Chapter 5

RESPONSES TO WARNING AND EVACUATION

Summary

Adequate and timely warning is crucial for survival in many disasters. Defined as a signal or message which provides information about the existence of impending danger and what action should be taken, a warning alerts the individual to adopt an attitude of vigilance and arouses some level of fear. The whole warning process consists of seven phases: detection, evaluation, decision to warn others, transmission of warning, interpretation by recipients, feed-back about how it is received, and transmission of new warnings. Ten factors determine effectiveness of warnings: information in the warning signal, how warnings are reinforced, organizational encouragement to respond, credibility of the warning sources, strength of the fear message, the receiver's degree of personal involvement, availability of protective measures, cost of taking protective measures, receipt of confirming warning messages, and preparation and training. Evacuation or removal from the actual or potential danger area is an important response to warning. Evacuation may involve only part or most of the population, and be temporary or long-range. There are eight kinds of problems which should be anticipated in planning for evacuation: administrative difficulties, motivation of the population, accomodation in staging and reception areas, allocation and reception of evacuees, provision of service personnel, caring for children, problems arising out of personal differences between people, and provision of constructive activity for evacuees.

Definition of Warning

Most disasters have been preceded by a warning period of sufficient duration that, had all of the people in the impact area taken appropriate protective measures, the frequency of deaths, injuries, and cases of shock would have been markedly reduced. However, in some cases survivors reported that they had not noticed any signs of danger nor received warning messages; in others they have confessed that they did not take the signs seriously or did not know what to do; and in a few instances officials who had information indicating danger did not transmit it to the people. It is clearly important to understand the steps in the warning process and to know what factors determine the effectiveness of a warning message, because the warning period is crucial in determining the outcome for the population.

Warning may be defined as the transmission to people of signals or messages which provide them with information about: (1) the existence of impending danger, and (2) what action should be taken to prevent, avoid, or minimize the consequences of impact (Williams, 1964). The second part of this definition is designed to emphasize the point that, to be effective in altering the consequences of a disaster, the warning message must produce some appropriate behaviour on the part of the recipient. As Fritz (cited by Williams, 1964) has stated, a warning should be "a call to action". If it does not have this function, it might as well not have occurred.

The warning phase of a disaster may be relatively long or very brief and virtually non-existent. When the warning period is short, fewer people typically receive the warning signal or message and there is less time to get organized and take protective action. This is often the case when a tornado strikes; a person suddenly hears a roar or sees a spiral-shaped formation in the sky and has only seconds or a minute or so to prepare for the impact. The inhabitants of Hiroshima had no warning of an air raid when the atomic bomb exploded over that city, but did have a few seconds between observing the flash and the impact of the blast. A few people reacted quickly, throwing themselves to the ground and in some cases diving into a shelter, and thus saved their lives. When the warning period is very brief the effectiveness of the warning depends on four things: whether it reaches the people, whether it has a clear meaning and call for action to the receivers, the availability of protective action, and whether individuals freeze momentarily or take that action.

In the case of long warning periods there is usually a gradual build-up of warning signs from the first indications of possible danger through to some final signal just before impact. Long warning periods of this kind are characteristic of inland flood disasters. The Red River flood of 1950 developed inch by inch over a period of many days. The people in the threatened areas received precise information on the rising waters, and were instructed to evacuate when the danger reached a certain point. Tens of thousands were evacuated from their bombs and other places of business and work, but in a relatively orderly manner. Hurricane Carla advanced from the Gulf of Mexico over Texas at a rather slow pace again there was a fairly graduals build-up of warning messages until people were instructed to evacuate which some one and one-half million did.

Long warning periods have obvious advantages for the target population: warning messages may be delivered to a larger proportion of the population through various informal and formal

channels, there is the opportunity to get organized and prepare to take more effective protective action, and a major move like that of evacuation can often be carried out in an orderly manner. However, even with a long warning period, the warning system may be ineffective, for reasons to be noted later.

Reactions to Warning

There are generally two kinds of reactions to a signal which has any warning value for a person: an alerting or vigilance reaction, and a fear reaction. With vigilance, the individual "looks up", his attention is shifted from what he was doing to the warning sign or message, he scans his environment for further information, and in general he adopts an attitude of vigilance. There are two kinds of information which the individual seeks under such circumstances: first, further indications of warning, clarification of the nature of the danger, and what actions would be appropriate; and second, reassuring information which indicates that the signal was a false alarm, or that it was not meant for the individual in question.

The level of apprehension and fear which a warning signal arouses has a bearing on the vigilance reaction. If fear is very strong, reassurance is likely to be ineffective, vigilance will be exaggerated and rather undiscriminating, and behaviour is not likely to be adaptive. On the other hand, if the level of fear which is aroused is mild, vigilance will generally be moderate and reassurance will come easily. The nature of these reactions will also be influenced by an individual's susceptibility to fear: some will react with much fear to a weak warning signal while others will have a small fear reaction even to high threat signals. How much fear an individual exhibits is largely a function of his past experience, whether he has been sensitized or adapted to warning signs in general and especially to the kind involved in a given situation.

Although the vigilance and the fear reactions are "natural" responses to novel or strange stimuli, they are largely acquired or learned to stimuli that we classify as warnings. Thus it is not surprising that the vigilance responses which people have learned vary from limited and inefficient scanning to rapid surveying of relevant information and possible courses of action. Efficient vigilance responses may be thought of as habits which have been developed by training and experience—for instance, the vigilance habits of the well-trained sailor, weatherman, or radar man. It is notable that when an individual has good vigilance habits, together with knowledge of possible courses of action, he will not be so susceptible to the disorganizing effects of fear. In the extreme case where the warning period is brief, an urgent warning signal would constitute a clear "call for action", and any other vigilance behaviour would be short-circuited as the person immediately takes protective action. Others in this situation would be affected primarily by the urgency of the warning and may freeze momentarily or act in a disorganized manner. The only way to reduce such responses is with prior information and training.

Phases in the Warning Process

Williams (1964) has specified the steps in the warnings process as follows:

(1) Detection and measurement or estimation of changes in the environment which could result in a danger of one sort or another.

(2) Collation and evaluation of the incoming information about environmental changes.

(3) Decisions on who should be warned, about what danger, and it what way.

