worth. A bright moon was shining on the Federal Office Building, the location of the Weather Bureau's Southern Regional Headquarters, and word had just come over the speaker phone from New Orleans that Camille had moved inland. Regional Headquarters staff evaluated warnings as accurate and timely. But the next morning, August 16, 1969, reports of deaths and injuries mounted to enormous proportions. Estimates ranged from 100 to more than 200 people killed. Regional Director W. L. Thompson voiced the question on the minds of the staff "how could so many people be killed when warnings were good?" The question was put to Dr. W. L. Giles, president of Mississippi State University, who in turn directed the Social Science Research Center of that institution to find out "why." The Center had just conducted several sociological surveys on that very stretch of Mississippi coastal land that was now so torn by Hurricane Camille.

As findings of the survey came in, it was obvious that considerable literature had already been published on the disaster subject. But the reports were widely scattered and not generally available to those doing the warning. Also, since each storm is unique, the reported findings could not be universally applied to all warning events. The need for a survey of literature was apparent; and because of the pioneering work of Dr. Harry Estill Moore, it seemed that the Hogg Foundation was the obvious organization to present this type of information in the most useful and effective manner.

INTRODUCTION

"... how could so many people be killed when warnings were good?" Such a puzzlement, quoted by the author of this book, was made by a regional director of the National Weather Service when Hurricane Camille devastated part of the Gulf Coast.

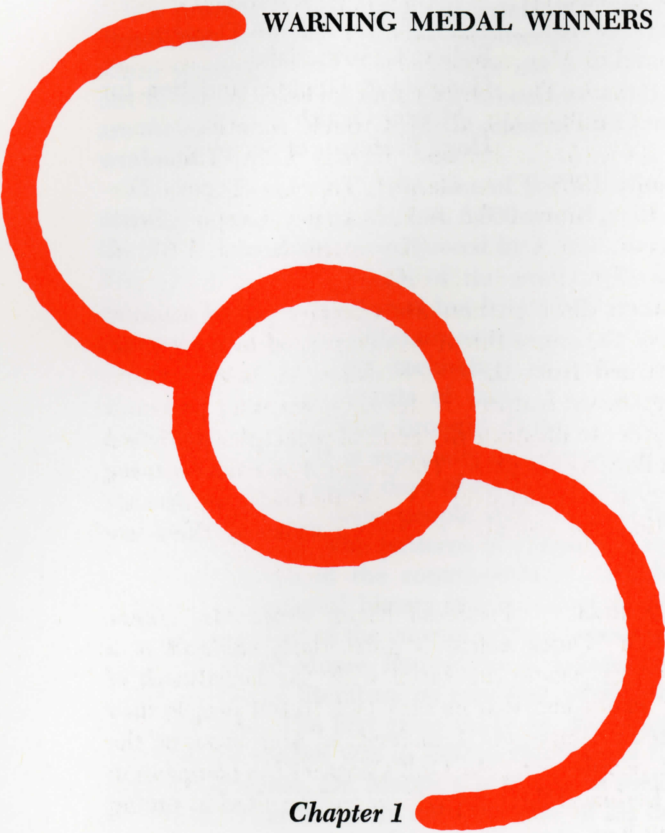
Or, in the author's own words, "disaster warning is not a product; it is a process." These words give a clue to why a mental health foundation is publishing this manuscript. The loss of life when storm warnings are disregarded is not a matter of meteorology but of emotions, attitudes, and subculture patterns. These items are the stock in trade of the social scientist and of the mental health worker.

The warning given at the time of the Galveston hurricane disaster seven decades ago when 6,000 persons were killed came at the last minute and was delivered by a Paul Revere type shouter. This storm wrecked much of the coast around Galveston. The damage was not widespread but because there was little advance warning until the tides literally swept over Galveston many people were killed. Since 1900, technology of communication has been revolutionized. The efforts of many government and privately supported workers have brought about the early and complete alarm system which is especially possible concerning hurricanes. With hours and usually days of radio, television, and even house-to-house warnings, some people still refuse to budge; others flee at the first words. The patterns of response vary by locality, by the exact nature of the communication, and by differences in social and emotional history and makeup of individual persons. J. A. Riley, author of the current survey, acknowledges the work of Dr. Harry Estill Moore. Four of the 45 sources cited by the author in his survey of literature on reactions to disaster bear the name of Dr. Moore. The first grant made by the Hogg Foundation for Dr. Moore's studies was in 1953 at the time of the Waco and San Angelo tornadoes. Dr. Moore, a professor of sociology at The University of Texas in Austin until the time of his death in 1966, was known as an expert in disaster research. Through the decade of his studies, his work received additional support and encouragement from the Foundation, from the Office of Emergency Planning of the President, the Office of Civil Defense, and the dean of Arts

and Sciences at The University, Dr. Alton T. Burdine. Mr. Riley's booklet carries on the behavioral science and mental health approach.

The new president of the Hogg Foundation, Dr. Wayne H. Holtzman, Dr. Bernice Milburn Moore (Mrs. Harry Estill Moore), Bert Kruger Smith, and other staff members of the Hogg Foundation join me in thanking the author for his spirited contribution to a complex field and to his acknowledgment of the pioneer work of our former colleague, Dr. Harry Estill Moore.

Robert L. Sutherland
Consultant, Hogg Foundation for
Mental Health
Hogg Professor of Sociology



WARNING MEDAL WINNERS

Chapter 1

Storms have one good characteristic; they often breed heroes. Safety agency officials, news media personnel and just plain folks rise to the occasion and take incredible chances to help their fellow-man. A special kind of the man responsible for a field station operation during

event.
decade, meteorologists in



hero is singled out here—
National Weather Service
ing a successful warning
Eight times in the 1960
charge of National Weath-

awarded the Department
of Commerce Medal of Meritorious Service for effective warning
of a hurricane or tornado. This role of honor includes W. L. Tilson,
Mobile-Hurricane Camille 1969; C. M. Crouch, Amarillo-Miami,
Texas Tornado 1968; A. L. Pearson, Kansas City—Tornadoes
Kansas City Vicinity 1968; R. A. Garrett, Topeka—Topeka Tor-
nado 1967; E. G. Bice, Brownsville, R. P. Mozeney, Corpus Christi
and E. A. DiLoreto, San Antonio— Hurricane Beulah 1967; E.
Carson, Galveston—Hurricane Carla 1961.

The medal winners did a particularly effective job of assuring
that the urgency of the storm threat was conveyed to the public.
Much can be learned from their procedures. A brief account
of some of the significant features of the eight warning processes
is given in this chapter to illustrate the general principles discussed
in detail in the following chapters. The account of each warning
period is in no way comprehensive; only events that bear directly
on warning reaction are included and even some of these are
omitted.

a. HURRICANE CAMILLE. President Nixon wrote Mr. Tilson,
September 19, 1969: "Quick action is particularly difficult at a
time of turmoil when people are faced with the heartbreak of
abandoning their homes and it is no easy task to tell people they
must leave and seek refuge, yet I understand you brought the
urgent message to people along the Gulf Coast with a compassion
and concern that hastened their departures and resulted in saving
the lives of thousands."

The letter to Mr. Tilson from the President sets the tone of the
warner's dilemma in as true a perspective as any summary found
in the warning reaction literature. The warner must convince the
public of the need to take protective action. In the Camille crisis,
area opinion leaders did believe the warning and communicated

the desired sense of urgency to the public.

Two key factors in this situation were: *close rapport* between Tilson and area opinion leaders and a continuous *flow* of current and credible *informa-*tion during the warning period. In the 20 years that Tilson has been in charge of the Mobile of- fice, he has contacted radio and television per- sonnel and safety agency officials at regular inter- vals. Mutual respect and trust, as well as an under- standing of what to do in emergencies, resulted from the long close association. When Tilson personally telephoned these area opinion leaders at about 5 A.M. (Camille reached the coast at 10 P.M.), they recognized the gravity of the situation, absorbed his sense of urgency and transmitted it to that segment of the public looking to each of them for advice. The first of several waves of evacuation occurred an hour or so after the telephone calls. Warning statements were issued at regular inter- vals in the following hours. The warning related expected condi- tions to land mark tides that occurred with previous storms. These statements enabled residents of the area to act upon the basis of their own past experience. This, combined with the regularity and credibility of the statements, allowed each individual to make a personal decision based on the most reliable information avail- able.



The close rapport illustrated the *two-step hypothesis* of communication. The warning statements illustrate the use of *personal experience* and the need for *credibility*.

b. MIAMI, TEXAS TORNADO. Warning of this storm is a classic example of teamwork that led to extremely effective protective action. A tornado was sighted over the open plains many miles west of Miami. It was reported by telephone to a local radio station; in turn the radio station called Mr. Crouch's office in Amarillo. The Weather Bureau issued the tornado warning, tracked the storm on radar and notified the Texas Department of Public Safety. The warning reached the Miami superintendent of schools, who sent pupils to the basement, holding them there after school normally would have been dismissed (the warning reached Miami just before closing time). Several school buses were destroyed and the upper level of the school building was severely damaged, but no children were killed. The only injuries were cuts and bruises received by two young boys who slipped upstairs to peek at the

tornado before it passed out of sight. The long chain of reports and warnings illustrates the essential nature of warning *teamwork* and unambiguous communication. The reaction of the school superintendent illustrates experience and advance the *disaster culture*.

NADOES. Mr. A. L. Pearson designing for an area of a City vicinity, a warning



the value of personal planning characteristic of C. KANSAS CITY AREA Torsion received his medal for few counties in the Kansas system that has worked effectively in several warning situations rather than a single warning event. Direct broadcasts are made over a network of many commercial broadcast stations in the area. When a tornado is sighted, broadcasts direct from the Weather Bureau begin and continue until the threat ends. The singular feature here is the *authoritative* stature given to the warnings, thus contributing to its credibility.

d. TOPEKA TORNADO. Perhaps the most distinguishing feature of this warning event was the extremely rapid reaction necessitated by the short lead time. The tornado was first sighted at 6:55 P.M., 12 miles from the southwest city limits. Only a few minutes elapsed between sighting and its direct threat to the city. As soon as it was reported to them, Mr. Garrett's staff issued a tornado warning and follow-up statements as they tracked it with radar. Radio and television stations cut into scheduled programs as soon as they learned of the threat, and most devoted their full facilities to warning the public. Despite the very short lead time of the Topeka Tornado, the Kansas Statewide Weather Wire had previously carried the report of a tornado 75 miles west of Topeka shortly after 6:30 P.M. This report set the stage and served as an alerting signal in the warning process. The long experience of the people of Topeka with tornadoes and tornado warnings enabled them to take protective action rapidly, thus again illustrating the nature of the *disaster culture*. Remarkably, only 17 people were killed, while 550 were injured and damage totaled over 100 million dollars.

e. HURRICANE BEULAH. Beulah was an immense storm producing a record number of tornadoes (115) and unprecedented flooding (10 to 20 inch rains) in south Texas, but despite its scale, storm deaths were held to an amazingly low number, only two fatalities. Mass media and safety agencies performed their functions in excellent fashion.

