Publications	Communications Studies

2019

Heuristics for communicating science, risk, and crisis

Katherine E. Rowan

Andrew S. Pyle

<div align="right">22</div>

Heuristics for communicating science, risk, and crisis

Encouraging guided inquiry in challenging rhetorical situations—the CAUSE model of strategic crisis communication

Katherine E. Rowan and Andrew S. Pyle

Consider the following:

- a young couple announces their pregnancy to their families. They explain that they will not work with the hospitals and doctors in their community. They have chosen to have a midwife and a doula assist a home birth
- according to the Alzheimer's Association, 5.7 million Americans suffer from Alzheimer's, a form of dementia. Recently, it became possible to identify people who experience no symptoms, but are 'biomarker positive' for dementia. Their disease will, eventually, rob them of memory and kill them. If being biomarker positive for dementia is used as a new definition for dementia, some estimate 47 million people in the United States could be viewed as at risk.[1] *Should* people be told they are biomarker positive for dementia, even though they are not experiencing symptoms? If so, how? And, how would a nation prepare for 47 million with dementia?
- it's 1994, and people in 35 US states have become ill with *salmonella enteritidis*. The Centers for Disease Control and Prevention find that the ill individuals, many of whom were hospitalized, ate Schwan's ice cream products. What should company president Alfred Schwan and his employees, who specialize in home delivery of frozen food, do?
- climate scientists want help communicating about climate change. Climate change is occurring at a rapid rate because we burn a great deal of fossil fuel for transportation, heating, cooling, food production, and manufacturing. These processes increase the amount of heat-trapping gas in the atmosphere. Climate scientists want us to understand that this is causing wet areas to be dangerously wetter and flood-prone, dry areas to be fire-prone, and extreme weather events such as severe storms to be more frequent[2]

These contexts vary. The young couple's decision to work with a midwife occurs in a family setting, and their challenges include earning their family's confidence in the qualifications of midwives and doulas, as well as understanding whether, when, and how to use hospital care.

<div align="right">295</div>

Katherine E. Rowan and Andrew S. Pyle

The Alzheimer's Association's interactions occur through professional meetings and other formal settings, including steps to develop research and policy proposals. Schwan faced a serious case of foodborne illness with multiple stakeholders, the worst case of its kind that the United States had experienced at that time. And, many say communicating climate change science is one of the toughest communication challenges ever.

Scientists' goals for communicating and knowledge of audiences

As Philip Bell and colleagues explain, science communication explores many contexts where science may be shared, including *formal* settings such as academic conferences or legislative hearings and *informal* settings such as family conversation, watching television, cooking, or taking hikes in national parks.[3] In general, as Bell and colleagues describe, formal settings are relatively structured by established norms and often tension-filled for those seeking to communicate within them. Consider the high expectations for speakers presenting an academic paper at a conference or reporting to a legislative body. In contrast, informal settings where people choose to learn and communicate about science, risk, and crisis are more apt to be structured by learners, may be less tension-filled, and probably more emotionally engaging. Unfortunately, there is evidence that scientists and other experts may not be trained to think about the *range* of communication situations they face and how best to learn lay stakeholders' interests and concerns about the science, risk, or crisis-relevant information. This lack of awareness is reflected in the goals scientists and other experts report themselves pursuing when they share their expertise. For example, researchers John Besley and Anthony Dudo asked members of the American Association for the Advancement of Science about their goals for engaging online with stakeholders concerning science.[4] Respondents' highest-ranked goals were 'educating lay stakeholders' and 'defending science'. While these goals are important, single-minded focus on them can inadvertently harm relationships with stakeholders. That is, if one vigorously defends science without first listening to and learning stakeholders' interests, values, and concerns, a compelling case for new directions in dementia research or an explanation of the importance of wetlands for flood prevention offered during a relaxing nature walk may not be appreciated by the intended audiences. Besley and Dudo explain that in addition to defending science and educating, there are many goals one can pursue in science, risk, and crisis communication. These include learning about stakeholders' concerns and values, earning their confidence, engaging stakeholders in thinking with experts, involving them in the wonder of science, or supporting them in thinking about policies that make sense for *their* communities.

Scholarship in science communication, risk communication, and crisis communication

The goals one could pursue in science communication are described by Burns and his associates. They define *science communication* as efforts to encourage many science communication outcomes, which they list using English vowels as a memory aid, AEIOU: awareness, enjoyment, interest, opinion-forming, and understanding of science.[5] *Risk communication* and *crisis communication* are scholarly and professional literatures that explore tensions and challenges present when people communicate about danger. Risk communication scholars examine contexts where health, environmental, or other hazards are communicated, but do not *yet* pose an existential threat. Examples include communication about midwives, dementia, and foodborne illness, as well as radon, flu, vaccination, lead, or vaping. In contrast, as Matthew

Seeger and his associates explain, a crisis is characterized by a surprise that creates high uncertainty and perceived threat to high-priority goals.[6] In crisis communication, one focuses principally on ensuring stakeholders' safety.