(4) Transmission of a warning message, or messages, to those whom it has been decided to warn.

(5) Interpretation of the warning message by the recipients and action by the recipients.

(6) Feedback of information about the interpretation and actions of recipients to the issuers of warning messages.

(7) New warnings, if possible and desirable, corrected in terms of response to the first warning messages.[1]

Detection. The information about changes in the environment which indicates danger is typically detected either by some official source or more informally by people who are sensitive to such things. The weather bureau is a good example of an official body which collects informatic · about tornadoes, hurricanes, blizzards and floods. However, it is often impossible for even such a group of experts to predict the point of impact precisely, and in some instances it has been individuals who were particularly sensitive to storms who informally warned a community of impending danger. Furthermore, most people do not act on a single warning message but seek confirmation, and many of them look to informal sources such as friends and neighbours, the police or civic officials—that is, to other people who are without primary information but who are trusted in some sense. The warning system may, or course, fail at this first stage, because warning signs were not detected or not recognized as such by one or another of these official and informal sources of warning information.

Evaluation. The second step in the warning process is that in which the information is collated and evaluated by some individual or organization that assumes or has responsibility for the matter. The chief problems at this stage are those of evaluating the reliability of the information, resolving the differences and contradictions between several sources of information, and estimating the precise implications of the data with a view to deciding whether a warning should be issued, to whom, how, and at what time. Quite often the person who must take final responsibility for the results of the evaluation and make a decision is someone ill-equipped to do so—such as the Mayor of a community. The warning process may bog down at this stage even when expert officials are responsible for the evaluation of the data. Prior to the Worcester tornado in 1953, officials in the Boston Weather Bureau did not use the word "tornado" in a public release until after the tornado which struck Worcester was actually dying out. Their failure to evaluate correctly the information that they had was apparently based on a number of factors: past experience contraindicated the occurence of a tornado in that part of the country, they could not be sure that their scientific information was right, and it seemed to be contradicted by the fact that the weather around them did not look so bad; they themselves did not receive reports of sighted tornadoes; and Weather Bureau policy at that time prohibited the use of the word "tornado" because of the unfounded fear that panic might result.

Decision to Warn. The decision to issue a warning of impending disaster may involve grave consequences. If the decision is not made and the disaster strikes, the impact may be much more destructive of life and property; if the decision is made and the disaster does not come off, the population in question will be put to a great deal of inconvenience, lost time and money, and will be subject to needless fear and anxiety. Either way, the decision-maker may be subject to criticism, guilt, and possibly loss of his job.

In some situations it is fairly clear what agency and officials are responsible for making the decision to issue a warning. The weather bureau may have this responsibility in the case of windstorms; civic officials like the Mayor may have the responsibility in case of other impending dangers; the Prime Minister

[1] From Human Factors in warning-and-response systems, by H.B. Williams. In G.H. Grosser, H. Wechsler, and M. Greenblatt (Eds.), *The threat of impending disaster.* Cambridge, Mass.: M.I.T. Press, 1965. pp. 82-83. Used by permission.

of the country may have this responsibility at the national level in the case of a nuclear threat. In a number of natural disasters the decision to issue a warning to a particular community and population has been made by some person who, sensing the danger, took it upon himself to issue a warning.

Williams (1964) summarized the considerations which should go into the making of such a decision:

> (1) Is the danger really going to materialize to a certain degree at a certain place? (2) When will it strike and how much warning do people need to take place? (3) When will be the consequences if it strikes and there is no warning? (4) Will it do any good to give warning? Is there time to take protective action? (5) How will people behave if they are warned? (6) How will people behave if they are not warned?[3]

These considerations make it clear that the decision makers must have considerable systematic and accurate knowledge not only about the disaster event with which they are concerned but also about human behaviour under disaster conditions. In the Worcester disaster a warning was not issued on the false premise that people might panic.

Sometimes the decision to issue a warning gets delayed or stopped along the channel of command. This happened with catastrophic results just before Pearl Harbour in 1941. Japanese submarines and aircraft were detected by radar operators and navy patrol vessels a good hour before the onslaught on Pearl Harbour, but no warning was issued. Apparently the personnel responsible for sounding an alarm would not do so without further confirmation from more senior officers. This was not forthcoming, and a false-negative decision was the result.

An important consideration in whether to issue a warning is the possible consequences of a false-positive decision. Not only may the decision makers be held responsible and be criticized unreasonably for the upset and inconvenience which they have caused people, but the population's sensitivity to warnings may be significantly decreased as a result of the false alarm. In the latter case, people may suffer on a future occasion because they disregard a warning that turns out to be valid. Thus decision makers are placed in a most vulnerable position. However, because false-negative decisions have such dire results, it may be best to err on the side of false-positive decisions. The negative psychological consequences of the latter can often be remedied to a large extent by appropriate publicity, official statements, and especially by a positive attitude on the part of citizens with leadership roles throughout the community, such as employers, emergency agency personnel, and other formal and informal leaders of various organizations and groups. In any case, it is essential that the appropriate and expert officials have unambiguous responsibility for making warning decisions, and that the public be made fully aware of who holds the responsibility.

Transmission of Warning. The next phase in the warning process is the transmission of warning messages to the public. Different channels of communication may be used, such as radio and television, telephone, sirens, loudspeakers, or door to door messengers. The use of multiple channels has the advantage that the message will reach a greater proportion of the population. On the other hand, such a massive onslaught of warning messages may produce excessive fear, increase the chances of contradictions and errors, and may call for more time and effort than is available. There is no one answer to these problems. It will depend on the nature of the impending disaster, the amount of time available, and especially on the amount and kind of preparation and training which the population has received for such an emergency.

Interpretation by Recipients. The next phase in the warning process in that of receipt an interpretation of the warning message by the target population and the action which is taken. A crucial problem here is that

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[3] From Human factors in warning-and-response systems, by H.B. Williams. In G.H. Grosser, H. Wechsler, and M. Greenblatt (Eds.), *The threat of impending disaster*. Cambridge, Mass.: M.I.T. Press, 1965, pp. 87-88. Used by permission.

warning messages may vary from the clear, concrete, specific and consistent to the vague, ambiguous, general and contradictory, and they can mean different things to different people depending on their past experience and their local circumstances. Furthermore, the warning message may include no information about what action should be taken, erroneous or vague information, or clear and specific instructions. The content of the message and the kind of information which it conveys will be discussed in more detail in a later section.