Beulah increased in strength over the Gulf of Mexico just after

dark, about 12 hours before she smashed into the southern tip of Texas. This reported increase sent *rumors* flying through the area that the entire lower Rio Grande Valley should be evacuated. E. G. Bice made direct radio stations early that they should not be evacuated on highways increased exposure to danger he felt any display of *am-confidence* would have sparked a flight erupting in wholesale chaos during that late hour of Beulah's approach.



broadcasts on commercial night stating that the Valley was not to be evacuated at that time. *Con-* would have greatly ing-ger. He later stated that *biguity, anxiety or lack of*

Damage to the Brownsville office building exposed the staff to personal danger but even so, only a calm and confident image was conveyed to the public. Perhaps Beulah in Brownsville is the best recent example of what a weather service office is all about. Tensions brought on by routine and repetitive duties, emphasized by the lonely nighttime vigils, were forgotten with the responsibility, excitement and even the danger of this crisis period. It was a proud period and the personal fulfillment of *meeting the test* is an important psychological factor in all phases of warning reaction—in the warning office as well as in the houses and shelters of the public to be warned.

Corpus Christi was threatened by Beulah for some time before she went inland farther south, and R. P. Mozeney stated that the *frequent*, credible statements issued through knowledgeable safety agents and news media (two-step hypothesis) kept the public properly prepared through the anxious period of Beulah's uncertain path.

Credibility often suffers when a warning does not verify. Public reaction at times even appears to be one of disappointment that the storm did not occur. Mozeney stated that he and his staff are well aware of the danger of the *loss of credibility* through *overwarning* but stated that events were so overpowering in nearby areas that there was almost none of this type of reaction. Follow-up information, presented in a convincing manner, explaining why a storm warning did not verify is considered to be an important, but often neglected, aspect of the warning process. If the follow up shows damage in nearby areas, negative reaction to an unverified warning is minimized.

In addition to the usual technical guidance provided by the San Antonio forecast center, the staff participated in a seldom played

role; it provided *back-up* weather service to the devastated Lower Rio Grande Valley. E. A. DiLoreto arranged for the emergency flow of weather information into the storm-struck area following the destruction of commercial channels. Many studies have shown that the lack of official information following a natural disaster leads to great inefficiency, waste of critical supplies, and to an actual continuation of the personal danger to the public.

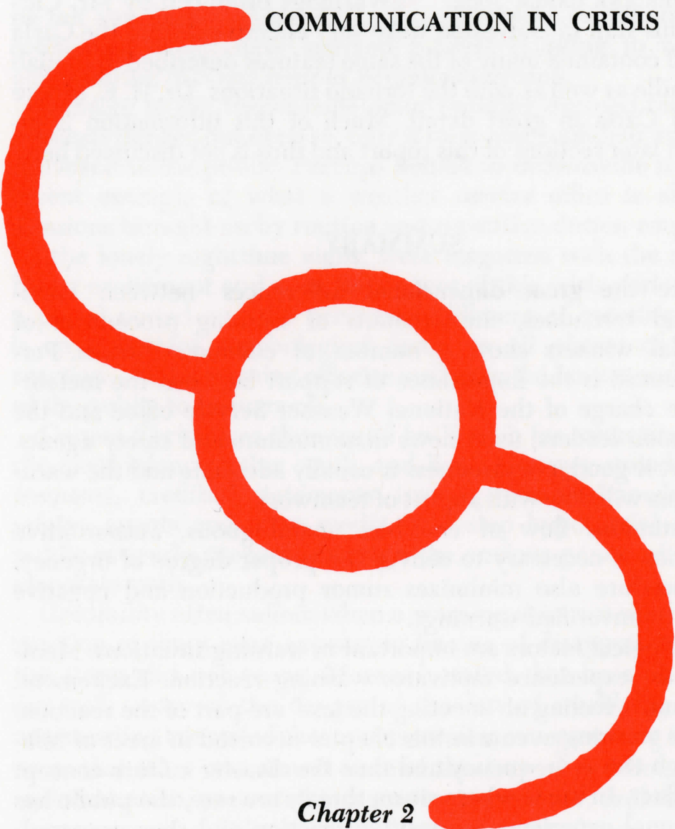
f. HURRICANE CARLA 1962. Warnings produced by Mr. Carson and his staff in Galveston were very effective during the Carla crisis and contained many of the same features described in Beulah and Camille as well as with the tornado situations. Dr. H. E. Moore analyzed Carla in great detail. Much of this information is included in later sections of this report and thus is not discussed here.

SUMMARY

Despite the great dimensional differences between hurricanes and tornadoes, the accounts of warning procedures of the medal winners show a number of common threads. Perhaps foremost is the importance of rapport between the meteorologist in charge of the National Weather Service office and the area opinion leaders, mass news disseminators and safety agents. If rapport is good, preparedness is usually adequate and the warning process will flow with a spirit of teamwork.

A continuous flow of credible, unambiguous, authoritative information is necessary to convey the proper degree of urgency. This procedure also minimizes rumor production and negative reaction to unverified warnings.

Psychological factors are important in warning situations. Memory of past experience motivates warning reaction. Excitement, anxiety and a feeling of "meeting the test" are part of the reaction. All of the warning events in this chapter occurred in areas of relatively high threat frequency and thus the disaster culture concept was in effect. In areas where storm threats are rare, the public has less personal experience in positive reaction and thus preparedness, rapport, and credible information take on even greater importance.



COMMUNICATION IN CRISIS

Chapter 2

"Clear" shouted in a loud and penetrating voice is the standard warning a pilot gives before he starts his airplane engine. And the meaning is unmistakable. "Get away from the propeller; it's going to start spinning." "Fore" has a similarly unambiguous meaning to golfers. But no one word has been accepted as a standard storm warning.



Hurricanes, with their femininity, bring forth thousands of words each year. This total is swelled amazingly by the augmentation of news media verbiage. Tornadoes, despite a briefer existence, are more frequent and the resultant number of words used to warn of their annual threat amounts to a sizeable total. The volume of this outpouring does not necessarily correlate with the effectiveness of a warning situation, and at times the relationship seems to be inverse. Since quantity alone is not the answer, attention must be turned to quality.

Effective communication is a key in motivating appropriate reaction to a warning situation. Even though all of us spend much of our time communicating with people around us, authorities on communication have concluded that few of us actually have much of an idea of what really constitutes effective communication. Each of us knows that misunderstanding is not a rare event. This chapter attempts to bring out significant communication concepts that bear on the problem of conveying the proper urgency in warning messages. The four parts are: a) basic communication, b) mass media communication, c) rumor development and d) the two-step flow hypothesis of communications.

a. BASIC COMMUNICATIONS: SOME PRINCIPLES AND THEORIES.

In the 1950's it became popular to complain about the pseudo illiteracy of the younger generation and many articles touted the theme "Johnny can't read." This was in spite of the noble efforts of an army of English teachers coaching their pupils on vocabulary, grammar and composition. Today we have new names. English is called communication or, for the sophisticated, semiotics. The new discipline called semiotics has three branches: semantics, syntactics and pragmatics.

An illustration of the wide range in sophistication of recent books on communication is *Pragmatics of Human Communication* by Watzlawick et al. (1967). They "postulate the existence of an as

yet unformalized code, a calculus of human communication, whose rules are observed in successful communication but are broken when communication is disturbed." In contrast to the nature of a calculus of communication, the authors illustrate their pragmatic dialogue from *Who's Afraid of Virginia Woolf?* and other earthy tales. These books bring communication into the new generation composed warnings



communication, the authors theory with analyses of *Who's Afraid of Virginia Woolf?* and books bring communication. Suggestions of communication have been made from

time to time in recent years, but the emotional nature of warning reaction clearly indicates that the type of communication needed is closer related to that in *Virginia Woolf* than in a calculus book.

In the more traditional vein, the book *Mass Communications* (1960) gives a collection of communication concepts written by a variety of authorities. Two of these, *Psychological Barriers to Communications* by D. Katz and *The Communication Process and General Semantic Principles* by W. Johnson, pointed out pitfalls to be avoided in the warning processes.

D. Katz said "language was not designed solely to achieve precise interchange of information but also to manipulate fellows and express emotional and psychological wants." Many authorities dwell on this with various degrees of concern. While the obscure origin of language limits our ability to give exact information, the principle emphasizes the possibility of transmitting unwanted emotional overtones and thus bringing undesired emotional and psychological reactions. Katz lists four psychological barriers to communication which impinge upon composition of warning messages: 1) failure to refer language to experience and reality, 2) inability to transcend personal experience in intergroup communication, 3) stereotypes; the assimilation of material into familiar frames of reference (over-simplification) and 4) the confusion of precept and concept; reification and personification.

W. Johnson's article also illustrates pitfalls; he groups disorders in the communication into three classes: 1) Deficiencies in vocabulary and grammatic form are real limitations. The average individual readily understands only about 10% of our language's 600,000 words. 2) Sheer ignorance is often a serious limitation. Differences in experience guarantee differences in usable information

between individuals. 3) Many thought processes are based on pre-scientific orientation. Identification, defined as the tendency to place things and events in general classes, leads to over-simplification. All abstracting pro-
 tails. Projection, the pro-
 condition into external
 but is unavoidable and
 ing processes lead to a
 or, but they omit the in be-



cesses tend to omit de-
 jection of our internal
 events, is not abnormal
 necessary. These abstract-
 two valued system, either-
 between shades of meaning.

These two articles suggest that over-simplification, assuming the warned know as much about the threat as the warner, is a pitfall in effective warning. They also imply that wording must be simple and that technical jargon be avoided. Perhaps a main inference is that all people in the warned area do not have experience to act protectively on receipt of the warning, even if they understand the warning message.

Authorities on modern communication theory and practice are sought after and few training manuals go to press today without an exhortation for better communication. W. Johnson (1966) writing in *Public Administration*, a textbook of articles for students of government, follows this trend. His conclusion states "Mr. A talking to Mr. B is a deceptively simple affair, and we take it for granted to a fantastic and tragic degree. . . . We are a noisy lot; and of what gets said among us, far more goes unheard and unheeded than seems possible."

This business of unheard and unheeded is attributed to selective perception by many modern authors. In taking part in conversation, reading an article, listening to radio and TV, nearly everyone selects certain parts of the message for special attention, usually distorts other parts, and will probably ignore some sections entirely. J. W. Riley and M. Riley (1960) in their article in *Sociology Today* said, "Research has made clear the fact that the individual does not simply see or hear what is transmitted; on the contrary, the individual hears what he wants to hear. In this way perception is adjusted to fit the needs, values, emotions and past experiences of the individual." Much research noted in the last chapter of this report indicates selective perception is an important factor in warning reaction; individuals adjust their concept of the warning message to fit their memory of a past similar event.

b. MASS MEDIA COMMUNICATION. Disaster surveys suggest

that a vast majority of the people affected by major storms in the last decade relied on television and radio for warning information. Lasswell's (1960) classic essay "The Structure and Function of Communication in Society" is often quoted to deposition in society. "The society performs three of the environment, discontinuities affecting the value and of the components within it; 2) *correlation* of the components of society in making response to the environment; 3) *transmission* of the social inheritance".



Although environmental surveillance and issuance of threats are listed as cardinal points of the mass media function, very little documentation of this exists in mass communication literature.

Lasswell and others make quite a point of the principle of equivalent enlightenment. The contention is: if expert, leader and layman have an equivalent amount of information on any important issue, public reaction to a problem will be functional. They do not place the communication goal as a complete exchange of information. For a warning situation this suggests that people in a threatened area do not need to know all the background of information available to the forecaster; they only need an equivalent enlightenment of the danger. The rationale of the forecast is sometimes included because it is wanted by a segment of the public but it serves the role of a confidence factor and is not essential. Confidence can be provided by other means.

