

Emotions and Sense Making in Disturbance: Community Adaptation to Dangerous Environments

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Abstract

When threatened with disaster, communities are faced with chaotic and threatening situations for which existing understandings provide no good explanations and established routines seem inadequate. A process is described here by which human understandings of dangerous environments and the risks of occupying them are socially reconstructed in the minds of the community following disaster or the credible threat of disaster. Those reconstructions may alter routines, changing how the community relates to its environment and, perhaps, change how well the community is adapted to the environment. Hypotheses are proposed predicting which of several competing reconstructions the community will adopt. Examples are described of how disaster managers might influence the reconstructions and, therefore, community adaptation to its environment.

Keywords: community, disaster, adaptation, sense making, emotions

Introduction

Disaster sociologists who adhere to the ideas of realist constructionism (Murphy 2002) recognize that human behavior, when it is influenced by the non-human environment, is affected by perceptions of the environment and understandings of how it works rather than by any environmental reality independent of human thought. Social mechanisms and technology by which communities interact with their environments reflect those perceptions and understandings. However, "...if human expectations about nature's dynamics are faulty, then human constructions can be tripped up by being out of step with those of nature, which can lead to disastrous results" (Murphy 2004, 254).

Human perceptions and understandings of both social and natural systems are imperfect under the best of conditions. What we believe we know is but an approximation of reality. In the sciences and everyday life, paradigms are likely to shift, shaking theories once thought to be solidly grounded or bringing them down altogether.

Nevertheless, perfect understanding of nature's dynam-

ics is not required. Social constructions of reality based on imperfect understanding allow us to create institutions and technologies that enable human beings to thrive in environments that would otherwise prove hostile or even uninhabitable. Imperfect knowledge is often adequate to the task.

But, what happens when it is not adequate? Misunderstandings of natural processes and the risks involved can result in maladaptations. To the extent that human interactions with their environments are based on faulty or incomplete beliefs about nature, they may fail to achieve their purposes and lead to disaster. Disturbance often becomes disaster where misapprehensions of nature lead to "socially constructed vulnerability" (Murphy 2004, 260).

Ordinarily communities are more or less well adapted to their environments. Institutions and routines are usually adequate to cope with everyday variability in social and natural processes. Mechanisms normally exist to deal with repeated disturbances. Fire departments respond to the usual run of fires and rescues without difficulty. Mutual aid agreements allow them to handle events larger than those they are staffed and equipped to manage on their own. Regulations, building codes, permitting, and inspections help adapt the community to resist disturbances and insurance and relief organizations help ensure that the community is resilient and can rebound from disturbance.

When the magnitude or character of the disturbance differs greatly from that for which the community is prepared and disaster threatens or actually occurs, people may reconstruct nature, especially if previously reliable adaptations fail. In the wake of Hurricane Katrina, when so many physical and social adaptations to a dangerous environment failed, vigorous public debate followed in which many adaptations once assumed to be effective were questioned. These ranged from the quality of levee construction to the competence of disaster management organization leadership.

Reconstruction of nature and community as a result of severe disturbance or disaster involves revised perceptions and understandings of how natural and social systems work and what effects human actions might have. Routines², roles, institutions, and organizations may need to be changed to be consistent with the emerging social construction of reality. Things that apparently worked will be reinforced. Those that

failed may be replaced or reinvented. As a consequence, the community will alter how it relates to its environment.

There is no certainty, however, that reconstruction of reality will lead to revisions in routines and roles or organizational innovations that make the community better adapted to its environment. Many different explanations are possible for events experienced. If the reconstructions are based on faulty expectations about nature's dynamics (Murphy 2004), the community may be no better adapted and changes could even worsen its situation.

In this paper, a process is described by which human understandings of dangerous environments and the risks of occupying them are socially reconstructed in the minds of the community following a disaster or credible threat of disaster. The process describes results from a synthesis of elements of environmental perception theory (Mehrabian and Russell 1974b) and sense making theory (Weick et al. 2005). Hypotheses are proposed that may predict which of several competing social reconstructions a community will adopt. Examples are described illustrating how managers and others might influence social reconstructions of reality to improve a community's adaptation to a dangerous environment.