Whether and how the target population reacts will depend on another series of considerations. For what kind of protective action is there sufficient time? How much cost is involved in taken protective action, in terms of leaving others and personal property, loss of time and work, and general inconvevience? And what is the extent of the estimated threat and cost if no counter-measures are taken? In a society where the individual is largely free to make even such crucial decisions for himself and his family, receipt of a warning message will initiate a complex evaluation process in his mind. Like the officials responsible for issuing the warning, he must make a decision, to act or not to act. The factors which enter into his decision and make the warning effective in evoking action will be detailed in the next section.

Feed-back and New Warning. The sixth step in the warning process is that of feed-back of information from the target population to those who have issued the warning. Was the message received? Are the recipients interpreting it as intended? What action are they taking? Unfortunately, provision for this step in the warning process has seldom been made, and warning officials have not even thought of it in many cases. In view of the problems of getting a message to all of the people, a message with the kind of information that evokes appropriate protective action, it is important to provide for this phase of the warning process. Appropriate feed-back will often call for the issuing of new and better warnings—the seventh and final step in the warning process.

Determinants of the Effectiveness of Warnings

When people receive warning signals they typically start to evaluate them informally in much the same manner that official agencies do when they collect information about a possible impending danger. They look to their past experience: What did the sign mean in the past? What were its consequences? Was the river ever higher than that before? They appraise the signal in terms of other perceptions which they are receiving at the time: Is the storm gathering, dispersing, or veering off one way or another? How are other people responding—especially people who are authorities, or who are significant in their daily lives? How strong is the threat—what are its probable consequences in terms of danger to life and damage to property? How much time is available before the danger strikes? What protective measures are available, and what can be done to reduce or protect injury, loss and death? What is the cost of taking protective action, in terms of time, effort, money, and personal inconvenience and sacrifice? If protective action is taken and the alarm turns out to be false or exaggerated, will the individual be derided and considered foolish by others, or possibly berated by his boss?

The various factors which enter into this evaluation process and determine the effectiveness of warnings have been isolated in experimental and field studies of disasters. Each of these factors should be given due weight in designing and operating a warning system. In some instances their use should be pretested to increase their effectiveness for particular populations and situations.

The Information in Warning Signals. We tend to assume that information is information, and that signs and signals convey what they are intended to mean. This assumption is very often wrong, as one can confirm

by recalling the frequent misinterpretation of cues and words which occur during courtship and other interpersonal exchanges. The assumption is a particularly dangerous one with respect to warning signs of impending danger. Not only are the stakes often a matter of life and death, but a single warning message may be interpreted in different ways by different people, so that members of the population in question "get" different messages.

One problem is that a warning sign or message is seldom a unique input of information which results in a predictable output of behaviour. Rather, it is but one of many stimuli which the individual is receiving at a given time, within a context of particular circumstances. In addition, it is fed into a context of past experiences, which also determine its meaning and what response will be given. Just prior to Hurricane Audrey's onslaught on Lower Cameron Parish (Louisiana) in 1957, the Weather Bureau, unfamiliar with the local terrain, advised people in "low exposed places" to evacuate to "higher grounds". To the residents of the target area "higher grounds" meant the ridges six to twelve feet above sea level which traversed the area. This was not what the Bureau intended, and it proved to be inadequate as a protective measure.

It is a common observation that people interpret danger signs and sounds as some more familiar event. Survivors of tornado disasters have reported that they thought the roar of the barreling wind was of a passing train; in flood disasters, they have interpreted the sound of running water as an open water tap, residents of Springhill variously thought the underground bump in the mine was a bomb under a neighbour's house, a truck hitting the house, or children thumping upstairs; and some of the survivors of the Halifax explosion in 1917 thought that they were being bombed by German zeppelins. When the fire commissioner and acting director of civil defence in Chicago sounded the air raid sirens to celebrate the first American League baseball title that the White Sox had won in 41 years, over one-third of the people made the "mistake" of interpreting the signal as being connected with the ball game.

A second problem is that the warning signs and messages are often vague and ambiguous in themselves. This results in a variety of guesses and hypotheses, usually based on personnal past experience, which the individual must test and evaluate. One of the best examples of particularly vague danger signs was that of the effects of escaping carbon monoxide fumes in a factory in Chicago. This gas is colourless and odourless, so that first signs of its presence are a person's own reactions of headache, weakness, dizziness and nausea. However, such symptoms will usually be interpreted as signs of more familiar things like the flu, a hangover, or some other physical condition. A women worker reported the following series of hypothesis in that emergency:

> "At 10.30 I got a headache, a temple headache. I thought it was just a headache. I didn't pay any attention to it because I just thought I was hungry....But the nearer noon it became, the worse the headache got....but after I ate it continued to ache. I had taken two aspirins and I laid down for 30 minutes and I took a third and then a fourth aspirin....it got worse as the afternoon went on. So I didn't know what to think. The first time I vomited I thought there was a possibility of me being pregnant, but after everybody started vomiting, I knew everybody wasn't pregnant"![3]

In an atmosphere that is charged with apprehension and uncertainty, the hypotheses and guesses that grow out of unclear information may become dangerous rumours. When Port Jervis, N.Y., was hit by heavy rain storms from Hurricane Diana and then flooded by the Delaware river, the population was subjected to continuing anxiety and uncertainty because of the possibility that the huge dam above the town might break. In order to reassure them about this, the police chief issued a statement that the dam gates were going to be opened in order to reduce the pressure. This information proved to be ambiguous, confirming the people's expectations of the possibility of flooding, and rumours began to circulate that the dam had actually broken. At this point, the fire captain radioed this rumour to his headquarters to check on it, but when a

[3] From Disaster, by C.E. Fritz. In R.K. Merton and R.A. Nesbitt (Eds.), *Contemporary social problems*. New York: Harcourt, Brace & World, 1961. pp. 155-156. Used by permission.

number of other firemen heard the message on their radios, they assumed that it was true and immediately drove their firetrucks through town, sirens wide open, and shouting orders to evacuate the town—which a large proportion of the population did, in a near panic-striken flight (Danzig et al, 1958).