Klapper's (1960) book *The Effects of Mass Communications* contains an extensive treatment of the "persuasibility" of mass media. Communication research strongly indicates that the effect of mass media is most often to reinforce previously held opinions. Many minor changes are more likely than conversion of opinion but occasionally widespread conversion does occur. Mass media can, and often do, create new attitudes, and this is especially true when the new attitudes can be established as a reinforcement of a somewhat related currently held opinion. Klapper notes "sources, or, more precisely, the audience's image of sources, affect the audience's interpretation of the communication and its persuasive effectiveness. Sources regarded as credible, trustworthy, or high in prestige apparently abet persuasion . . . Highly specialized sources

appear to be more persuasive for their own specialized audiences than are more general sources for the same audiences." This latter statement verifies the importance of National Weather Service direct broadcasts during

suggested in Chapter 1. tent characteristics and related to media persuasion: tation is more effective tion as a device for con-



storm threat situations as Klapper lists various con- devices which are re- "1) The two-sided presen- than one-sided presenta- verting the highly edu- cated (but vice versa also) . . . 2) Persuasive communica- tions which explicitly state conclusions are more likely to be effective than those which allow audience members to draw their own conclusions . . . 3) Communications which evoke extreme fear are *less* likely to persuade the audience to take precautionary actions than are communications which do not strongly emphasize the threat . . . 4) Repetition, particularly repetition with variation, has been consistently found to increase the efficacy of persuasion. . . . 5) Communications which offer ways of implementing the existing needs of their audiences are more likely to be successful . . ." Each of these points bears on warning communication.

Marshall McLuhan's book *Understanding Media-The Extensions of Man* created a stir among today's academicians. Some compare him with Darwin and Freud, while others spell Freud "fraud." Perhaps his central theme is his statement "the medium is the message" and by this he appears to mean that television has the effect of putting this country back into the tribal state of com- prehensions, regardless of the type of program considered. He makes the point that childhood learning from the printed page promotes a logical pattern of progression, while childhood learning from TV exposure promotes a randomness of observation and thought pattern that is unlike the reading process. McLuhan describes media as an extension of the individual and thus they take on a personal relationship. He classes the various media as either hot or cold and attributes definite characteristics to each be- cause of this. His last paragraph on television describes paradoxi- cal aspects of this "cool medium" and says it involves the audience in moving depth, but it does not excite, agitate or arouse. Some of the disaster research noted in Chapter 4 does not go along with this. Regardless, McLuhan has had a great impact on the academic world and the book *McLuhan Hot and Cold* edited by G. E. Steam

(1967) is an interesting sequel to McLuhan's own composition which has such wide discussion.

C. RUMOR DEVELOPMENT.
seminated in a fairly con-
develop a need to do
to talk about what they
to release this tension, as
need to set up an action



When a warning is dis-
vincing manner, recipients
something, even if it is just
are going to do. The need
well as the more practical
plan, creates a potential

for rumor. And rumor is an important factor in warning reaction.

Rumor can impede protective action, thus increasing storm loss, or rumor can encourage premature or overly protective action, thus conditioning recipients to laxity in subsequent warning periods. Regardless of the direction of the rumor force, the degree of rumor activity seems to be proportional to: severity of the threat, relative ambiguity of information defining the threat, and the lead time preceding the impending threat.


Behavioral sciences have directed many studies of the rumor process to their area of primary interest: psychologists—accuracy of perception and recall; psychiatrists—venting repressed impulses; sociologists—social problem solving. The different perspectives lead to different and sometimes contradictory conclusions.

Viewed through psychological studies, rumor is considered a distortion of serial transmission. A story told in relay fashion by a number of people seldom remains unchanged, thus promoting rumor. Perception and recall ability vary among people as do interests and vocabularies; consequently repetition leads to inaccuracy.

The comprehensive study by Allport and Postman (1947), and validated by many later psychological studies, lists three sources of distortion of serial transmission:

1. Leveling—tendency of accounts to become shorter, more concise and more easily grasped.
2. Sharpening—tendency toward selective perception, retention and reporting of a limited number of details.
3. Assimilation—tendency of reports to become more coherent and more consistent with presuppositions and interests of the subjects.

They also framed the widely quoted formula for rumor intensity ($R \sim i \times a$), "the amount of rumor in circulation will vary with the

importance of the subject to the concerned individuals times the ambiguity of the evidence pertaining to the topic at issue." In a later study Chorus (1953) divided the right side by (c) standing for critical ability. He in-

tended this to be a meas-
 rumors decrease when
 phenomena. For the storm
 in preparedness coupled
 of the warning process,
 "rumor wise" with the
 same desirable end.

Psychiatric studies of rumor have emphasized the importance of personal desire and interest, wish fulfillment, and frustration in the face of an uncontrollable threat. Many of these studies point out that a person who repeats, or modifies a rumor, claims he is only passing on what he has heard and thus disclaims responsibility for the facts. Rumor provides an outlet for releasing repressed impulses; and the contribution of each individual to the formation of a rumor depends upon personal needs. Rumor from this standpoint is something pathological and a rumor-monger is a person with poor adjustment to reality.

Improvised News: A Sociological Study of Rumor by Shibutani (1966) defines rumor from the sociological viewpoint as "a recurrent form of communication through which men caught together in an ambiguous situation attempt to construct a meaningful interpretation of it by pooling their intellectual resources." He distinguishes rumor from other types of collective transactions which occur at times of ambiguous situations as occurring at a lower degree of normalization. This viewpoint rejects a commonly conceived attribute of rumor, that it is based on error. It also rejects the position that rumor is a pathological phenomenon.

For the storm warning process Shibutani states a useful axiom: "If the demand for news in a public exceeds the supply made available through institutional channels, rumor construction is likely to occur." Credibility of the institutional channel is a necessary prerequisite and is implied in the axiom.

d. TWO-STEP FLOW OF COMMUNICATION. Lazarsfeld et al. (1948) stated their two-step hypothesis in their now classic book *The People's Choice*. Analysis of individual decision making during an election campaign led them to believe that the flow of influence from mass media was less direct than previously supposed. They

hypothesized that influence stemming from the mass media first affects "opinion leaders" who in turn pass on their information and opinion to their associates. Many subsequent communications studies have verified and E. Katz (1960) expands "The Two-Step Flow of indicated the process occurs personal relationships. He nels of information, 2) and 3) sources of social support.



amplified this principle. the subject in his article "Communication" and in- within channels of inter- states these are 1) chan- sources of social pressure

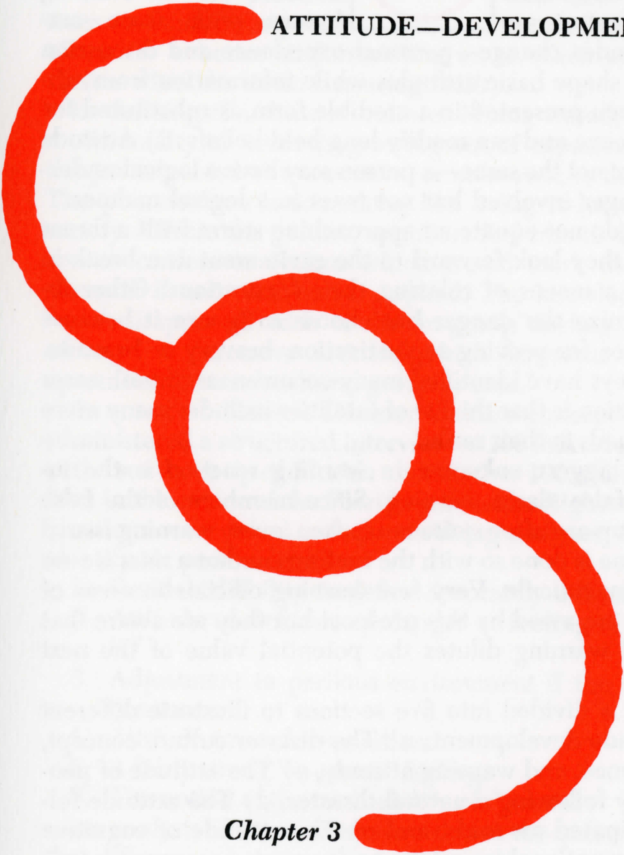
Moore's studies following Hurricane Carla indicated that the two-step flow occurred prior to the storm and helped shape attitude and resulting behavior; but during the actual warning, most people reacted to the direct guidance of mass news media. After the impact period, opinion leaders and the two-step flow took over again.

Perhaps a useful adaptation of the two-step flow hypothesis in preparing for future warning situations is to consider the news media as the opinion leaders and thus attempt to inform them as completely as possible on varied aspects of the warning process.

e. SUMMARY. If the storm warning process is to promote a positive reaction, two distinct types of communication are essential: 1) Personal communication on the part of the warning office to establish rapport with area opinion leaders—mass news disseminators and safety officials—so that all groups will function as a team and 2) Official communication of warnings composed in an understandable manner and presented in a credible and authoritative fashion.

Establishing rapport and developing teamwork among all elements contributing to the warning process is an extension of the two-step flow hypothesis of communication. This is an essential function and its importance increases rather than decreases with the development of more sophisticated procedures and equipment.

Composition of warning messages is fraught with many pitfalls, and communicating an equivalent knowledge of the storm threat is a complex process that requires much practice. Delivery of the warning message must be unambiguous, credible, and frequent in order to stem rumor production, convey the proper degree of urgency, and communicate the needed information.



ATTITUDE—DEVELOPMENT AND MODIFICATION

Chapter 3

Determination of personal attitude towards storm warning and towards seeking protection during actual storm conditions is at best only an indirect effort. Analyses of post disaster surveys summarizing some 10,000 per-
main source of informa-
also been drawn from
have entered the litera-



Despite the limitations
attitude, two factors are

known with some certainty: 1) Attitudes change—personal experience and discussion with associates shape basic attitudes while information from official sources, when presented in a credible form, is substituted for personal experience and can modify long held beliefs; 2) Attitude and behavior are not the same—a person may have a logical understanding of danger involved but not react in a logical manner.

Some people do not equate an approaching storm with a threat to their safety; they look forward to the excitement as a break in routine and as a means of relaxing their frustrations. Other individuals recognize the danger but choose to ignore it because it offers a chance for proving sophistication, bravery or bravado. Post storm surveys have identified many occurrences of both cases and the supposition is that the list of fatalities includes many more of these individuals in their ranks.

Perhaps the biggest unknown in warning reaction is the influence of the false alarm warning. Since members of the false alarm critic group are often quite outspoken, every warning issued on the local scene is done so with the realization that a miss is sure to be greeted by ridicule. Very few warning officials in areas of frequent threat are awed by this prospect but they are aware that each unverified warning dilutes the potential value of the next warning.

This chapter is divided into five sections to illustrate different aspects of attitude development: a) The disaster culture concept, b) Age, experience, and warning attitude, c) The attitude of people immediately following a natural disaster, d) The attitude following unanticipated air raids, and e) The attitude of cognitive dissonance and emotional inoculation.

a. DISASTER CULTURE CONCEPT. H. E. Moore developed the concept of a disaster culture in his book *And the Winds Blew*. People who live in an area that is exposed to storm damage at

fairly frequent intervals develop attitudes towards storms and storm warning quite different from attitudes in areas relatively free from storm threats.

Perhaps the basic feature found along the Gulf coast under threats is an attitude in ability to "take it." But to have its very practical



tures are built for exposed populace has a better understanding as to when and how to take shelter when the storm is nearing reality.