Sense Making

Sense making is one way in which social constructions of reality are achieved. It begins when a situation becomes unpredictable. People seek cues from their environment, and interpret and structure information in conversations with others in their social system to construct "plausible" stories³ explaining what is happening and why. "...sensemaking allows people to deal with uncertainty and ambiguity by creating rational accounts of the world that enable action" (Maitlis 2005, 21). Because sense making leads to action consistent with the reconstruction of reality it has the potential to create new organizational routines that alter the organization's structure and functions if the new behaviors are integrated into the social structure. Routines are the capability and predisposition to act in certain ways in response to prompts from the organization's environment (Hodgson 2004). Routines can be learned and, therefore, can be replicated in different organizations. Thus, sense making in response to disturbance in a community's environment has the potential to alter that community's adaptation to its environment and even the adaptation of other communities to other environments.

When a community is faced with a major environmental disturbance such as a wildfire threatening life and property, people are likely to experience confusion about what is happening. The fire itself is a source of uncertainty, introducing smoke, flames, and the unusual actions of many strangers and equipment not typically encountered. The fire spreads in ways

that most people cannot easily predict. It incinerates some parts of the landscape while sparing others. Some homes burn while others nearby survive. All this happens without apparent reason, at least to most wildland urban interface⁴ residents with limited knowledge of fire behavior principles.

Sense making begins in unpredictability.

...an expectation of continuity is breached, ongoing organized action becomes disorganized, efforts are made to construct a plausible sense of what is happening, and this sense of plausibility normalizes the breach, restores the expectations, and enables the project to continue" (Weich et al. 2005, 414).

However, what is normal following sense making, what is expected, and what actions are taken as a result are likely to be different under the community's revised social construction of reality.

As the disturbance develops, people are immersed in a fast moving stream of confusion. Early on, it is not clear where the fire is with respect to things that are valued. It is not clear in which direction the fire is spreading or how fast. It is uncertain that firefighters will be able to stop the spread before the fire reaches vulnerable values or, if it does reach homes and other important values-at-risk, how much damage it might do.

In response to confusion, people seek information and attempt to put together a story that explains what is happening and predicts what will happen. Patterns are sought and relationships and interactions hypothesized. These take the form of if-then and cause-effect statements as well as declarative statements of perceived fact — where the fire is, what direction it is spreading, how intensely it is burning, who is doing what to contain it, and so on.

As patterns develop and relationships emerge, complexity is reduced and the situation makes more sense. Sense making happens, "by looking back over earlier observations and seeing a pattern" (Weich et al. 2005, 412). Patterns are identified based on cues from the environment, past experience, and knowledge. Sense in an uncertain environment is more created than discovered. Understandings of nature and the social system established before the disturbance influence the stories that emerge as much as do new and unusual experiences of the disturbance itself. Sense making is a reconstruction of social constructions of reality rather than the invention of entirely new understandings. Stories told to explain the chaotic situation and restore order develop iteratively. Tentative hypotheses about what is happening and what it means are continuously revised as new information is found and created. "(Sensemaking) is more comprehensive, incorporates more of the observed data, and is more resilient in the face of criticism" (Weick et al. 2005, 415).

The stories that emerge during sense making do not nec-

essarily accurately reflect reality. As stories are revised, they improve. However, “People may get better stories but they will never get the story” (Weick et al. 2005, 415) (emphasis in original). It is unlikely that a single plausible story will arise out of a disturbance. “What is plausible for one group, such as managers, often proves implausible for another group, such as employees” (Weick et al. 2005, 415).

In a community threatened by wildfire or other disasters, different groups will experience the event differently. The events encountered and the frameworks for interpreting them will not be the same for firefighters and neighborhood residents. It would be surprising if both groups told the same stories about the fire or attributed effects to the same causes for the same reasons.

Early in a disturbance it is likely that many emerging plausible stories will compete to make sense of the situation. During Hurricane Katrina, people attributed the disaster variously to the fact that portions of the city were below sea level and should not have been built there in the first place, that the levees were inadequately constructed, that sediments no longer reached the marshes from the Mississippi River reducing vegetation and leaving the city more exposed to the gulf, that priority was given to evacuating whites and the poor black population was not provided for, and that the head of the Federal Emergency Management Agency was incompetent. Over time, a few of these stories will dominate and others will fade into obscurity.

Sense making is social and develops through discourse. Communication within social networks mobilizes the collective store of experience and knowledge. Observations made by social system members are shared. Information is sought from outside the social system from official and unofficial sources, the mass media and informal interpersonal contacts — or just encountered. Information is not simply gathered, however. Conversation enables information processing.⁵ Credibility and usefulness are judged. Meaning is attached. New ideas are created. Most importantly, patterns and relationships are discovered. Plausible stories are constructed through social interaction.