Another detrimental consequence of ambiguous and conflicting messages and warning signs is that official sources of information lose their credibility. This happened in Brighton, N.Y., following a series of explosions. The people did not know what had happened and why, and rumours circulated to the effect that hundreds of houses had already exploded and that a fire was raging inside the gas mains and might blow up the whole town. For a week or more the residents were uneasy and apprehensive, jittery and unable to sleep. Moreover, they would not accept the repeated assurances by the authorities that the danger had passed. Official information was no longer acceptable because it had been ambiguous and unreliable for predicting and preventing the danger.

There is no easy answer to the problems of the information value of warning messages. However, their effectiveness may be greatly improved by rigorous attention to a number of principles. First, the information should be accurate, specific and concrete, in terms of the target area and population, the nature and extent of the threat, the time available, and the kinds of protective action which should be taken. For instance, the area might be specified with a T.V. map or by names of streets; people might be instructed to proceed on foot to particular locations, or to open all doors and windows.

Second, the information should be related to local circumstances and the past experience of local residents. Thus local terrain, availability of shelters and emergency facilities, and people's previous experience of similar events should be considered in framing the message. Third, provision should be made for feed-back about how people are interpreting and acting on the warning message, with follow-up messages if indicated. Fourth, there should be planning and judicious pre-testing and rehearsal.

Reinforcement of Warning Value. A warning signal or message is designed to arouse vigilance and to motivate or evoke behaviour. However, there is nothing in the warning itself which is arousing and indicates danger. The power to arouse and convey a sense of imminent danger is an acquired property of warning signals, something that must be learned. It is therefore important to understand what conditions make a signal arouse, produce vigilance, and ready a person for action.

The meaning that a warning signal acquires depends on whether the message is confirmed or reinforced by painful and unpleasant consequences. "Don't touch" carries no force with the young child, until he touches and gets burned, or experiences slapped fingers or some other unpleasant consequence. Thereafter this message will usually have the desired effect. However, it must be reinforced occasionally or it will lose its meaning by the process of extinction. From such simple beginnings man acquires a complex repertoire of signs, gestures, and verbal messages that have warning significance in terms of unpleasant consequences. Many of these will never have been directly followed by negative consequences, but will have acquired their meaning by association with other verbal warnings, pictures of consequences, and so on. Thus a child or adult who has never experienced the dangers of war may still react with fear and vigilance to such a threat—by virtue of hearing and reading stories and seeing pictures of the consequences.

It is quite clear that previous reinforcement of the significance of a warning signal is very effective in making the warning a call to action. Individuals who have experienced tornadoes react to tornado signs and warnings without delay. After the atomic explosion over Hiroshima, the inhabitants of that city would scurry for shelters whenever any airplane flew overhead. Of the residents who fled from Port Jervis, New York, when the rumour spread that the dam above the town had burst, almost 90 per cent were those from the previously flooded area. On the other hand, there was widespread evidence in the cities of Great Britain during World War II that the warning sirens and even airplanes overhead lost their power to evoke protective action for most of the people, because they were not followed by personally involving negative consequences.

A major difficulty with warning signs and messages about disasters is that their evocative meaning is weak because most people have either not experienced them before or at least have not experienced them in association with the consequences of a disaster. The problem is made more difficult by the fact that people have heard and read about disasters, but having not experienced the consequences; they tend to develop indifference and feelings of invulnerability—as did civilians who had only remote-misses in bombing attacks during World War II. They become adapted to warning signs and ignore the threat. From one point of view it would be better if they had no previous knowledge or experience of the warning signs because then the very novelty of the stimuli would tend to arouse vigilance and apprehension. Air raids sirens had this effect on civilians in Great Britain at the beginning of the war. However, the risk is that many people would not know what a novel warning signal means, and furthermore, its novelty can only be retained by not having any practice drills. The dilemna is further complicated by the fact that if a warning message is used repeatedly in practice drills, it will come to mean "This is a practice drill", and not "This is a *real* warning". Not only are people typically much less responsive to practice drills, but they are often resentful of them. Indeed, people have been annoyed and resentful of bona fide false alarms when the disaster struck elsewhere or proved to be a minor one. Such negative reactions to warning signals are, of course, a function of the inconvenience and annoyance that protective action entails: the drill or false alarm often involves considerable cost and unpleasantness in terms of inconvenience, loss of time, work and money, and the arousal of apprehension.

Nevertheless, a warning which proves false fo a given community may still be positively reinforced. For example, some 10,000 residents of Panama City in Florida responded with evacuation to the warning that Hurricane Florence was approaching their city, only to find that the hurricane suddenly changed its course and struck the coast about 100 miles away. However, although subjected to considerable inconvenience in evacuating the town, most of the people did not complain about the false alarm but said that they would evacuate under similar circumstances in the future. This positive attitude was apparently induced by their perception of the consequences: they observed the very high tides, experienced some of the high winds, and had frightening descriptions and pictures of what happened only 100 miles away. Thus their response to the warning was effectively reinforced by concrete and vivid information about the consequences (Killian, 1954).

An important factor which reinforces the meaning of a warning message is the receiver's belief in the likelihood of the event in question. Studies of the false air raid alerts in Chicago, Washington, D.C., and Oakland, California, revealed that those people who believed that war was imminent, that the international situation was tense, or that a war might be set off by mistake, were much more likely to interpret the sirens as signalling a real alert. In a similar manner, warning signals tend to become significant and meaningful when there is a general build-up of apprehension and fear. Hurricane Carla created this atmosphere over the two or three days that it was approaching the coast of Texas and the threatened population apparently responded very well to the sequence of warning messages. The Russian-American crisis over Cuba in 1952 had a like effect on officials and most citizens in the United States. It is not known what the response of Canadians was, whether the threat stimulated people to investigate warning signals and protective action or conditioned them to be even more indifferent. Of course, appreciation of such a crisis depends largely on the manner in which national and other leaders and the communication media take it seriously and convey this to the population.