In defining the disaster culture, Moore stated, "At the core is a community of interests growing out of experiences common to the participants but uncommon, or unknown, to the larger society. The phenomenon is something like being inducted into a secret society. Within the culture, members feel free to display emotions and to confess to actions which would mark them as seriously aberrant if universal norms applied. The knowledge of probable social disapproval adds to the 'in-group' feeling and further encourages a defensive attitude which functions to increase the apartness of the subcultural group or area."

As a test of Moore's Disaster Culture concept Osborn (1970) administered a structured interview to 100 individuals in Key West at the southern tip of Florida and another 100 individuals in Lakeland in the center of the Florida peninsula. Eighteen multiple part questions were asked and the resulting analyses were grouped to identify six personal traits.

1. Residents' ability to define accurately a disaster situation.
2. Attitude of defiance of danger or feeling of ability to "take it."
3. Adjustment to perilous environment if the danger is fairly constant.
4. Attitude toward evacuation.
5. A fairly strong "in-group" feeling.
6. The notion of the inevitability of disaster.

An analysis of the answers recorded in the questionnaire showed that differences between the two areas were statistically significant at the .001 level for all but trait 6, the notion of the inevitability of disaster. Thus it was concluded that the respondents in Key West gave sufficiently different answers as compared with respondents

in Lakeland to be able to classify the Key West population as a "Disaster Subculture."

Some of the specific differences are particularly interesting. Key West respondents had a potential structural damage as from high tides. Key West respondents checking weather reports Lakeland the percentage



much better idea of po- from strong winds as well Seventy-six percent of the made a point of always at least once a day; in was only 26. During hurricane season 81 percent of the Key West interviewees check weather reports more frequently, while in Lakeland only 61 percent indicated increased vigil. In Key West 82 percent correctly defined hurricane watch and 80 percent hurricane warning; in Lakeland the percentage was down to 26 for hurricane watch and 27 for warning. One question asked for a yes or no to the statement "Storm warnings probably make little difference as to the amount of loss of life caused directly by hurricanes." In Key West 97 percent disagreed and in Lakeland 86 percent disagreed. The difference was small but it was an encouraging sign that the public regards the warning service as beneficial.

The Disaster Culture has a definite effect on the operations of safety agencies. Helbush and Sadowski (1966) writing in the "Police Journal" illustrated the increased vigilance and more sophisticated procedures employed by police and civil defense organizations located in areas of relatively frequent storm threat.

One manifestation of the Disaster Culture is definitely self-defeating, and this is the tendency to make light of danger after the storm has passed. Newspapers seem to be especially attracted to this trait. Whether it is their search for the different, or a desire to cheer a battered population, they carry frequent articles about those who flaunt danger. The hurricane party syndrome was exaggerated out of proportion in connection with Hurricane Camille as shown by Wilkinson and Ross (1970). And, it seems that newspapers find it hard to resist running the stereotyped article of Aunt Minnie sitting and rocking on her front porch amidst the furor and rubble and calmly saying, "What's all the fuss about?"

A basic feature of the Disaster Culture is the attempt to deny or minimize the danger faced and the loss incurred. Numerous case histories document the apparent fact that there is a stronger attitude toward the minimization process in disaster prone areas than

in areas free from threats. This reaction seems to be a conditioned reflex from family and neighbors and reinforced after each disaster as praise from outside areas flows in for their having survived another one.

tion of the practical and quotation Dr. Moore in-lady of an old, prominent in Galveston in 1961. "I and amused when I was



before Carla and noticed the steady stream of people in and out of liquor stores—not to give false courage but to pass the long hot hours expected without air conditioning. It is also worthy of note that we enjoyed a bounty crop of babies last May and June—Carla babies they are called, and explains how a great many of our citizens spent their time during the storm."

Preparation of warning bulletins must take into account the Disaster Culture, but also with the increasing number of travelers and new residents, especially along the coast, warning must also care for people out of the culture.

b. AGE, EXPERIENCE, AND WARNING ATTITUDE

"I rode out Hurricane Betsy sitting right here at my little old kitchen table and I am not about to leave for Camille." Sam Smith said this 24 hours before his home and his little old kitchen table were swept right into the Gulf of Mexico.

Sam's sentiments are not rare. Many people in the storm prone areas feel much the same, having lulled themselves into a false sense of security by relying on an out-of-focus view of storm warnings brought about by a limited experience with storms.

Personal experience is closely related to an individual's attitude towards storms and storm warnings. This is widely documented in the literature, but some contradictory results have been reported because a significant number of analyses have failed to define experience in sufficient detail.

The terms *core experience* and *peripheral experience* are proposed here to define this important concept. Core experience—being present in the middle of a damaging storm—is cautionary. Peripheral experience—being located on the outskirts of a major storm or in the middle of a minor storm—is non-cautionary and often leads to a laxity of vigilance and underestimation of danger.

As far as can be determined there have been no studies that

have classified storm experience. An interviewed respondent was considered either to have had experience or not. This factor sometimes led to a positive relation to protective attitudes, sometimes negative, but most often

Wilkinson and Ross experience factor in the city survey following Hurricane Camille. Nearly 400 individuals were administered and one of the ques-

tioned was "Have you experienced a hurricane before?" Eighty-eight percent of the people who did not evacuate had experienced at least one hurricane before Camille. Only 81 percent of those who evacuated before or during the hurricane reported this experience. The difference between the two groups is small and suggests that hurricane experience does not promote protective attitudes. This is the same negative result reported by a number of other studies, but the Wilkinson and Ross study went on to test the respondent's knowledge of warnings and the relation between critical weather conditions and implied danger. Although not a direct measure of personal experience, these results give an estimate of personal understanding based on information acquired by any means available: reading newspapers, listening to radio or television, or conversations with other people, as well as personal experience.

Seventy-three percent of the leavers defined hurricane warning correctly, while only 66 percent of the stayers could make the definition. Seventy-seven percent of the leavers, as compared with 71 percent of the stayers, defined hurricane watch correctly. Although the leavers had a slightly better knowledge of warning terminology, the difference was quite small.

The factor that gave the biggest separation between leavers and stayers was their comprehension of danger. Leavers had a much better understanding of storm damage. The difference between leavers and stayers was 34.6 percent for the potential water damage scale and 17.7 percent on the potential wind damage scale. The useful information displayed by the leavers as compared to the stayers could have been acquired by core experience with storms or by an educational safety program, but it is doubtful that peripheral experience with storms could have accumulated this information.

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Age is a measure of experience. On the average, older people in

a storm-prone area have seen more storms than younger people. So many other factors are involved, however, that the effect of greater experience is masked by more important variables such as mobility, health, and sources.

summarizes known storm from Hurricane Camille occurring in Jonesboro, and Jackson, Mississippi (the tornadoes are discussed in the last chapter).



availability of news The following table fatalities by age resulting and from major tornadoes Arkansas and Hazelhurst

STORM FATALITIES

<i>Age</i>	<i>Hurricane Camille</i>	<i>Tornadoes Ark. & Miss.</i>
0-5	8	15
6-15	18	13
16-25	9	6
26-35	4	23
36-45	12	8
46-55	11	9
56-65	16	9
66-75	24	9
75-up	21	1

Hurricane Camille was far from impartial. Flood tides showed a strong preference for older people; 17 percent of the fatalities were over the age of 75 and 37 percent over 65. When compared with the total number of people in the various age brackets, the vulnerability of the older citizens becomes even more shocking. Tornadoes are somewhat random pillagers. The table shows a peak in the 26-35 age group. This reflects the exposure of this age; these individuals move around more and probably take more chances. The very young are also extremely vulnerable as well as the over 65 group.

Fatalities claimed by Hurricane Audrey and reported by Friedsam (1957) again illustrate the great vulnerability of older people.

AGE OF IDENTIFIED DEAD AND PERSONS REPORTED AS MISSING FOLLOWING HURRICANE AUDREY

Age	Missing	Identified Dead	Total	Deaths Per 1,000 Pop.
9 & under	61	54	115	79
10-19	20	23	43	38
20-29	26	18	44	46
30-39	11	13	24	27
40-49	20	24	44	56
50-59	16	12	28	51
60-69	11	19	30	111
70 or over	18	19	37	159
Unknown	13	25	38	—
TOTAL	196	207	403	64

As shown by the last column, the greatest vulnerability by far is in the 70 or over bracket. The 60 to 70 year group had the next highest fatalities, while the third largest group is the very young.

Osborn (1970) made an analysis of differences in attitude and understanding of storm conditions and warning procedures between individuals under or over 45 years of age in Key West. The 45 year cut-off is too low to define attitudes of older people, but the analysis does give some clues. When the interviewer asked the respondents if they planned to ride out the next hurricane at home, 12 percent of the younger group answered yes, while twice as many of the older group said they would. Eighty-seven percent of the young people could define hurricane warning while only 76 percent of the older ones could. The younger persons had a somewhat better understanding of both wind and water damage. Surprisingly, 80 percent of the older group said they always checked the weather report at least once each day as compared with only 70 percent of the others. But during the hurricane season the younger group caught up with the older ones.

At least three features have been suggested as related to the high storm vulnerability of older persons (over 60) by Moore and Crawford (1955) and Friedsam (1960) and later studies:

1. Relative isolation from informal communication networks and to a lesser extent from the radio and television media and thus less access to the warning system.
2. A frequent fatalistic attitude that incorporates a reasoning that says "if my home goes, I might as well go, too."
3. A reduced mobility brought on by declining health and vigor.

Whether these three factors overcome the potential advantage of having accumulated more core experience through advanced years, or whether storms single out of those older individuals who have missed out on core experience is not known, but it is obvious that the current warning system should give more attention to the needs of the senior citizen.



C. ATTITUDE IMMEDIATE-DISASTER. Escape from traumatic events. Survival

produces a pattern of psychological reaction which in turn leads to a rather well defined system of post disaster attitudes. The degree to which these attitudes are adapted varies with the individual and with his closeness to the crisis.

Since post disaster surveys are the means of gaining additional information on the storm and on the effectiveness of the warning system, it is important that anyone interviewing storm victims be aware of these attitude patterns. From a humane consideration, the interviewer must expect to find victims with their emotions exposed and vulnerable to accidental damage; from a purely practical standpoint he must realize that these attitudes warp objective analysis of the storm conditions.

Disaster, A Psychological Essay (1957) by Martha Wolfenstein is a classic treatment of the subject. A summary of this book prepared by K. R. Mitchell in the *Journal of Pastoral Care* was used as an interview guide immediately after the Topeka tornado in 1967. Varying degrees of some of these attitudes are described as fairly permanent characteristics of the disaster culture.

Perhaps the most general attitude characteristic held by storm victims immediately following the disaster is the post disaster utopia. Mitchell wrote "There is an insistence that 'we were lucky.' Everyone, no matter how much loss is sustained, insists that he knows someone who sustained a worse loss. This appears to be true even in the case of loss of life . . . Since a disaster provides excessive vicarious satisfaction for the negative components of feelings for others, the positive sector comes into the ascendancy. There is a sharp upsurge of positive feelings called the post disaster utopia. This breaks down in time and the beginning of the breakdown is signaled by hostility toward rescue agencies first (like Red Cross, Salvation Army, churches)."

A true analysis of warning effectiveness can be obscured by either the positive or negative attitude or by the switch from posi-

LY FOLLOWING NATURAL death is one of life's most of a tornado or hurricane

tive to negative, thus reducing the objectivity of the post disaster interviews.