Sense making leads to action and action facilitates sense making. Some actions involve information seeking and processing. But people do more than talk sense into the situation; they also act on understandings as they emerge. People do things that they think will protect their families, friends, property, and themselves. They even come to the aid of strangers. Actions reinforce ideas and opinions. Public action represents public commitment to an idea. Actions also produce reactions from nature and from other people and institutions. Those reactions reinforce some ideas and tend to extinguish others (Murphy 2005).

During the evacuation of more than 45,000 people from

mountain top communities above San Bernardino, California during the Old Fire of 2003, some people stayed behind. One person who came to be known as “Ranger Al” monitored conditions and reported to evacuees on the state of their homes and the local fire situation. Eventually Ranger Al established a website to report on the situation for people who left the mountain. The initial response from official information sources was to discourage his activities. Later this orientation was reversed at the highest levels of the firefighting organizations and he was recognized and supported (Taylor et al. 2007).

The initial negative reaction from officialdom might have discouraged future unofficial reporters. Ranger Al, however, was an experienced wildland firefighter and that made a difference. The fact that he took action resulted in responses from agencies that might contribute to beliefs that agencies control information during disasters and try to allow only the information of which they approve to get out. Part of the plausible story might be, “Things happened there that the government doesn’t want you to know about.” That could lead to speculations about what sorts of things those are and rumors unkind to the agencies.

Sense Making & Community Adaptation Summarized

Sense making in the face of disaster and its influence on community adaptation to its environment can be summarized in this way. When disaster threatens, people face a rapidly changing environment that appears threatening. The uncertainty of the experience motivates people to find ways to make sense of the confusion.

To do so, they look for patterns in what, at first, seems to be a more or less random flow of sensations. Using existing knowledge and experience and seeking new information, they define concepts and hypothesize relationships among them. Emerging patterns reduce perceived complexity and suggest if-then and cause and effect relationships that prompt actions. These reconstructions of reality are called “plausible stories” in sense making.

The actions people take based on their reconstructions of reality trigger reactions within the social system and from nature. Those reactions generate information that further revises the stories and leads to other actions.

The stories people create are tentative and subject to continuous revision as perceived facts and relationships are encountered. Stories are altered to better account for changing knowledge and to better resist challenges.

Early in the disaster, many different stories are likely to emerge. These stories will evolve in competition with each other. In the end, one or a few stories that are perceived to best explain the situation and lead to satisfying actions and results will dominate and exert the greatest influence on social action.

Sense making is a social function. The plausible stories that emerge are social reconstructions of reality and they tend to organize and direct collective action. Sense emerges from confusing situations through discourse. Through conversation, people mobilize the knowledge and experience in their social system and in the social networks of members that may extend well beyond the social system itself. Conversation also processes the raw information, interpreting it, evaluating it, and applying it through actions.

Knowledge acquired and invented in the community's social response to disaster may alter the community's capacity and propensity to respond to future environmental prompts. New or altered routines may be institutionalized — made part of individual habits and collective expectations and integrated with other established social system routines.

Routines can be learned and communicated from one social system to another. In this way, routines that are developed in one community as a result of sense making during disaster can be transmitted to other communities, affecting their propensity and capacity to respond in certain ways to prompts from their environments.

Alterations to routines do not necessarily improve a community's adaptation to its environment. To dominate, stories do not have to be accurate; it is enough to be believable and suggest satisfying actions. If the stories conflict with reality in important ways, changes may actually worsen the community's adaptation to the environment.

For frequently occurring disturbances, one might expect environmental reactions to community actions to reinforce story elements that more accurately reflect reality and to change elements that produce inaccurate expectations and inappropriate actions. Things that work will be repeated and the ideas behind them reinforced; those that fail will be abandoned or changed and the ideas behind them discredited. In this way, plausible stories, the routines they spawn, and the resulting actions will become increasingly consistent with reality. Communities will become increasingly well-adapted to their environments and less susceptible to psychological distress and social and economic disruptions.

When disturbances of unusual magnitudes or kinds occur rarely with respect to turnover among community members, stories, routines, and actions will not be tested often enough to provide corrections. If those routines derive from social reconstructions that are out of step with nature, they may lead, as Murphy (2004, 260) says, to "socially constructed vulnerability" and disaster once again when the next disturbance occurs.