All of the evidence is that warning signals will be automatically interpreted as "acute danger" if they have in the past been followed all but invariably by a validating event. Indeed, this is so for any stimulus that tends to evoke a response automatically. For example, when the telephone rings, we nearly always reach for the receiver and say "Hello", because the ring has been regularly validated or reinforced by someone answering our "Hello". However, if the ring and our answering is repeatedly followed by no validating event—if no one answers our "Hello", its interpretation as a signal for action will be extinguished. This is one of the major problems with the holding of practice air raid alerts: they are *not* followed by air raids, and hence this meaning tends to be extinguished in the minds of the people. Fortunately, however, there are other ways of maintaining the warning value of air raid alerts. If practice alerts are held

invariably at the same hour and *on the same day of the week*, this becomes the expectancy in the minds of the population. Then the occurence of an alert at a different time and on a different day is much more likely to alert people to the possibility of a real alarm rather than a test, practice drill or mistake. This principle was confirmed in the Chicago false air raid alert: only four per cent of the respondents defined the siren as a test, practice drill, or mistake and a large proportion expressed feelings of apprehension and fear, presumably because the siren sounded at night whereas they were used to hearing it at 10.30 a.m. every Tuesday. On the other hand, if practice alerts are sounded at different times of the day and on different days of the week, this develops the expectancy that a practice alert might occur at any time. This was the practice in Oakland, California, and when a false alert occurred, more than 50 per cent of the people thought it was a test, practice drill or mistake.

Organizational Encouragement. Mack and Baker (1961) emphasize the power of an organization to determine human behaviour, *regardless of peoples attitudes* toward the signal they receive.

> ... Attitudes are separable from behaviour. An organization can inhibit a man's discriminatory behaviour even if he holds prejudiced attitudes. When the United States Navy desegregated recruit companies, white apprentice seamen shared bunk, mess, and shower facilities with Negroes whether or not they were prejudiced. Why? They received, interpreted, and acted upon the organization's signal to behave in a non-discriminatory manner because the organization had power over them. They had become accustomed to the fact that the organization could impose sanctions, that it would reward those who responded to directives and punish those who did not. They had become conditioned to conforming when a directive announced that "All personnel will now..." do the following, whether it was fall out for rifle drill or form companies into racially integrated units.[4]

If an organization is present to encourage this action or that in its members, and if the organization is oriented toward emergency measures or civil defence, then we could expect a higher proportion of the members to take protective action in response to a warning signal. This principle receives support from the findings on the false air raid alerts in Washington and Chicago. In Washington many workers were in government offices where the correct response had been made known, or if they did not know what to do there was a good chance that others would, especially supervivors or colleagues with civil defence training, and most office walls had placards with the relevant information. Probably encouraged by this organizational environment, 20 per cent of the respondents took protective action—although only 7 per cent thought the sirens indicated a real air raid alert. This contrasts with Chicago, where most people were not in their organizational environment but with their families at the time of the alert: although 43 per cent thought the sirens indicated a real air raid alert, only 2 per cent took protective action.

Credibility of the Warning Source. The extent to which a warning will be taken seriously is strongly influenced by the credibility of the source or official from which the warning is issued. Does he have the position and status which evoke respect? Do people believe that he has reliable and valid sources of information? And does he have a history of reliable and good judgment?

It has been found that even a mild fear message can produce a strong response if it comes from a credible source (Miller and Hewgill, 1964). On the other hand, a strong fear message has very little effect if it comes from a low credibility source or individual. It is probably the factor of credibility that makes people turn to friends and to selected officials when they are apprehensive. A friend, a policeman, or a physician are credible sources of reassurance and direction within their respectives areas of recognized competence. It is essential that official warning agencies be not only known by the population but that they have developed high credibility by demonstrating a high proportion of "hits", reliability, and frankness in setting

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[4] Raymond W. Mack & George W. Baker, *The Occasion Instant – The Structure of Social Responses to Unanticipated Air Raid Warnings*, Disaster Study No. 15, (Washington, D.C.: NAS–NRC, page 40).

forth the unpleasant with the pleasant. The B.B.C. established such an image of credibility in Great Britain, and indeed throughout Europe, during World War II.

There is some evidence in the literature (Moore et al, 1963) that elected officials are sometimes reluctant to take warnings seriously and to take the responsibility of authorizing drastic measures. In some instances they have waited till people had taken the initiative and were evacuating on their own, before issuing the order to evacuate. The issues of leadership roles, purposes, and judgment which such cases raise will not be analysed here. However, it must be emphasized that, in so far as any warning system or emergency organization must deal with people who are already integrated within a social system and keyed to selected sources of information, it would be well to examine the credibility of relevant officials and agencies within communities and the nation with a view to developing and utilizing this important quality.

Strength of the Fear Message. It was believed for some time that a message with strong fear content was not the most suitable to change attitudes and get action from people. For one thing, it was thought that a strong fear message would arouse too much emotion and detract from the development of appropriate coping behaviour. More recent studies indicate that the effects of the amount of fear in a message are also a function of other factors. Miller and Hewgill (1964) compared messages with strong and mild fear content about the advisability of building underground schools which would be a protection in nuclear war and and natural disasters. Their experimental subjects were members of Parent-Teacher Associations. They found that the message with the strongest fear content, if it came from a highly credible source, was most effective in changing subjects' attitudes. While a message with mild fear content from a highly credible source was not far behind, this study indicates that a strong fear message can be very effective.

Although not investigated in the above study, it is likely that the effects of strength of fear are also related to how much time is available for action and to what kind of action is indicated. For instance, if time is short and the kind of action called for is relatively complex, it is likely that a strong fear message would arouse so much anxiety that execution of the behaviour would be less than efficient. Another factor that interacts with strength of fear content in a message is the current anxiety level of the receivers. Janis and Feshback (1954) found that subjects who are already anxious respond better to mild fear messages than they do to strong fear messages, while low anxious subjects respond better to strong fear messages. Presumably this differential effect is a function of both the individual's chronic or long standing level of anxiety together with his level of anxiety as aroused in a particular situation. This means that in order to build the appropriate level of fear content into a message it would be necessary to know the level of chronic anxiety in a given population as well as their current level as produced by present circumstance.

Members of the population who exhibit indifference, apathy, and feelings of invulnerability may present special problems. If their attitude is essentially one of indifference rather than of being defensive, presumably strong fear messages would be indicated. However, if their indifference is defensive, this may be a front for a highly sensitized person, in which case a strong fear message may produce disorganization.