Following a severe storm some people on the scene insist that they, for physical reasons, couldn't see anything. A few report hysterical blindness or a temporary nature. Some make up accounts to impress those around him, to create an image—bravery, shrewd analysis of danger. Many speak of a “cursed spot” or a “magically protected one.”



other similar symptoms of individuals apparently press the interviewer, or ate some desired personal observation, or keen and people speak of a “cursed

Two basic divergent efforts of victims are the need to relive the event and the need to escape any reminder of the disaster. The need to relive is proportional to the lack of preparation before the storm and the inability to react adequately during the storm.

Sleeplessness, lack of attention to current events, and anticipation of a second disaster are common psychological reactions to severe storms and detract from objective analysis of storm events by the victims. The “sightseer” phenomenon is probably the best known psychological result of a disaster. Authorities attribute sightseeing to a gratification of sadistic impulses but it usually is an unconscious motivation that is denied by sightseers.

Psychological reaction described so far in this section applies to the time scale of several days after the disaster. Healy (1969) included in his book a report from the American Psychiatric Association which deals with shorter term reaction found immediately after a disaster and which is applicable to the time scale of minutes or hours. Five classes span the immediate reaction range: 1) Normal, 2) Depressed, 3) Overactive, 4) Bodily, 5) Individual panic.

Normal reaction—Some individuals remain calm even in crisis circumstances but most show some sign of disturbance such as perspiring or trembling or they may become weak or nauseated for a short period.

Depressed or apathetic reaction—Some individuals become numbed and confused and are unable to help themselves in emergencies. The time span of this reaction varies with individuals but rarely exceeds a few hours in storm situations.

Overactive reaction—In contrast to the victims just described, some explode into a flurry of activity, much of which is useless. They jump from job to job and are intolerant of any ideas but their own. These are the ones who begin the rumor and scapegoat-

ing processes, and, because of an unreal confidence in their own abilities, can disrupt useful effort until controlled.

Bodily reactions—A small percentage of victims may advance beyond the normal reaction and become truly disabled by severe nausea, even smaller percentage a different disorder called "conversion hysteria." This is not hysterics. In conversion hysteria the victim unconsciously converts his great anxiety into a personal belief that some part of his body has ceased to function, and for practical purposes it has. By bypassing the disability to some degree, it is possible to help some of the victims regain their composure while waiting for medical help.



Individual panic—This reaction, often called hysterics, is far less frequent than might be expected; but because it is so contagious, it is extremely important when it does occur. Prompt and patient control can usually calm victims even in acute panic in five to ten minutes; but if not controlled, the panic can spread rapidly. Storm situations which most often lead to this type of behavior are those in which the victim feels trapped and all escape routes appear to be cut off. Sheer horror can also induce panic. The sight of a close friend or a family member who has suffered gruesome injury may bring on panic in some individuals, especially if they themselves have suffered little or no physical injury.

Post storm surveyors rarely reach the disaster scene early enough to experience the five reaction patterns listed just above; however, the attitudes listed in the first part of this section often extend into the post survey period. Officials making these surveys should not only be aware of the phenomena of victims on the scene, but they must also recognize these natural impulses in themselves.

d. ATTITUDE FOLLOWING UNANTICIPATED AIR RAIDS. No large scale investigations have been made of any storm warning situation that was not followed by a severe storm. This is because disaster studies have focused on attitude and behavior after impact rather than during the warning period to the storm. Air raid warnings and storm warnings have a common goal—to stir protective action. But studies of the two types of warnings have been based on opposite approaches—all investigations of air raid warning situations in this country have focused on the pre-impact, or warning stage, obviously and happily because there have been no air

raids even though there have been air raid warnings.

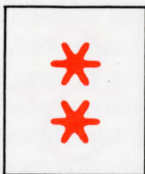
Air raid warnings in the 1950's generated very little public response and the National Academy of Science's Disaster Report 15, *The Occasion Instant* (1961) by Mack and Baker, attempted to find out why. The report summarizes three research studies of air raid warnings: "Warning Yellow" tells of a warning based on the approach of unidentified aircraft towards California's Bay Region May 5, 1955. It was cancelled about 15 minutes after release but at the time it was an authentic warning. "Wrong Number" occurred November 25, 1958, in Washington, D.C., because telephone workers accidentally triggered the warning system. "Joy in Mudville" was the case of sounding civil defense sirens in Chicago on September 22, 1959, in celebration of the White Sox winning the American League pennant after forty years of futile attempts.



The Washington, D.C., warning was interesting for a number of reasons, one of which was the great number of people involved that should have been well versed on air raid warning procedures. Approximately 500 government workers were interviewed from: the Departments of Commerce, HEW, State and Treasury and the Veterans Administration and the Weather Bureau. (The report distinguishes Weather Bureau from the Department of Commerce because they were housed in different locations). Approximately three-fourths of the interviewees had on-the-job training for civil defense warnings. Some attempt to establish the nature and purpose of the signal was made by 95 percent of the people and more than one-fourth left the building in which they were working but did not go to shelters. One-fifth went to a shelter. There were significant differences between agencies. Mack and Baker stated that "No one in the Weather Bureau went to the air raid shelter but a third of the people at the Department of Commerce did. These are the two extremes." Though interesting, no rationale was attempted by the authors and none will be attempted here.

In addition to analyzing the three air raid warnings, Mack and Baker drew upon other warning studies and came up with a list of 15 broad general propositions encompassing patterns of human social behavior to warnings and 36 hypotheses illustrating particular features of warning reaction. These were grouped by attitude and by behavior. The first group is discussed here.

The attitude towards the warning and the interpretation of the meaning of the signal message depends on: 1) What persons in the immediate environment believe; if associates regard the warning as valid, the observing individual accepts their attitude; if not, he also does not. 2) Previous experience with the same type of signal without validation by most individuals. 3) Display of an unsure or ambiguous attitude to the warning by official sources brings a similar attitude to the individual and vice versa.



The attitudes of individuals vary according to the primary group within which they are situated at the time the signal is received. Persons surrounded by their own family group tend to treat the signal more seriously than when situated in any other primary group. Individuals situated in a group of peers are least likely to treat the signal as valid. Peer groups tend to discuss the situation but generally conclude to ignore the threat unless it is particularly urgent.

Social categories appear to show differences in attitude to warnings. Women are more likely to interpret the signals as valid and indicative of an impending disastrous situation than are men and they are more likely to report a strong emotional response to the warning. Middle educated groups are most likely to interpret the warning to mean what it is formally intended to mean than are poorly educated (persons who have gone no farther than grammar school) and college educated individuals. Small town residents, or city people with small town backgrounds, are less likely to interpret a warning as valid than are residents of large cities. Generally the older the individual, the less likely he is to interpret as valid a warning intended to preface a disaster.

These variations in attitude to warnings emphasize that the public cannot be considered as a mass and warned with one simple message. But we know that a warning agency cannot frame a specific warning for each group. The only way to resolve this is by advance preparation and a specific approach to each group prior to the occurrence of a warning situation.

e. COGNITIVE DISSONANCE AND EMOTIONAL INOCULATION.

Storm surveys have shown that some individuals have a clear understanding of the danger to which they are exposed but yet they do nothing to minimize the hazard. Behavioral scientists have

recognized this paradox in many threat situations and have documented the phenomenon in studies of highway safety, cigarette smoking and various other health hazards.

A *Theory of Cognitive*

Festinger deals with the that the individuals seem types of gratification from are flaunting danger. This idea and is a dissonance



Dissonance (1957) by L. paradox. He indicated actually to receive certain the cognition that they is the so-called "he-man" reducing mechanism. Hur-

ricane parties, held by small elements of society in areas of frequent tropical storm threat, are a manifestation of the cognitive dissonance concept; this example involves women as well as men. I. L. Janis et al. (1951) proposed the emotional inoculation theory in "Effects of Preparatory Communication on Reactions to a Subsequent New Event." They wrote: "A step-wise increase in feelings of insecurity has two advantages from the standpoint of personal adjustment. First, it stimulates each individual to rehearse the future danger situation in his own imagination and this, in turn, often leads to the spontaneous development of a variety of personal techniques for handling one's own anxiety. This process of internal preparation probably leaves the person in a less vulnerable psychological position when he is confronted with subsequent anxiety arousing events." This emotional inoculation in certain individuals is reinforced by unvalidated warnings and constitutes a real problem in a limited number of individuals.

These two concepts are illustrations of the paradoxical bridge between attitude and behavior. Further, these examples of personality variations show why any system of warning cannot preclude the possibility of storm fatalities even under the best of conditions. The required type of personality training involved here is clearly beyond the scope of warning preparedness.

f. SUMMARY. Attitude toward storms and storm warnings is a highly personal matter and this is the reason that individual reaction to storm warning is such an erratic phenomenon. Disregard of safety by individuals or groups infected by cognitive dissonance is a basic emotional attitude that cannot be influenced by the warning process; however, this aberrant condition fortunately is restricted to a small segment of the population. The great majority have some flexibility of attitude. They can be turned toward more

positive reaction, and they are strongly influenced by attitudes of other persons within their view and within their contact through the mass news media.

The disaster culture is a defense mechanism and must be reckoned with in each warning. Acceptance of the characteristics of the culture varies widely from area to area and between individuals within an area; however, there is enough commonality in areas of frequent threat that this concept must be recognized.

Emotional reactions are normally strongly repressed in warning offices, often so much that the warner loses sight of the fact that warning reaction is largely an emotional affair, not one of logic. This contrast is particularly evident when the warner attempts a post storm survey. Any official planning this type of survey should prepare for it as carefully as he prepared the original warning information.



BEHAVIOR—THE MOMENT OF TRUTH

Chapter 4

When crushing wind or pounding surf knocks on the front door and tries to get in, when terror in the form of lightning streaks the sky and thunder rattles the windows—this is the moment of truth for personal storm survival. Has a lifetime built stand the threat or has a taking come to an end? This moment of drama, of success or failure, is not despite the personal test the moment of truth for the warning system. The system's test is already over, won or lost. At some period prior to the personal crisis, the individual has decided to act or not to act upon the warning.



Probably a key shortcoming of many studies of warning reaction recorded in the literature is the failure to distinguish between these two moments of truth. In the study of any single warning event it is impossible to make the distinction because the objective of both is to minimize loss and the only yardstick for measuring either is the list of storm casualties. Thus in a particular storm, success in the personal moment of truth—minimum loss of life despite significant danger to a large segment of population—is equated to success of the warning process. But escape or nonescape in some storms resulted from a manner of behavior brought on by a sequence of events quite unrelated to the warning process.

The attitude of cognitive dissonance discussed in the previous chapter allows a segment of the population to maintain a vulnerability to danger despite good warnings. But on the positive side, human behavior occasioned by stress situations often allows individuals to escape at the last instant even though they took no preparatory protective action.

Post storm surveys, the major source of data on storm warning behavior, suffer from a number of limitations which result in the inability to distinguish between individual survival and success of the warning process.

Mack and Baker (1961) discussing surveys stated "There are simply too many chances for error here. Occasionally, people may deliberately falsify answers, perhaps out of fear of punishment from the organization, hope of approval from the interviewer, or shame at their own ignorance, cowardice, or folly. Probably more often the case is that, out of similar motivations, people unintentionally or unconsciously warp their own memories of a situation so

that they see themselves as they would like to have been rather than as they were."

In addition to this distortion of reported behavior, another aspect of the limitations of fact that they all must obviously there can be no storm has come and gone, rival has disappeared; all decision making are now a



post storm surveys is the cur after the fact. Obvi-
post storm survey until the
the uncertainty of its ar-
the facts needed for de-
part of the record and it is

almost impossible to evaluate objectively the actual ambiguity that influenced real time decision making.