Emotional Response to Disturbance

Mehrabian and Russell (1974b) proposed a theory describing emotional arousal as the result of environmental ex-

periences. In 1995, Mehrabian again described the rationale for a three-dimensional model of emotions and presented refined measures. The model is known as PAD for pleasure, arousal, and dominance, the three dimensions. PAD has been successfully used in applications as different as marital satisfaction, marketing, outdoor recreation, chess playing, and robotics. PAD provides a way to assess emotions aroused by the threat of disaster, suggests hypotheses about sense making, and provides a foundation for recommendations to fire managers wishing to mitigate negative effects of fire disaster on communities and enhance social and economic recovery.

Emotional response to environments and situations are composed of combinations of three primary emotions much the same way that all colors are combinations of three primary colors. Pleasure, arousal, and dominance dimensions have been shown to be independent of each other. Details of development and testing of the scales can be found in Mehrabian (1995).

Pleasure is defined as "positive vs. negative affective states" along a continuum from pleasure to displeasure. Arousal — non-arousal is measured by adjective pairs that suggest activity or mental alertness varying from frantic to inert. Dominance-submissiveness describes the degree to which a person feels in control of what is happening or at the mercy of events (Mehrabian 1995).

Other emotional states can be described as combinations of these primary emotions. For example, feeling angry is described by low pleasure, substantial arousal and moderate dominance. "Bored" is described by low pleasure, low arousal, and moderately low dominance. PAD scales can be used to predict emotional responses to situations described verbally. For example, the situation described as, "Today, you were promoted at work. You are about to tell your spouse that now, finally, you can purchase the kind of home you both have always wanted," elicits, pleasant, arousing, and dominant feelings. On the other hand, "You had your annual physical two days ago. Your physician has called you to say that he needs to see you at his office first thing tomorrow morning," is associated with unpleasant, arousing, and submissive feelings (Mehrabian 1995, Appendix A).

Emotions associated with the immediate threat of disaster such as residents might experience when a wildfire is burning toward a neighborhood can be measured using PAD. In such situations one can expect that people will anticipate losses, perhaps even as serious as injury or death to themselves, family, friends, and pets. They are likely to be highly aroused. If they know what to do, have prepared, and are able to take actions to protect themselves, others, and things that they value, they may feel some dominance. If they are evacuated and prevented from taking meaningful action, they may feel submissive. Firefighters protecting homes in the same

neighborhood will be less likely to anticipate loss, will be less aroused (because they know fire better), and will feel more dominant (because they are better equipped and trained). The emotions experienced by neighbors might be described as anxiety or in some extreme cases as terror. Fire-fighter emotions might be described as aggressive or excited. The same environment and conditions will stimulate different emotions in different people depending on how the situation affects the three primary emotions.

Disaster is likely to create varying degrees of loss and psychological and physical pain for people affected. The anticipation of loss and pain will have consequences similar to actual loss or pain but, perhaps, less pronounced. The degree to which anticipated losses are experienced as emotions may depend on such variables as the individual's ability to empathize.

Nevertheless, few neighborhood residents faced with an advancing wildfire are likely to feel pleasure. The amount of loss anticipated can be changed, however. If residents are shown how to prepare their property to be less susceptible to damage and easier for firefighters to protect, they may anticipate fewer losses. If they have collected irreplaceable treasures and important papers and can take them with them out of harms way, and if what remains is protected by insurance, fear of losses will be further reduced. If the family is together and pets are in the car, the car is loaded and everyone is ready to evacuate and knows where to go and when to leave, the fear of injury or death to oneself and family will be lessened. Although the anticipation of loss cannot be totally eliminated, it can be reduced. People tend to avoid pain and approach pleasure and situations that are associated with them.⁶

Arousal results from exposure to many environmental variables associated with wildfire and its control. High levels of activity, strangers, noise, and irritants such as smoke increase arousal (Mehrabian and Russell 1974b). Arousal is also a function of the unpredictability of a situation. As a situation becomes less predictable, arousal increases. People facing the threat of disaster are likely to experience high levels of arousal. People tend to seek increases in arousal at lower levels and to avoid higher levels of arousal.

Information rate is a measure of the unpredictability of an environment. A stimulus is low in information to the extent that knowing one element allows one to predict other elements. For example, a checker board has low information because seeing a few of the alternating red and black squares allows one to reconstruct the entire board. A random number table has high information because knowing any number or sequence of numbers does not allow one to predict any other number or sequence of numbers. Information rate describes the unpredictability of a stream of stimuli and is unpredictability per unit of time.