The level of fear which is aroused by an early warning message has influence in determining how subsequent messages are interpreted. If the initial message did not arouse apprehension and vigilance, subsequent messages that are at all ambiguous and may be interpreted in various ways will tend to be ignored or taken as reassurance. On the other hand, if the initial message aroused strong fear, subsequent ambiguoug messages will be interpreted as confirming that fear. This was illustrated in Cantril's (1940) study of people's reactions to the radio program which purported to present an "Invasion from Mars". Those who thought the invasion was real interpreted the flow of traffic outside as unusually heavy and a sign that people were flying from the city. On the other hand, those who took the "invasion" as fiction interpreted the traffic as normal and reassuring. Thus there is a tendency for people to look for and "see" information which confirms their current attitudes and feelings. The implication of this is that people who are highly aroused will be more subject to the influence of rumours and other misinformation, and that those who are not aroused by early warning signs will require powerful fear messages to produce the appropriate arousal and vigilance.

Degree of Personal Involvement. An important factor in sensitizing people to the content and significance of warning signs or messages is their degree of personal involvement in the sense that they have a family member or close friend or relative in the danger area. This factor was first brought to light in the investigation of the Springhill mine disaster (Beach and Lucas, 1960). Most of the wives whose husbands were in the deep underground mine at the time of the "bump" immediately interpreted the quaking of the house as a bump in the mine. On the other hand, those whose husbands were not in the mine at the time tended to interpret the event as some external occurence like a car crash.

In the studies of the false air raid alerts reviewed by Mack and Baker (1961) it was found that persons whose families were in the potential danger zone, were more likely to interpret the sirens as a real alert. This was the case whether they were with or separated from their families. Moreover, those who were with their families reported a much higher incidence of fear, excitement and apprehension. However, the latter group was notable for its failure to take protective action—they exhibited a disconcerting gap between their feelings and attitudes on the one hand and their behaviour on the other. Perhaps having the family together in the home was felt to be some kind of protective behaviour. Nevertheless, this kind of gap between attitude and behaviour should be investigated further.

The following social categories also showed a greater tendency to take the false alerts seriously: women, people with high school education as opposed to public school or university education, residents of large cities more than small-town or urban residents, older people, and members of "middle status" churches. People who were with their peers (neighbours and friends) were least likely to interpret the sirens as a real warning. Presumably they sought validating information from one another, but tended to play down the potential threat because they were concerned not to appear afraid in the eyes of their peers.

Availability of Protective Measures. The effectiveness of a warning message will also depend on the individual's evaluation of the situation in terms of what protective measures are available, his estimate of the loss if he does not take protective measures, how effective he believes the protective measures to be, and the feasibility of the protective measures in terms of time and means. In natural disasters like tornadoes and fires, the individual may frequently be unable to do much to protect property, but he can nearly always greatly reduce the chances of injury and death to himself and his family members. However, most people seem all too unaware of this—even with respect to protective measures against car accidents. The problem is generally that of lack of personally involving experience in terms of both the unpleasant consequences and the effectiveness of protective measures. These can hardly be provided at will. However designed educational programmes may be an effective substitute; they should make use of credible and authoritative informants, personal accounts of first-hand experiences, audio-visual aids, and utilize small groups to enable members to become involved in evaluating and absorbing the information.

The problem of protective measures is a particularly important one in the case of nuclear emergencies. If people believe that they are likely to die whether they take protective measures or not, not only will recruitment, preparation, and training be extremely difficult, but warning messages will have no effect except to announce that "This is the end". Some of the people in Chicago who thought the sirens indicated a real alert but did not take protective action explained that they did not know what they could do, or thought it was futile anyway. If this attitude is prevalent in Canada—this has not been determined—special measures would be required to counter it. Detailed and concrete information on the various effects of nuclear explosions would have to be provided for the public. The manner in which this is done will make the difference between apathy and constructive cooperation. For one thing, the presentation of information should emphasize the positive and hopeful aspects rather than negative features. For instances, if the estimate is that 100,000 would die in a city like Toronto, this prediction should be put in a different form: that a man's chances of survival are nine out of ten. Second, the information should be conveyed by individuals with high credibility. Third, more positive and constructive attitudes are likely to result if the information is provided in small group discussions where it can be adequately worked through. Fourth, the information should always be accompanied by specific instructions on what can be done. If rehearsal and training in

protective action is also provided, the trainees usually feel much more positive about the problem and their attitude will affect their associates and the public.

Cost of Protective Measures. This factor logically belongs with the previous one, but warrants special emphasis. In natural disasters people often fail to take protective measures on receipt of a warning because, together with an underestimate of the probable consequence of the disaster, they are deterred by thoughts of lost time, money, and work. Some are loath to leave their home and business properties, while others are unwilling to leave family members, friends and others who cannot be moved or must stay for special reasons. In this respect, man is not unlike the birds: he does not like to leave his home habitat. Fortunately, the influence of this factor in determining response to warning can usually be countered by information about estimated consequences if no protective action is taken, and the effectiveness of the protective action.

Cost factors are more important from a practical point of view when it comes to false alerts and practice drills. In the former case, the individual suffers cost *because* he has taken protective action. If the warning sign is not to lose its significance and "call to action" value, special means must be adopted to compensate for the cost, inconvenience, and possible laughter of others, and to reinforce what was appropriate behaviour. This can best be accomplished by the appropriate recognition and rewards which leaders, employers, and other significant people in the social system can provide. Cost for participation in practice drills must be balanced in a similar manner by special reinforcements from the social system.

Confirming Warning Messages. It has been observed repeatedly that people seldom react with protective behaviour to a single warning message. Rather, they typically seek confirmation of the warning. As Williams (1964) has indicated, when people get a message which says "This is it!" they seem to require a second message which emphasizes the point by saying, "Yes, this *really* is it!" In the studies of false alerts in the United States it was found that about three-quarters of the people who heard the sirens sought further information, to confirm or negate the warning—from friends, neighbours, officials, high status people, and T.V. and radio. Apparently the reason so few people in Chicago took protective action—though many thought that is was a real alert—was partly because they received no confirming warning. The tendency to seek confirmation is also characteristic of personnel at relay points in the warning system. It would be important to minimize and regulate this tendency to confirm warnings, at least among the personnel of the warning system. On the other hand, there should still be provision for confirmatory messages, and these should be planned in conjunction with a feed-back system which reports how messages are received.