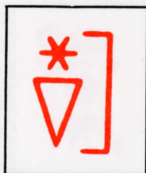
Nearly all surveys have been confined to areas of hits, not misses, and there is little real information on reaction to unverified storm warnings. If it is found in a post storm survey that an individual took protective action, it is assumed that he acted wisely despite the possibility that his action was motivated by reasons other than his belief in the warning. But if an individual did not seek protection, even if this is a learned reaction caused by experience with many preceding unverified warnings, the survey assumed he acted unwisely. Is this logical? A number of surveys have shown that highly educated individuals are often among the last to take protective cover.

Weather conditions prior to a warning also influence behavior. A storm preceded by threatening weather usually promotes a higher degree of positive warning reaction. Hurricane Camille produced a minimum of harbingers while Hurricane Carla gave a vivid preview of events to come. Tornadoes preceded by sunny weather come more as surprise than those developing in rainy weather. But visible tornadoes occurring in daylight and without rain are easier to avoid than those imbedded in heavy rain and occurring at night.

The ability of the individual to take immediate evasive action when faced with a stress situation has enabled him to meet his personal moment of truth even though he had not acted upon the storm warning. Mild excitement tends to make an individual more alert, his receptive systems become more sensitive, selected perception increases and attention narrows to lines of adaptive action. Thinking is facilitated, irrelevant images are suppressed and concentration and alertness are greater. Acute emotional upset, however, is a disintegrating process and reactions become negative.

Basic behavioral patterns occurring under stress are discussed in the first part of this chapter and specific patterns associated with hurricanes and tornadoes are covered in following sections. A few specialized aspects of these patterns are summarized in the last parts of the chapter.

a. BASIC THREAT BEHAV-



central theme of this section that bridges the gap between attitude and behavior. If a warning does not convey a sense of urgency, then the individual does not react as if it were a threat. If the storm does arrive, his reaction to threat is immediate and relates to physical danger readily observable in the environment. It is the recipient's conception of the threat, whether in the warning or only in the environment, that motivates his behavior.

Two collections of articles by authorities on a wide range of disciplines give a comprehensive view of this subject. In particular, "Psychological Effects of Warnings" by I. L. Janis and "Reaction to Uncertain Threat" by S. B. Withey in *Man and Society in Disaster* (1962) and "Human Factors in Warning-and-Response Systems" by H. B. Williams and "Sequential Accommodations to Threat" by S. B. Withey in *The Threat of Impending Disaster* (1964) have much detail on threat behavior.

Withey (1962) defines threat, its view by individuals and their resultant behavior, in terms of five primitive characteristics:

1. Probability of occurrence of the threatened event.
2. Qualitative nature of the threat—physical pain, loss of loved ones, etc.
3. Estimated magnitude of deprivation in the mode of threat.
4. Timing—imminence and duration.
5. Possibility of escape or adaptation.

Williams (1964) applies these primitive characteristics to storm warnings. "The way an individual responds to warning is apparently a function of the way he defines the situation. This definition seems to include the following factors: strength (how likely is the danger to materialize, and how serious will be the loss if it does?), the time element (how long will it be before one has to decide, and how long will it require to take effective protective action?), the cost of protective action (economic, psychological, social), the presumed effectiveness of available counter measures (will they do any good against the threat?)." Many reports suggest that

this pattern of reasoning is followed in an informal way. Unconscious and irrational factors enter the process and it is rare that any formal evaluation of the five points is actually made. If there is time, most warning recipients try to gain additional information on the threat situation and they nearly always try to secure a confirmation of the original warning. Williams suggests that any serious needs to have a second message that merely says: Yes, this really is



enters try to gain additional situation and they nearly firmation of the original gests that any serious second message that mere-a threat.

In his later article Withey (1964) traces the social evolution generated by increasing threat. "Many threats create an initial feeling of camaraderie in exposure to a common fate. Increased seriousness of the threat leads to a recruitment of allies and a mobilization of resources, duties, and commitments on the part of others. Continued threat leads to greater organization and a tolerance of central authority. If this is ineffective, scapegoating may occur; and if it is inadequate, social disorganization sets in and is replaced by social organizations of units, cliques, gangs, and so forth, at a smaller level. If these are inadequate, a state of everyman-for-himself signifies complete disorganization and extreme threat."

Among several models of behavior in the face of a threat, that proposed by I. L. Janis presents an easily understood pattern. Warning information and environment cues give rise to a reflective, or a thoughtful, fear in the individual. This fear gives rise to two needs: need for vigilance and need for reassurance. These two opposing needs lead to a range of behavior extending from indiscriminate vigilance to blanket reassurance. A compromise formation is the mid-point between the extremes and is suggested by Janis as normal behavior to an adequate warning. In every warning situation, however, there will be individuals at the vigilant or the blanket reassurance extremes. Although there is no way to moderate these extreme individual behavior patterns, Janis proposes four situation factors that influence behavior of the entire population toward either increased vigilance or increased reassurance:

1. Anticipated inaccessibility of existing escape routes. Vigilance increases if warning or physical signs suggest that a currently available route will be cut off when the threat materializes.
2. Anticipated need for self-initiated action. Vigilance increases

if the individual thinks adequate protection for himself and his family depends on self-initiated action; it decreases if he thinks he can rely on others to initiate the action.

3. Anticipated restriction condition, even not expect his own activity in reducing his chances of being victimized, vigilance increases if the individual thinks his own activity will be restricted



tion of activity. Under any those where a person does to play a significant role being victimized, vigilance increases if the individual thinks his own activity will be restricted at the time of the hazard.

4. Anticipated restriction of social contacts. Vigilance increases if the individual thinks he will be out of contact with authority figures, members of his primary group, or other significant persons upon whom he is emotionally dependent.

Official warning messages seldom touch upon any of these situational factors except escape routes. Informal comments by mass media often slip into the personal relation areas indicated in the last three points and consideration of Janis' points clearly suggests the emotional confusion that can be stirred up in those individuals who are naturally prone to excessive vigilance.

b. HURRICANE EVACUATION. Reaction to a hurricane warning is a very complex phenomenon in that so many people are involved and their involvement is so complete—economically, socially and psychologically. But despite the complexity, the behavior of each individual during a hurricane warning event is dictated by two principles: personal experience and advice from those who seem to know more about the threat than he does.

Thousands of hurricane victims have been interviewed in the 1950 and 1960 decades by institutions with expertise in the fields of sociology and psychology and there is a great deal of published information on their reaction to warnings and to the storm itself. Surprisingly, however, little of this literature has penetrated the operational files of those doing the warning.

Carla—Hurricane Carla, which hit the Texas coast in September 1961 is perhaps the most studied and analyzed hurricane of all time from the standpoint of warning reaction. Carla was an immense storm, its circulation nearly filled the Gulf of Mexico and hurricane force winds extended 300 miles from the center. But perhaps the most spectacular feature was the reaction it motivated along the Texas and Louisiana coasts. Approximately one half million people evacuated their homes and moved inland. Although 45 fatalities were attributed to Carla, none were blamed on the

mass evacuation. Another major landmark feature of Carla was the influence of television. Moore (1964) determined that about 90 percent of the affected population relied on information from television for the basis of their decision making. Safety agencies played a vital role in recurring effective evacuation and the influence of television was in the capacity of communicating and reinforcing official statements. Prior to Carla, a large part of the population relied on a combination of discussion with other people and only infrequent reports from radio and television.



M. E. Treadwell's comprehensive booklet *Hurricane Carla*, the official report of the Office of Civil Defense, gave the following summary of opinion of officials in both Texas and Louisiana as to why people did or did not evacuate:

Why People Went

1. Audrey—When asked, "Why did people leave when asked to?" most Louisianans and East Texans replied unhesitatingly, "Audrey."
2. News Media—Many credited successful results to radio and television. In the Jefferson County critique, news media were complimented for "the outstanding contribution made in preparation of public sentiment for the evacuation." The newest medium, television, had an unexpected impact. "People always were eyeminded," reported a district commander of the Department of Public Safety. When TV cameras in Galveston focused on the Weather Bureau radar, everyone could see just as plain as the Weather Bureau where it was. In between shots of that, they'd show spray going over the seawall, and as fast as anything was knocked out, they showed it. . .
3. Example of Officials' Families—In the city of LaMarque, police officers sent their families 150 miles inland early Saturday. . .
4. Effect of a Uniform—When those going from door to door wore a uniform (it seemed to matter very little what kind) improved results were noted in several Louisiana communities. . .
5. Women's Influence—The Galveston County Judge added another opinion: "Most men were working and didn't know much about storm bulletins; it was the women who had been watching TV all day who got them to leave. . ."
6. Unanimous Requests by Officials—None of the other factors, however, appeared to rank with a final one: positive action by local officials, with a firm, uncompromising and unanimous official position. . .

Why People Refused to Leave

For the small but important 1 to 10 percent who refused to leave, reasons were not always clear-cut. In general they were:

1. Afraid of Looting—A Louisiana National Guard Commander stated, "You have to understand how these people feel. It's not easy to leave your home and all your belongings. . ."

2. Decided Too Late—In some were trapped; a Louisiana ARC worker said, "All along the road we found people with their things all packed up, but just to leave."

Dozens of cases were cited 80's and 90's, who had never about to. . .



trying to be the last man out, Louisiana ARC worker said, found people with their waiting until the last minute

3. Pride in Remaining—of people, many in their fled a storm and were not

4. Wishful Thinkers—"They hear the warning but refuse to believe the situation will be as bad as officials say."

5. Left but Sneaked Back—"The man who sneaks back is usually his own weather bureau; wants to move his furniture a little higher or something like that and gets trapped; offers no resistance and is usually glad to be helped out again."

6. Just Ornery—A last category, defying classification, was sometimes defined by rescuers, as "obstinate," "would remain under any circumstances," "just sat there," and less printable figures of speech. At times near-illiteracy, prejudice, or language difficulties seemed involved.

For all of these categories, officials at all levels expressed a "drastic need to forcibly require evacuation." Not only were the victims' lives often lost, but rescuers' lives and equipment were risked going back repeatedly to beg them to leave.

One of the most interesting studies of warning reaction in connection with Carla, or any storm for that matter, was the comparison between Chambers County, Texas, (on the eastern shore of Galveston Bay) and Cameron Parish, Louisiana, (the southeast tip of Louisiana) by Moore (1964). The two areas are very similar in geography and economy and each had a population of about 10,000. About 97 percent of Cameron Parish evacuated but only about 65 percent of Chambers County evacuated. Two hundred in-depth interviews were conducted under similar conditions in each area Moore stated "Differences in behavior in the face of the hurricane seem to be associated with three major characteristics: different political control, varied conceptions of the nature of hurricanes and their potential dangers, and dissimilarities in the cultural heritage."