Information rate or entropy is computed as $[H = -\sum p_i \log p_i]$ where p_i is the probability of the event, "i" (Shannon 1948). In the case of the checkerboard there are two events of equal probability, red squares and black squares. Perceived information rate can also be measured using a semantic differential scale. Perceived information rate rather than objective information rate influences arousal, and therefore, the emotions aroused by an environment during disaster. Verbal measures of information rate were developed by Mehrabian and Russell (1974a).

One key to reducing arousal is to find repeated patterns in the apparently random flow of events. Discovering things that tend to be found together allows clustering and thus the reduction of the number of events. Entropy is reduced and so is arousal. In this fashion, the process of sense making affects arousal and therefore, the nature of emotions experienced during disturbance.

The third dimension of emotional responses to environments (including disasters) is dominance. One feels dominant when one senses that one has a great deal of influence over the outcomes of events and can engage in actions that will make a difference. When one feels at the mercy of events, dominance is low. Dominance is associated with both positive and negative emotions. For example, low dominance, high pleasure, and moderate to high arousal might be experienced when viewing the Grand Canyon from the rim. Such experiences are often described as awe. One might feel the same watching a wildfire burn through brush when one neither anticipates personal loss nor empathizes with people who might experience losses.

When pleasure is low, arousal is high, and dominance is low, one feels despair or anxiety. When pleasure is low and arousal is high and one feels dominant, the emotion one feels will be closer to aggressiveness.

Emotions, Sense Making, and Community Adaptation

Sense making affects emotions experienced during a disturbance. Sense making reduces complexity and increases the predictability in a situation thus reducing arousal. In a disaster, as arousal is reduced, emotional responses may become less negative and more endurable for people affected. Uncertainty reduction is an important contributor to moderating strong emotions associated with disaster.

Weick et al. (2005, 411) say, "Sensemaking starts with chaos." They show how sense making proceeds through noticing, bracketing, and labeling, all ways of reducing complexity and improving predictability. They also say, "If the first question of sensemaking is 'what is going on here?' the second, equally important question is 'what do I do next?'"

(Weick et al. 2005, 412). What one does next is dependent on the nature of the stories that arise to explain events. The attractiveness of potential actions will depend on both beliefs about the effects those actions will have (the stories predict these) and how people feel about both the actions and the outcomes they will have. Here is where Mehrabian's PAD theory contributes to sense making and theory about how organizations, including communities, adapt to disturbance.

Emotions experienced during and following disturbance may influence which among the competing plausible stories achieves greatest acceptance within the organization or community. The following hypotheses are suggested.

1. Stories that reduce perceived losses and emphasize gains will be preferred to stories that increase a sense of loss or the importance of those things lost.
2. Stories that provide structure sufficient to reduce arousal to more acceptable levels will be preferred to those with less (or more) structure.
3. Stories that increase perceived control over events (past, present, and future) will be preferred to those that suggest less influence over events and outcomes.

Stories that Reduce Losses

It is not necessary to actually reduce the physical losses people experience in order to reduce the displeasure associated with a disturbance. People often re-value things and situations when their feelings do not match the reality of the situation. Cognitive dissonance theory (Festinger 1957) predicts that when two beliefs or attitudes are in conflict, an uncomfortable sensation is felt. This is called dissonance. People seek to reduce dissonance and can do so by making their attitudes and beliefs more congruent. If the fact cannot be denied that the view that one once valued has been burned, one may reduce dissonance by devaluing the lost view and making it less important. One may also increase the value of things saved. Perhaps this explains the often heard statement that although everything was lost in the disaster, "...at least none of us were hurt. We got out all right." Dissonance can also be reduced by focusing on the future and anticipation of improvements rather than on the losses experienced.

One would expect that among the competing stories, those that emphasize what was saved, de-emphasize the losses, find benefits in the disaster (closer relationships with neighbors, and so on), and look forward to a better future will tend to succeed where stories that emphasize the losses experienced will be less attractive.

Stories that Optimize Arousal

People seek to optimize arousal, the relationship between approach behavior and arousal being an inverted U-shape.⁷ Usually in disaster, arousal will be uncomfortably

high and people will seek to reduce it. The principal avenue for reducing arousal is to create stories that add structure to the confusing situation. Stories that include cause-effect and relationships among events will reduce arousal.

Successful stories will not eliminate uncertainty but will, instead, retain some degree of mystery so that desirable levels of arousal are maintained. To the degree that perceived entropy is eliminated, one might expect that successful stories will add drama, detail, or other elements to raise arousal.