Preparation and Training. Previous instruction and training are important determinants of response to warning. In false air raid warnings in the United States it has been found that about 55 per cent of those with civil defence training have taken some sort of protective action, while only between three and ten per cent of others have done so. The response of those who have had a personal experience of disaster can be further improved by training, especially in terms of acquiring a variety of protective behaviours. Training has the disadvantage that people may become adapted to the warnings signals and in some countries, for instance, Great Britain, the sirens are not used. However, appropriate social reinforcement of response to the warnings will help to counter the adaptation tendency. Moreover, with better prediction facilities for both natural disasters and nuclear war, there is likely to be a period of crisis build-up, with apprehension and vigilance, which will usually sensitize people to the crucial warnings signals.

For the population at large, training should be focused on signal recognition and practical knowledge of protective behaviours. All of the factors cited above as determinants of response to warnings should be considered in the development of training programs, especially organizational encouragement and social reinforced of appropriate behaviours. Members of the warning system will probably require even more training and rehearsal, in every step of the warning process, with as much emphasis on human factors as on technical know-how. Elected leaders and other such officials must have adequate briefing and training—or the whole system may be ineffective.

Mack and Baker (1961 concluded on the basis of studies of false alerts in the United States that the apparent ineffectiveness of civil defence measures could not be attributed wholly to public apathy. Rather, there was inadequate use of existing research findings in the design and implementation of emergency measures, and insufficient use of the research process in dealing with problems of motivating and informing the public, establishing public confidence, and so on.

Evacuation

Evacuation refers to the removal of people from their living area for temporary periods, because of real or potential danger. Evacuation is to be distinguished from migration, which involves relocation on a permanent basis. Three main kinds of evacuation be called for in disaster:

(1) **Tactical evacuation** is the temporary or short-range removal of most people, except possibly for maintenance personnel, from the potential danger area. This assumes a sufficiently long warning period to permit the move. Successful evacuations of this kind have been carried out in the face of threat from floods and hurricanes. This is the kind of evacuation that might occur if there was certain threat of a nuclear strike on a particular community, and if there was sufficient advance warning. A tactical evacuation may also be carried out following the impact of a disaster if the area is a continuing source of danger because of epidemics, radioactive contamination, or simply because it would be much more feasible to support and care for the survivors elsewhere for a time.

(2) **Partial strategic evacuation** involves the removal of those not essential to maintain the community, women, children, the aged and infirm from the actual or potential target area for an extended period. This kind of evacuation was carried out from a number of cities in Great Britain, Germany and Japan during World War II, some on a voluntary and some on an official basis. Partial strategic evacuation may also be carried out because of the difficulty of supporting and sheltering all of the population in the devastated area. This was a consideration in London during World War II where 1,150,000 homes were destroyed or damaged in the nine months from the beginning of the blitz.

(3) **Complete strategic evacuation** involves the removal of all but maintenance personnel from an area for an extended period of time. This kind of evacuation has been rare in the past, but it might be indicated in the event of nuclear war.

In a society in which millions of people are concentrated in large cities, and when those cities might well be targets in any nuclear war, the problem of evacuation assumes formidable proportions. If there is a warning period of only minutes, there would be no time for evacuation and the problem does not arise. However, in the more likely case that there is a fairly obvious build-up of international tension, certain areas may be evacuated on order. Indeed, whether there is an official policy and move to evacuate people, there may well be unofficial voluntary evacuation and this should be anticipated in planning and preparing for such an emergency. The technical problems of transportation, shelter and feeding in a large scale evacuation will not be discussed here except insofar as they affect the human problems. Research on evacuation (Ikle and

Kincaid, 1956; McLonahan and Hostettez, 1965; Titmus, 1950) has pointed up certain problems and lessons dealt with below which should be considered in planning for evacuation.

Administration. Whether an evacuation is to be carried out on short notice or in phases over a longer period of time, there must be detailed planning and rehearsal of informing and instructing the population, collection, movement, staging, reception by hosts, and maintenance in the reception areas. Officials in Great Britain developed efficient procedures for the movement of large numbers of people when they evacuated three and one-half million in the three months prior to World War II. Then, in the three days just before the War over 1,400,000, mostly women and children, were moved from crowded cities without a single accident or casualty. In London, the evacuees were assembled at 1600 collection points and guided by an army of voluntary helpers, many of them teachers. A notable feature of the operation was that extensive use was made of identifying banners, labels, armlets, and other markers. Although movement out of the city to staging and reception areas was remarkably successful, planning and preparation was lax beyond that point and the operation nearly broke down--to the point where open revolt almost occurred in some reception areas. Some evacuees were dirty, had scabies, came in rags, and were worn out with fatigue and uncertainty. The potential hosts did not welcome, but often rejected such people. Supplies of clothing and other material and facilities, such as those for expectant mothers, were inadequate. And evacuees and hosts alike were unprepared for the many other problems they had to face. In the end, 900,000 of those officially evacuated returned to their homes in London by January 1940. Largely as a result of this negative experience, a massive compaign to carry out another evacuation in the spring of 1940 met with little response: less than 20 per cent in target areas registered for evacuation and only one in 50 householders in reception areas was willing to offer his home and help. The British experience demonstrates the necessity for detailed planning and administration for all phases of an evacuation from its inception until evacuees have been returned to their homes. Evacuees and hosts should be thoroughly informed and instructed, there must be an adequate network of administrative and welfare personnel at every level and stage of the operation, and specific problems like those listed below should be considered in planning and administering the operation. There should be adequate provision for traffic control, for registration of evacuees, and for the official and informed communication needs of all people involved.