Following Hurricane Audrey, which killed between 400 and 500 people in Cameron Parish in 1957, a detailed preparedness plan was developed and safety officials became very concerned with this effort. Also, the Governor of Louisiana had authority to order

evacuation and he did so, but in Texas the state officials said they had no such authority and this political difference was significant. Of the individuals surveyed, 79.3 percent in Cameron and 27.1 percent in Chambers re-

advised or ordered to

The cultural differences to center on a closer family than in Chambers. French the Acadians and other

tute almost the entire population of Cameron Parish and family ties are strong.



ported that they were evacuate.

between the areas seem relationship in Cameron speaking descendants of Gallic immigrants consti-

tute almost the entire population of Cameron Parish and family

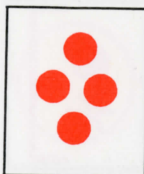
The difference in experience with past storms is significant and may account for the difference in evacuation. Only about 10 percent of the Cameron residents had never experienced a disaster before Carla, while over one third of the Chambers population had not. The survey indicated that as danger of Carla became fairly clear, 46 percent of the men of the house in Cameron households and only 25 percent of the men of Chambers households were determined to evacuate. In Cameron, 68 percent of the women, and in Chambers only 36 percent of the women, felt it was necessary to leave. In Cameron, less than 10 percent of the households contained no member that wanted to evacuate while in Chambers the percentage was over 40.

Audrey—Hurricane Audrey, striking Cameron Parish in June 1957, was a brutal but effective teacher for behavior during Carla. The book *The Social and Psychological Consequences of a National Disaster: A Longitudinal Study of Hurricane Audrey* by F. L. Bates et al. (1963) gives a full account of social transformation after the storm, but information on warning reaction may suffer because much of it was gathered several years after the storm. The analysis, however, suggests that at least three factors may have limited the effectiveness of the warning process:

1. Sufficient effort had not been devoted to preparedness prior to Audrey. Seven major storms had hit Cameron Parish since 1900, but they were not as severe as Audrey and the population did not think a hurricane could be that severe in their area. A storm in 1918, second only to Audrey in the area, claimed an unknown number of lives in Cameron Parish but with the 1940 storms, loss of life had been rare.

2. On the night before Audrey struck the area, a number of

individuals relaxed their vigilance because they had heard radio reports from Port Arthur, Lake Charles, and some more distant cities which indicated that the storm was not a threat (presumably in their own localities). It is hard to see how the residents could have been lulled into a false sense of security by distant reports but this is one of the listed factors.



series of conotosis, low-to 12 feet above the surrounding marshes, in the southern part of the county and the report indicates that residents assumed that warnings of "evacuate low areas and move to higher ground" meant for them to move to the cheniers. In any case this is what happened and many lost their lives because they did not move to higher ground located north in the county. The cheniers did not offer the needed protection.

Much of the personal interview survey of the area did not occur until several years after Audrey and no doubt is subject to the errors noted by Mack and Baker (1961) in the first of this chapter. Considerable controversy followed Audrey and there was a good deal of scapegoating shortly after the appalling loss of life became known. Points 2 and 3 mention by Bates et al. (1963) would decrease the effectiveness of any warning but whether these points are really applicable to the high loss of life that occurred with Audrey is subject to question.

Williams (1964) stated that the experience of an Audrey, which punishes or results in a near miss, is a great teacher. "No more than 40 percent of the residents of Lower Cameron Parish evacuated before Audrey struck in 1957. But in the next year, 75 percent evacuated in the path of tropical storm Ella, even though Weather Bureau advisories did not at that time advise evacuation. And when Carla occurred in 1961, about 97 percent evacuated Cameron Parish."

Hurricane Diane in 1955 was cited as the great teacher in a similar manner prior to Hurricane Donna in 1960. Damage was twice as great with Donna, but fatalities were only one tenth as large.

Post storm surveys have pointed to the importance of two factors: preparedness meetings and operational plans brought to a state of readiness prior to the hurricane season; and a clear, unambiguous flow of advisories which conveyed the proper degree

of urgency. The storms themselves have also significant lessons—Audrey showed that hurricanes can be killers, Carla showed that the warning system can be improved by using past experience, and Camille has shown that there is still a strong need for improvement.

C. TORNADO PROTECTIVE
tion is the key to a success-
hurricane warning process,
hensive, in-depth com-
ing; in the tornado warning process, the emphasis must be on the
rapid, near-instantaneous type of communication.



ACTION. Communica-
ful warning event. In the
emphasis is on a compre-
munication of the warn-

Another difference in communication of hurricane and tornado warnings is the greater participatory role of the mass media in tornado situations. The short lead time of tornado warnings dictates both differences. Before storm impact, nearly all hurricane information filters through the Weather Bureau office but this cannot be the case when a tornado is in progress or bearing down on a populated area.

Communicating the urgency—D. Adams in *The Minneapolis Tornadoes, May 6, 1965—Notes on the Warning Process* (1965) stated:

Once the initial warning bulletin had been released by the Weather Bureau and broadcast, those radio stations operating full-time on the disaster relied rather heavily on unofficial information, especially on telephone messages from residents of the Twin Cities who had spotted tornado funnels. Additional information was issued by the Weather Bureau throughout the evening, but the original relationship between the bureau and the radio stations had been in effect reversed. As one member of a radio station staff put it:

It was pretty much us, followed by some kind of an official back-up from the Weather Bureau. And what was really happening is that they were listening to us. They'd hear a report from the public . . . and they'd look at the radar screen after hearing it on the air and say, "Yes, this is correct."

During this period the Weather Bureau itself also was receiving telephone messages and its staff were making calls to a number of their ground observers for reports on weather conditions. The bulk of the warning information, however, was being received and disseminated by the various radio stations. And the sources of this information were largely unofficial. Unavoidably, this raised several serious issues.

Another illustration of the participating role of the news media is the booklet by T. M. Sandstrom "For God's Sake, Take Cover! A History of WIBW-TV and WIBW Radio's Service to the Community Before. . . . During. . . . Tornado, June 8, 1966." In of this organization the

Thousands viewed the re-all shook their heads in dis-words like, "It's amazing and not killed or injured."



and After the Topeka telling of the fine warning booklet says:

sults of nature's wrath, and belief. On their lips were unbelievable that more were

Indeed it is. And there is only one answer. The warning was clear, concise and commanding. Topekans heard the now famous words of WIBW Newsman Bill Kurtis, "For God's sake, take cover!" Topekans heard and heeded. Most survived. Over and over, by letter, telephone and in person, grateful Topekans have told WIBW, "I heard your warning—and went to my basement in the nick of time. Without WIBW, surely my family and I would have been killed or seriously injured."

Killer tornadoes struck San Angelo and Waco, Texas, cities about 200 miles apart, on the same day, May 11, 1953. Moore (1958) analyzed behavior patterns in the two cities and, despite similar storm characteristics, he found contrasting public reactions. The study was similar to the comparison of reaction in Chambers County, Texas, and Cameron Parish, Louisiana, with Hurricane Carla.

The Waco Chamber of Commerce had publicized an old Indian legend that the area was immune to tornadoes and despite the fact that storm advisories had been issued during the day for the general area, Waco citizens paid them little heed. A local peace officer spotted the funnel some miles southwest of town on that weekday afternoon and called the Sheriff's office. But he could not give details as the telephone lines broke during his call. The storm moved through downtown Waco, knocked out the radio and telephone service, killed 114 people and injured over 1,000. The lack of communication facilities combined with a poor state of storm preparedness led to great confusion during and after the storm.

San Angelo had adequate warning not only from the Weather Bureau but had on-the-scene reports from the Texas Department of Public Safety as they tracked the tornado from the point of its original sighting, 40 miles northwest of San Angelo, to its passage right through the city. Radio stations stayed on the air until the

storm hit the city and telephone service remained intact except along the path of the tornado. A radio network connecting safety agencies remained operational throughout the entire storm period. Eleven people were killed and 66 injured but the superintendent of schools estimated that 300 to 400 students would have been killed or injured if they had not been warned of the storm's approach. In contrast with Waco, San Angelo had a well developed Civil Defense organization, and behavior remained fairly orderly. Adequate warning and open communication facilities minimized the disruptive affect of the storm in San Angelo. Despite the fact that San Angelo was already quite vigilant about tornadoes, storm cellars were added to about one-third of the city's residences during the next year.



The awareness of tornadoes seems proportional to the frequency of the storms and somewhat inversely proportional to the population of the community. A study of reaction to a tornado warning at Leady, Oklahoma, in 1958, showed that almost the entire population was in storm cellars when a tornado struck after a half hour of warning by the Weather Bureau issued through the radio station. A number of studies in the area of high tornado frequency have confirmed this pattern.

Perhaps one of the most unusual tornado warning studies is that reported by Fritz and Mack (1954). They concluded that a warning issued one minute before a tornado struck an Arkansas area, in 1951, did more harm than good. Though it was somewhat inconclusive their rationale was that the last minute warning caused some individuals to expose themselves to danger in the rush to take cover and caused some others to become so excited that they could not take protective action. Individuals who had a warning of several minutes and those who had no warning whatsoever actually fared better than those with the one minute warning. This probably is an unusual occurrence as the literature has demonstrated many cases where an individual has saved his life by diving under the bed with a warning of one minute or less.

Tornadoes of the 1960's—Afternoon is the peak period for tornadoes but not for tornado fatalities. Protective behavior is much more likely during the period of regular business hours through the early evening than it is at other times and this type of behavior seems to overcome the threat during the period of maxi-

mum tornado frequency. Of the four most vicious tornado situations in the 1960 decade, one occurred in daylight, one occurred in darkness, one spanned the sunset, and one spanned the sunrise.

The Palm Sunday tornado series of 1965 was by far the most lethal. It affected four states — Indiana, Illinois, Michigan and Wisconsin — and lasted from 12:45 P.M. to 9:45 P.M. In spite of the fact that 33 of the 37 reported tornadoes occurred within the forecast area, 271 people were killed and 5,000 injured. The Weather Bureau Survey report by Kutschenreuter (1965) stated:



nado series of 1965 was by affected four states — and Wisconsin — and 9:45 P.M. In spite of the reported tornadoes occurred 271 people were killed

A large number of people in the areas for which tornado forecasts were issued on April 11 were aware of the forecasts. However, due to the “balmy” Palm Sunday afternoon (the first really pleasant day of this year), many were away from radio and TV and did not hear the subsequent warnings. Undoubtedly also, because of the balmy weather existing at the time, many considered that this was just another instance of crying wolf.”

Many had heard tornado forecasts before and hadn’t experienced any tornadoes. This is not surprising. The area included in a tornado forecast generally encompasses some 20,000 to 30,000 square miles. The area traversed by an individual tornado averages on the order of four square miles. An average of about two tornadoes occurs in a tornado forecast. . . . This means that on the average only about 1/50 of the area would be within even five miles of a tornado.

In addition to the fact that many who heard the warnings ignored them because of the “balmy” Palm Sunday afternoon, the survey reported that staffing was short at many radio stations. For this reason, announcers made few trips to the news teletype machine; thus, there was lack of timeliness of the broadcast of tornado information.

These disastrous storms and the survey of what happened represented a turning point in Weather Bureau responsibility. Studies of storm warning reaction were recognized as an important part of the total storm warning system. One of the recommendations of the survey was “In addition to surveys as this one carried out by Weather Bureau staff (and the separate and more intense local surveys carried on for research purposes) occasional surveys should be carried out by behavioral science groups and aimed at evaluating the effects of forecasts and warnings on individual user reactions.”

After the Palm Sunday storms of 1965 the next serious tornado occurred in the afternoon hours of 4 P.M. to 5 P.M. of March 3, 1966. It killed 43 people as it skirted the south and east parts of Jackson, Mississippi. A tornado watch was issued and broadcast widely by radio and television about two hours before the storm struck. The tornado itself formed just outside of Jackson and the first reported sighting was received only three minutes before it slammed into a populated section of south Jackson. Power and telephone lines were damaged and the warning of the actual tornado received very little dissemination prior to its arrival, but news media and safety agency personnel credited the watch with saving many lives.