Stories that Increase Dominance

More successful stories will portray residents in roles that make a positive difference in the outcomes of the disaster. To the degree that one cannot do that, failure to take action and make a difference will be explained by events beyond their control. It is unlikely that successful stories will attribute fire damage to resident's failure to thin brush and clear fire hazard from around their homes. People may attribute losses to fate rather than their own actions or failure to act. The "miracle house" may be found that survived while all others burned around it. Rather than attribute survival to characteristics of the house and landscape that made it less flammable, people may create stories of haphazard fire behavior that skips around with random impacts. It might be expected that the owner of the miracle house and firefighters will have different stories featuring their actions that saved the house.

Evacuations create conditions that strip residents of almost all sense of control over the outcome of the situation. People who go to shelters are cared for and called "victims" in the media. Those who stay with friends or in motels can do nothing more once they leave their neighborhoods. Typically, once one evacuates, one is not allowed to return. Feelings of helplessness may account, at least in part, for the commonly heard comment that "I won't evacuate next time — I'll stay to protect my place." Just saying so may help restore a sense of control.

Undesirable Consequences of Strong Negative Emotions

Experience of strong emotions associated with exposure to disaster results in psychological distress that, in turn, affects the social and economic functions of communities. "The more severe the disaster and the more terrifying or extreme the experiences of the individual, the greater the likelihood widespread (sic) and lasting psychological effects" (Ehrenreich 2001, 13). "Even more than the physical effects of disasters, the emotional effects cause long-lasting suffering, disability, and loss of income" (Ehrenreich 2001, 5).

Consequences of exposure to disaster include (Norris et al. 2001):

- Specific psychological problems such as posttraumatic stress, depression, and generalized anxiety were found in 74% of the 117 disaster studies reviewed.
- Health problems such as increased use of sick leave, sleep disruption, verified medical conditions, and increased substance use were identified in 39% of the studies.
- Family strains and conflicts, troubled interpersonal relationships, and social disruption, were regularly found in the studies that looked for them.
- Behavior problems, separation anxiety, deviance and delinquency increased among adolescent survivors.

Posttraumatic stress symptoms include many that make social interaction ineffective (Ehrenreich 2001, 17). Social withdrawal may make those who experience it less likely to participate in community efforts at recovery and reconstruction. Increased drug and alcohol use, difficulty concentrating, difficulty making decisions and planning will make it hard for people to do their jobs well. They will also interfere with collaboration in community recovery. Irritability, hostility, and anger, will make it difficult and uncomfortable for people to work together. When combined with moodiness and a tendency to sudden emotional outbursts, hostility may make group meetings unworkable.

Those affected by disaster tend to recover with time. The first year following the disaster will see the greatest effect. Only a minority of the community will experience lasting effects (Norris et al. 2001). However, the consequences of poor decisions, disrupted social relationships, and economic impacts from reduced manager and worker effectiveness can create long lasting personal, social, and economic problems for the community. The effects on children resulting in problems with school and learning may also cause long lasting undesirable consequences for individuals, families, and the community.

Management Actions Affecting Sense Making

Disaster managers can influence the emotions experienced during disasters and the outcomes of sense making. In the short run, psychological distress and social and economic disruption can be reduced. In the longer run, by increasing the accuracy of plausible stories explaining the disaster, managers can help the community to develop routines that better adapt the community to its dangerous environment.

The following are selected examples of actions managers might take to affect emotional responses and sense making. They are provided as illustrations and not as recommendations. Although each of these actions is generally appropriate, each community and disaster situation is different.

Community Preparedness

Assisting communities to prepare in advance of wildfire or other disturbance will reduce losses and the anticipation of losses. This will alter emotions from anxiety, despair or terror (in extreme cases) toward emotions closer to concern. People who have prepared, have evacuated with their family and pets, and have left their property in a condition better able to be defended by firefighters and that is calculated to survive the disaster will anticipate less loss and pain.

If preparedness also includes information and practice of actions to take as the disaster approaches and in the event of evacuation, uncertainty will be reduced. As uncertainty declines so will arousal. At lower levels, arousal is useful because it stimulates curiosity, alertness, and information seeking. At very high levels, arousal contributes to strong negative emotions and the undesirable psychological distress and social and economic disruption that follow.