Motivation. Potential evacuees must be motivated to move and to follow instructions, and potential hosts must be motivated to receive evacuees. Many people in potential target areas will be motivated to leave if an obvious build-up of threat Official and unofficial Great Britain expected most cities to be devastated by bombing at the beginning of World War II, and this was a big factor in motivating people to evacuate at the beginning of the war. Other people will be stimulated to move when the danger becomes imminent--over two million silently and voluntarily left London during the blitz in 1940. However, many people will not be inclined to move either because of feelings of invulnerability or because of a strong tendency to stay at home in familiar surroundings. Others may need to be reassured that the government and officials intend and have the capacity to care for them. Local civic officials, teachers, clergyman, and others may be most useful in persuading people to respond. Evacuees should be given precise instructions about what to take, where to assemble, how to identify and mark themselves, and the sanctions which they will suffer if they do not conform. Potential hosts should be informed, instructed and motivated in a similar manner. They should also be promised and given tangible compensation. Finally, it is necessary to provide means for maintaining the motivation of evacuees and hosts by providing adequate supplies on the one hand and sympathetic counsel on the other so that differences and problems may be resolved.

Accomodation. Three kinds of accomodation may be used for evacuees: camps or bivouacs, public facilities like hotels, and private homes. --Fallout shelters would be a fourth category for tactical evacuation in case of a nuclear strike. The first two types of accommodation would generally not be adequate for most long-range purpose. In past disasters and wars private homes have proved to be the main and preferred source of shelter for evacuees. However, it would be well to plan for improvised accomodation especially for a nuclear emergency. Because space is usually limited in such situations, it may be important to assist host and evacuee in using the space most efficiently.

Allocation and Reception. The destination and reception of evacuees should be worked out in advance if at all possible. This was not done in some instances in Great Britain and the result was often unhappy. In some areas the evacuees were walked or paraded around while various local householders took their pick of those whom they would shelter. Mothers were not generally in demand. Those who were dirty and in rags were often bypassed, and scenes reminiscent of a cross between a slave market and a bargain basement were described—farmers picked strong looking lads, the nicely dressed were chosen first, and so on. The question whether hosts or evacuees should be allowed to chose one another has not been resolved. There is some evidence that voluntary selection makes people happier initially, but that problems may become exaggerated because of disappointed expectations with respect to one another. If possible in terms of time and adequate welfare and administrative personnel, allocation of evacuees on the basis of social and personal characteristics would probably work out as well or better in the long run. In any case, family groups should be kept together. When families were evacuated from cities in Germany during World War II, while their husbands stayed behind to work, there was much dissatisfaction and productivity decreased. The authorities resolved this problem by locating families on the fringe of the city or nearby so that husbands could visit them at least occasionally.

Provision of Service Personnel. A major problem in caring for large numbers of evacuees for more than a few days is the difficulty of providing adequate numbers of the appropriate service personnel. The latter include medical and paramedical personnel, clergymen, welfare workers, teachers, and technical personnel. This was not handled satisfactorily in Great Britain during World War II. Hundreds of thousands of children were without education, health services, and school meals and milk for more than 4 months, and over 100,000 were still not receiving any educational instruction after 8 months. Such as omission could lead to serious health and social problems.

Children. Of all evacuees, children probably suffer most and create most problems. Bedwetting and soiling increased markedly among evacuated children in Great Britain. In some reception areas it seemed that in the mornings every window was filled with bedding, hung out to dry and air in the sunshine—"the scene is cheerful, but the householders are depressed". Many householders did not know how to handle such problems and used punishment and strict dicipline rather than understanding and the provision of attention and security. These difficulties were particularly frequent when children were separated from their parents. Moreover, with no educational facilities in many cases, the children were not provided with sufficient routine activities and supervision.

Personal Differences. Various personal characteristics such as social status, education, religion, moral customs, manners, and habits can make for conflict and more serious problems between host and evacuee. Upper and middle class families in Great Britain were reluctant to take evacuees of any class and often sought exemption on medical grounds. We may err in thinking that this would not occur in Canada—the attitude of many Canadians toward the privacy of their home and personal property might incline them to act in the same manner. Differences in social status and education can make for problems in communication, understanding, and cooperation. Most people are inclined to be intolerant of different religious views and practice. Differences in moral customs, and other manners and habits may lead to discrimination, conflict and unhappiness. For instance one Glasgow mother was reported to have spoken sharply to her 6 year-old child, "you dirty thing, messing the lady's carpet, go and do it in the corner". In another instance, when the householder went to see two children in the nice clean bed she had provided for them, she found them huddled in the corner of the room. One of them said "We are not goin' there, that's a bed for the deid folk". Another child said "The country is a funny place, they never tell you you can't have no more to eat". And one child told his mother "they call this Spring, Mum, and they have one down here every year". While Great Britain may have had an unusual number of evacuees who were different, poor, and ill informed, it would be a mistake to assume that all Canadians are alike in terms of experience, wordly goods, habits, and other personal qualities—approximately one-quarter of our population, urban and rural, is seriously underpriviledged in terms of economic and living conditions. In planning for evacuation, it would be important to consider personal characteristics in matching hosts and evacuees and to provide service personnel and facilities which would help to minimize difficulties.

Provision for Constructive Activity. There has been little mention in the literature about the importance of providing activity outlets for evacuees. However, this would be important, especially if evacuation was for an extended period of time. Not only should children be provided with educational facilities and instruction, but both children and adults should be actively involved in work and play that will contribute to the development of community spirit on the one hand and contribute to the process of reconstruction of society on the other.

Suggested Readings

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FOREWORD

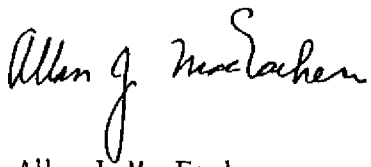
The Department of National Health and Welfare has recognized the need of a manual on the management of human behaviour in various disaster situations, for the use of health personnel and others involved in emergency measures planning.

The purpose of the present manual is to acquaint the reader with the kinds of individual and group behaviour that may be expected in peacetime and wartime disasters, or other emergency situations, and to suggest ways of dealing with such behaviour.

This Manual has been prepared by Dr. Horace D. Beach, Professor of Psychology, Dalhousie University, under contract to the Department of National Health and Welfare.

It will be noted that certain sections of the manual are printed in smaller type. These sections will be of interest primarily to the emergency planner and the student of human behaviour. The general reader however, will find much useful knowledge and information therein.

First editions may not be entirely satisfying in every respect; the virtues and shortcomings of the first edition of this manual will become apparent through use. Comments and suggestions that would permit an improved second edition at some future time are invited from readers and users of the manual. They should be addressed to the Public Health Consultant, Emergency Health Services, Department of National Health and Welfare, Ottawa.



Allan J. MacEachen,
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