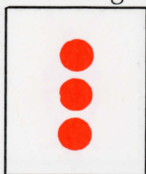


Numerous tornadoes occurring on a squall line stretching all the way from Arkansas to Iowa claimed nearly 60 lives two years later on May 15, 1968. The first fatalities occurred about 6:00 P.M., an hour before sunset, while most of the deaths occurred during the 9 P.M. to 11 P.M. period. The most lethal of the series of tornadoes brushed the southern edge of Jonesboro, Arkansas, shortly before 10 P.M. Heavy rain preceded and accompanied the storm and the sound of the pounding rain seemed to drown out the characteristic roar of the tornado. The storm caught most people completely unprepared and left 36 fatalities in the city of 20,000 before it moved on.

Although it was raining hard on a black night during the Jonesboro tornado, there was one similarity to the balmy afternoon Palm Sunday tornadoes. Radio and television announcers in Jonesboro did not check the press wire machines often and tornado information rolled out of the machine unbroadcast. However, interviews of Jonesboro citizens after the storm indicated that some people had heard the tornado watches, warnings and storm reports from Memphis and Little Rock stations. While a lack of broadcast warning minimized protective action, the pounding of the rain and the dark of the night were probably even more important in that they prevented that last minute dive for cover that has saved so many during somewhat similar situations.

Mississippi bore the brunt of the greatest number of lethal storms in the 1960 decade, and the last bad killer tornado of the 1960's swept a path 100 miles long in the south-central part of that state during the early morning hours of January 23, 1969. Twenty-nine

people lost their lives. The tornado formed a little after 5:30 A.M. in a sparsely populated area of southwest Mississippi; no report reached the Weather Bureau during its early life. Radar indications in the Jackson office suggested that a storm had become severe a little after 6 A.M. The Mississippi Highway Patrol was asked to check it out. The dispatched patrolman found it, in fact the storm overtook him and blew out the windows of his patrol car in the process. Despite injuries from the broken glass, the patrolman called in the first visual sighting of the tornado and a tornado warning was issued immediately. But it was almost too late for the little town of Hazelhurst. Eleven people died there as the storm moved right across the town. Ironically, a mainline railroad parallels the tornado track and the train was due in Hazelhurst at about the same time as the tornado arrived. Many individuals commented that they mistook the characteristic roar of the tornado for the noise of the train and thus did not feel any need to take cover.



The warning was sent on downstream and people in the Braxton-D'Lo area had about half an hour warning. Many of these people got in their cars and drove out of the way of the storm. Many others jumped into ditches or other protected places. But 7:15 A.M. is still a little early for some people to get up and the storm took its toll despite the warning. About the same number of people were killed late in the storm, after the sun came up and after the warning was given wide distribution, as before this time. This seems to illustrate an important characteristic of tornadoes. The number of fatalities is more closely related to the population and the vulnerability of the area rather than to any other factor. The visibility of the storm and the adequacy of the tornado warning reduce potential loss of life, but if a major tornado hits a populated area, only extreme good luck can eliminate all fatalities.

In any event it seems that the lesson to be learned from the many surveys of tornado disasters is somewhat similar to the lesson indicated for hurricane protection: preparedness meetings and a rapid communication system.

d. SENSITIZATION. If an individual goes through a storm disaster, either hurricane or tornado, he will be more sensitive to warnings than if he did not have this firsthand experience. Also, if during a warning event an individual receives information that

makes him think his exposure to danger has increased, he will become more sensitive to subsequent statements. I. L. Janis (1962) proposed the term sensitization to include both the long term effects of personal experience and the short term effect of convincing warn-



As examples of long cited the increase in the noted by Moore in San tornado. The evacuation

tropical storm Ella in 1958 and Hurricane Carla in 1961 following the devastation of Audrey in 1957 is a classic example of the long range influence of sensitized warning behavior.

Near misses also produce a sensitizing effect. Hurricane Florence was expected to hit Panama City, Florida, in September, 1953, and 10,000 people followed the advisories and evacuated. Fortunately for Panama City, Florence hit with main force about 100 miles away and residents experienced only a mild windstorm. Those who had ignored the evacuation warning lost nothing and were much less inconvenienced than those who did.

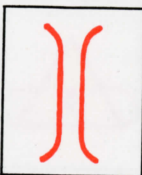
L. M. Killian (1954) conducted a series of interviews and found that the "wolf calling story" does not always apply to unverified warnings. The vast majority of those that evacuated said they would do so again under similar conditions. Killian found the same reaction with individuals who did not evacuate. Forty percent stated unequivocally that they would evacuate if a similar threat occurred again, even though they did not evacuate during Florence. The fact that news media showed the hazardous conditions that did occur nearby was the sensitizing factor. As noted in the first chapter, R. P. Mozeney, in charge of the Corpus Christi Weather Bureau office, found the same reaction following Beulah in 1968. There are no comprehensive surveys of tornado warning when no storm materialized but the negative aspect of this type of a situation no doubt does follow the "wolf calling story."

The term sensitization has not been widely adopted in connection with short term behavior; however, Janis (1962) has stated a hypothesis which seems consistent with survey evidence: "when preliminary warnings provide information that heightens awareness of potential vulnerability to an impending disaster, the recipients will become more sensitized to new warnings, as manifested by a general increase in their fear reactions to all relevant threat cues and a corresponding increase in vigilance reactions

to subsequent emergency warnings about the imminent onset of the danger.”

e. CONVERGENCE.

C. Fritz and J. H. Mathew-
well-recognized behavior
studies. The components



Convergence Behavior by
son (1957) has become a
pattern in many disaster
include:

1. Personal Convergence—movement of persons on foot, by car or other means into the area of disaster.
2. Material Convergence—movement of supplies and equipment into the disaster area.
3. Information Convergence—movement or transmission of messages into and out of the storm area.

Evacuation can cause personal convergence. If it occurs during storm impact, it can generally increase exposure to danger. Personal convergence is necessary after the storm in order that the business of cleaning up can begin, but the sightseer portion of this convergence has no demonstrable benefit. In many storm scenes, the mass convergence of people has blocked incoming rescue equipment and outgoing vehicles carrying injured people to hospitals. Moore (1958) quoted an official at the Waco tornado scene: “There were thousands of persons milling around, it looked like the storming of the French Bastille.” Perhaps the news media could help stem the influx but generally their coverage only attracts greater crowds.

Material convergence has no significant effect on the warning process.

Informational convergence begins as soon as the warning process starts. It has been shown that the first impulse of a large segment of the population is to obtain confirmation of the warning and second is to determine if family and friends are aware of the threat. Moore (1964) reported that the four day period centered on Hurricane Carla’s arrival showed three million telephone calls in Houston compared with the normal total of just over one million. And this occurred after a large number of telephones were knocked out of service by storm damage. In San Angelo and Waco, Moore (1957) reported that long distance telephone calls more than doubled during the day of the tornado. This type of convergence can choke up the flow of warning information, but this does not occur often and perhaps the main significance is to point to the

importance of follow-up weather information after the storm passes on.

f. WIDGETS AND WARNING is neither ambiguous warner's dilemma is the nature of the information the warning. Significant of change in storm intention usually do not come to the warner in a smooth, even flow. They come in spurts and bursts and often later reports contradict earlier reports.



INGS. An effective warner uncertain but the ambiguous and uncertain that must be used to frame observations and reports

sity and direction of movement

"How do you convey your partial state of knowledge in such a way that you can update your forecast without looking inconsistent with yourself? How do you tell someone something when your knowledge is very limited, without becoming ambiguous, or appearing to be evasive?" Dr. Myron Tribus, Assistant Secretary of Commerce for Science and Technology (1970) put these two questions to the Sixth Technical Conference of Hurricanes. And he suggested a possible solution: "There are some important recent advancements in the foundation of inductive logic which lead to some new ideas about probability theory. I believe these new ideas are going to play an important role in the development of improved forecasts, perhaps directly in hurricane warnings."

He continued: "For the purpose of this illustration, I am going to appoint you as the Board of Directors of a company that specializes in the making of *Widgets*. Most of you do not know what a Widget is—I can tell you only that it is a female version of a Gadget. This company makes 200 Widgets each day and for very complex technological reasons, which I do not want to go into here tonight, each day's run of Widgets must be painted exactly the same color. The company stocks and sells three different colors of Widgets: Red, Green and Yellow. Each day a decision must be made as to what color to paint the 200 Widgets. The chief of production has quit, looking for a job of less responsibility, and you are stuck with the task of making the decision. . ."

Then he gave bits of information on which to base a decision. Each new bit gave a new answer which contradicted the previous decision, but by using probability theory he did come up with the most logical decision based upon the latest total information.

A mathematical treatment for decision making followed, but for purposes of this report the important factor is—the warned is also faced with a changing set of conditions, he must make a new decision each time he re-statement. Perhaps it is this study of storm warning thought that while it is not certainty from a warning, cate a probabilistic estimate a public. And if this is done in an effective manner, it will convey the proper degree of urgency; and as indicated in the preceding pages, all of this will take a lot of doing.



ceives a new warning appropriate to concluding reaction with the possible to remove un- it is possible to communicate of the threat to the

g. SUMMARY. Emotional reaction to threat is increased excitement. A mild increase sharpens ability to handle the threat while an excessive increase eliminates the individual's ability to cope with the threat. Social reaction to threat first leads to a spirit of camaraderie and a tolerance of central authority. If the threat continues, large scale organization collapses and individuals align themselves with gangs and eventually enter the stage of every-man-for-himself.

When storm warnings are convincing, emotional and social evolution follow these patterns; when warnings are not convincing, the evolutionary patterns develop at storm impact.

Personal experience is perhaps the most important single influence over individual and group reaction to storm warning. However, preparedness meetings prior to storm warning seasons can develop protective procedures and shape attitudes so that reaction will be positive.

Communication is a second key to positive reaction. It must be understandable, convincing and authoritative. For hurricane warnings communication of advice must feature an in-depth approach, for tornadoes the emphasis is on rapid and near instantaneous communication.

Sensitization results in increased positive reaction in areas struck by severe storms, or in areas that just missed but observed effects in nearby areas. A flow of warning messages indicating an increased threat during a storm warning period sensitizes persons and increases their vigilance.

Convergence of people on escape routes evacuating before a storm increases their exposure to hazard, while personal convergence during and after storm impact hinders recovery operations.

Communication convergence chokes up channels needed for emergency operations and emphasizes the need for a continuous flow of weather information after the storm has occurred as well as before and during the peak violence. Advance planning is the only method of reducing potential loss of effectiveness.

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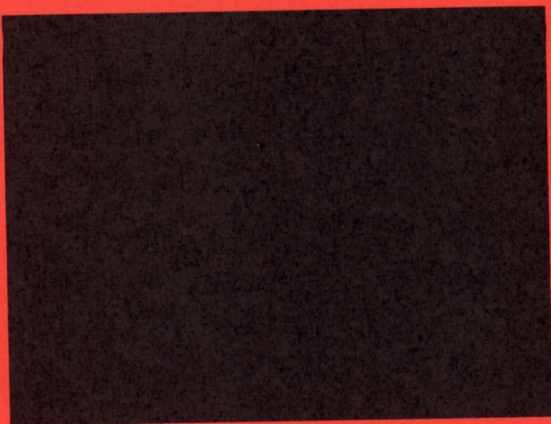
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This still seems appropriate -
especially in view of continuing natural
disasters and concern about them. It
should be widely distributed.

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