Preparing is also likely to increase a sense of control over the outcomes of a disaster. Individuals will be less likely to experience helplessness. If communities prepare together, people may also feel that they can rely on neighbors, thus increasing the combined ability to cope with the disaster. If emergency food, clothing, and other necessities have been stored, and responses have been practiced, the onset of disaster is likely to result in feelings of competence.

Pre-Disaster Hazard and Risk Mitigation

For many disasters, people can do things that will reduce potential losses. Vegetation can be modified around homes and communities to alter wildfire behavior making it less dangerous. Buildings can be strengthened and furniture secured to reduce damage from earthquakes. Hazard and risk mitigation can reduce the losses anticipated, altering the pleasure dimension. Actually doing the physical actions to modify vegetation or secure furniture can enhance feelings of being able to control the consequences of a wildfire or earthquake.

To achieve the best effects, mitigation campaigns should include learning the science behind the disaster and its management. Residents of communities that might be threatened by wildfire should learn principles of fire behavior and how fire management uses those principles to fight fire. Fire educators can demonstrate how the modifications people make to their landscapes will alter fire behavior. Learning fire ecology helps people understand how fire and fire hazard mitigation will affect environmental characteristics they value. Knowledge of these principles help people organize information before and during the disaster, reducing arousal.

In contrast, the common practice of promoting hazard mitigation by showing destroyed buildings and devastated landscapes to motivate people to adopt the recommended

mitigation measures only increases arousal without providing means to reduce it effectively. It also increases anticipation of loss.

Education about the mechanisms of disaster and mitigation increases one's ability to think out appropriate actions and take them, adding to the sense of dominance. Increasing arousal and anticipated losses while at the same time leaving a person feeling relatively helpless is the recipe for despair. That emotion is hardly likely to promote protective actions. The reasoning, of course, is that by adopting the recommended actions, people can relieve the negative emotions aroused by the scary messages. When one does not feel confident of one's ability to take the necessary actions, however, the emotions aroused by such messages and associated actions could be undesirable.

Fire Information

During wildfires and other disasters, managers are in an excellent position to provide communities with information that helps them cope with the threat and recover quickly. Fire (and disaster information in general) can provide the frameworks that social reconstructions of reality are built on. The demand for information and explanation is very high as the disaster unfolds. People seek information wherever they can get it.⁸ If official sources provide helpful information, those sources will be used often. If the information is not useful, official sources will be ignored.

Information that explains what is happening and why will be most useful early in the disaster. People need to know where the fire is, how fast it is spreading and what the chances are that it will reach the community. People also need information that they will use to decide on actions to take. How-to information such as how to prepare for evacuations, what to do with livestock and pets, how to prepare one's home to best survive if embers or the fire reach the community, and the like will be useful. Information will be most effective if it includes explanations and reasons behind statements. The information program should seek to reduce uncertainty and other sources of arousal, increase a sense of being in control of events or influencing outcomes, and reduce anticipated losses.

For example, "The fire is located 25 miles northeast of Red Rock Junction, and is burning in brush. No homes are immediately threatened. Resources on the fire include" provides little that helps reduce entropy.

A more detailed message such as this might work better for the community. For example,

The fire is not expected to reach Brentwood today. The fire started about 1/4 miles north of State Road 36, along Crystal Creek. It is burning intensely and

spreading rapidly upslope on the west side of the ridge. The fire intensity and rapid spread are caused by the steep slope, dense brush and wind from the southwest. Fire burns more quickly upslope and with the wind and more intensely in thick fuels. As the fire reaches the top of the ridge this afternoon, the rate of spread will slow while it backs down the east slope through more patchy brush and grass into Poker Valley. Wind speed will drop this evening as the sun goes down. Firefighters are building line ...

Post-Fire Recovery

It is possible to influence the nature of the plausible stories adopted by the community following the disaster by involving the community, especially opinion leaders and other key communicators in recovery and restoration efforts. Public tours of the fire that describe how the fire burned in different areas and why and the firefighting actions taken will help the stories to more accurately reflect reality (at least as that reality is understood by fire scientists and managers). These public tours might be modeled after the staff rides used in the military and fire management.

Increased dominance and a future-focus can be developed best by engaging community members in planning and implementing restoration activities on both public and private lands. People will volunteer to assist with projects. Community members can sometimes be hired by the agencies to do restoration work. In both cases, time should be devoted to explaining to workers why restoration is needed (or not needed), why it is being done the way it is, and what to expect in the future on the site. What participants learn will be communicated to other community members through the community's informal networks. Regular public meetings to discuss plans and progress and to show the work accomplished will enhance the effects of the activities. Learning on the job will also reduce complexity and arousal. Experience in restoration work will help people redefine their values, perhaps (but not necessarily) in ways that reduce the sense of loss.

An example of extensive and successful community engagement in post fire restoration is found in Los Alamos, New Mexico where a sustained community effort following the Cerro Grande Fire has helped heal both the burned landscape and the community, itself.⁹

Conclusion

When faced with the confusion engendered by disaster, people seek to make sense of events. With others in their social system, they seek, evaluate, and interpret information

and form it into stories that are believable, account for new information, and suggest actions. The actions taken may alter routines that guide collective behavior sequences in response to environmental prompts. If the routines are institutionalized and integrated with other social system routines, the structure and function of the community organization will be altered, perhaps changing the community's adaptation to its environment. Routines can be learned and communicated to other communities leading to alterations in how those communities adapt to their environments, if they adopt the innovations.

The emotions aroused during a disaster will influence sense making and the nature of the stories that emerge. Early in a disaster many stories are likely to compete for adoption by the community. It may be possible to predict which stories are likely to be adopted and which are abandoned. Hypotheses are proposed relating emotional arousal by stories to adoption.

Disaster management actions can influence the nature of emotions aroused and the social reconstructions of reality (plausible stories) that arise. By influencing the stories to make them more consistent with reality (as it is best understood) it may be possible to help communities adapt better to their dangerous environments. Illustrations are included of selected management actions and discussions of how they may influence emotions and stories.

Endnotes

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2. Routines are "...organizational dispositions to energize conditional patterns of behaviour within an organized group of individuals, involving sequential responses to cues" (Hodgson 2004, 6). Routines are characteristics of organizations much in the way that habits are characteristics of individuals. Routines differ from habits in that they mobilize and integrate behavior among roles in organizations. Routines are not a sequence of behaviors; instead "they are stored behavioral capacities or capabilities" (Hodgson 2004, 4). Routines function at the social organization level in ways analogous to how genes function at the organism level. They are persistent. They contain information that influences the structure and function of the organization. And, they can be transmitted from one organization to another where they influence the structure and function of the receiving organization.
3. A story is plausible if it is believable. It does not need to be true or accurate. However, to be and remain believable, a story needs to be consistent with observed "facts." When the story conflicts with observations or when beliefs within the story are inconsistent with each other, cognitive dissonance will be experienced and either the story or the "facts" will be revised to achieve better consistency. Facts can be revised by discrediting the source, misinterpreting them, or ignoring them, for example (Festinger 1957).

4. The wildland urban interface is the landscape in which homes and businesses intermingle with flammable wildland vegetation, where developments border on flammable wildlands, or where areas of wildland are surrounded by development. Wildfires burning in the wildland urban interface often quickly threaten lives, property, and other values.
5. "...information processing is purposeful behavior by which individuals, groups, or organizations become aware of, handle, make sense of, resolve, or control data and information about the environment. One outcome of environmental information processing is a representation of the environment—a schema reflecting important trends, threats, and opportunities that decision makers use as the basis for strategic action" (Sutcliffe 2001, 211).
6. When people anticipate positive affect, they tend to approach objects or situations they believe to be associated with it. They tend to avoid those associated with negative affect. Approach and avoidance can take many forms. People may approach something by actually increasing physical proximity to it. They may seek to preserve, restore, or enhance the object or situation. They may avoid it by fleeing it, ignoring it, or attempting to destroy it. When multiple situations or objects are involved, the strength of approach or avoidance will be a function of the combined anticipated affects.
7. As perceived information rate (entropy per unit time) increases, arousal increases. As arousal increases, approach behavior first increases and then declines (Mehrabian and Russell 1974b). At low levels of arousal people seek situations that will increase arousal. Increased information rate will be desirable in such situations. At high levels of arousal, people will seek to reduce arousal. One way to do that is to seek or create conditions that are more predictable. The function relating arousal to approach behavior is described as an inverted U-shape because it looks like an upside down letter U.
8. "Dervin (1980) summarized literature showing that when people are in information-seeking readiness not only do they grab possible answers to their questions from wherever they run into possibilities, but they often do so beyond their presumable skill and literacy limits" (Dervin 2001, 36).
9. Descriptions of community post-fire restoration activities are found at the Volunteer Taskforce homepage at <http://www.volunteertaskforce.org/VTF%20Home.htm> (Accessed 17 December 2006).

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