The default deficit model of science, risk, and crisis communication

In all of these scholarly and professional literatures, there is a common finding: those who are in managerial or 'expert' roles, be they scientist, physician, engineer, public health official, or emergency management professional, have a tendency to view stakeholders or lay persons as passive and uneducated, sometimes stubbornly so. Further, experts often think, wrongly, that stakeholders' lack of knowledge renders them excessively emotional or excessively apathetic. This tacit and wrong notion is called the 'deficit model of science communication'.[7] The deficit model of science communication says all science, risk, and crisis communication failures result because of *one* problem: stakeholders' lack of knowledge about some topic. Since stakeholders' lack of knowledge or ignorance is the problem, then the solution is to assert some scientifically correct statement in simple words and insist on its correctness.

In sharp contrast to the assumptions of the deficit model, we know that the contexts and audiences for science, risk, and crisis communication are complex and varied. Therefore, it is unlikely that in all cases the *sole* problem is the lack of scientific or technical knowledge among stakeholders. A more compelling analysis is that those who share scientific, risk, or crisis information lack education about the range of rhetorical situations in which science, risk, and crisis messages are shared and effective relationships developed. Professionals who communicate in science, risk, and crisis contexts often have not had opportunities to reflect about the communication situations they face.

Unfortunately, there are many cases where scientists, managers, or others in authority seem to assume that the deficit model is correct. For example, Rowan and co-authors found that some US emergency managers coping with the aftermath of a hurricane in Virginia viewed community members as 'stupid' because community members were upset about losing freezers full of food following a predicted hurricane.[8] The managers' unhelpful attitude may have developed because emergency managers see people in a state of crisis, and they themselves feel stressed: emergency managers in Virginia justified the erroneous 'people are idiots' lay theory because, while they were rescuing some community members, others were hampering rescue efforts by requesting free delivery of ice for their freezers. In another case, Alan Irwin cites a failed effort to reassure the people of Britain that their beef was safe. This effort was launched when there were numerous news reports in the 1990s of cows falling ill from bovine spongiform encephalopathy (BSE), and of people possibly contracting a frightening human form of this neurological disease. In 1990, the British Meat and Livestock Commission attempted to reassure the public with this advertisement in *The Times*:

> Eating British beef is completely safe. There is no evidence of any threat to human health caused by this animal health problem (BSE) […] This is the view of independent British and European scientists.[9]

This approach to risk communication was spectacularly unsuccessful. Meat sales fell.

In each of these examples, those in charge assumed there was little need for inquiry about *why* people were unprepared for the hurricane or *not* reassured that their meat was safe. When the deficit model of science communication is unquestioned, its default assumptions encourage those with expertise to 'school' others, and adopt an unhelpful paternalism toward

their audiences. Frequently, an alternative attitude would be more helpful: scientists and other professionals should approach both formal and informal communication contexts with genuine puzzlement about why some topic is surprising or upsetting. They should approach these situations with genuine curiosity and respect. It's therefore essential to teach scientists, engineers, emergency managers, and all those sharing science and technical information to develop an attitude of genuine puzzlement and recognition of the complexity of science, risk, and crisis communication. As Peter Sandman, a risk communication scholar, writes:

> In the history of language, 'Watch out!' was almost certainly an early development. 'Stop worrying' probably came on the scene a little later, as it reflects a less urgent need, but both poles of risk communication—alerting and reassuring—undoubtedly predate written language. So does the discovery of how difficult risk communication is. If there is a central truth of risk communication, this is it: 'Watch out!' and 'Stop worrying' are both messages that fail more often than they succeed.[10]

Sandman's central truth about risk communication holds as well for science communication and crisis communication. Often the failure to see the rhetorical or communication challenges in situations, as well as a lack of curiosity about the possible ways to approach such situations, thwarts mutual learning and goal achievement. Therefore, to help current and emerging scientists, managers, and other professionals who routinely face science, risk, and crisis communication challenges, this chapter offers an alternative to the deficit model. We offer an analysis that stems from rhetoric and is informed by pedagogical and social science research.

Kairos, *heuristics, and the CAUSE model for science, risk, and crisis communication*

Communication may seem to succeed or fail because some communicator does or does not 'say the right thing at the right moment'. Indeed, Lloyd Bitzer identified 'rhetorical situations' as contexts where speakers must address the 'exigence' or felt needs of the situation. For example, consider a funeral for a heavy smoker. One *could* use the funeral as a context for a lecture on the dangers of smoking but to do so would *fail* to address the 'exigence' or demands of situation: a funeral's purpose is to honor the recently departed and comfort that person's loved ones.

The Greek term *kairos* is somewhat similar to Bitzer's concept of rhetorical situations. Janice Lauer defines *kairos* as 'discoursing at the appropriate time and in due measure'.[11] But *kairos* is not a 'natural' or unteachable instinct for the right words for the right times. Instead, as Carolyn Miller writes, *kairos* references 'two arenas' or contexts where communicators strive to understand and contribute to ongoing dialogue. She says that *kairos* 'is both a conceptual or intellectual space, understood as the opportunity provided by explanatory problems [such as scientific puzzles], and a social or professional space, understood as the opportunity provided by a forum of interaction'.[12] Lauer argues that discoursers need guidance in how to enter and engage challenging intellectual and emotional matters. For Lauer, the best way to help writers and speakers manage these challenges is to approach the teaching of writing and speaking as inquiry. That is, rather than requiring students to begin their communication with a thesis statement, Lauer's pedagogy encourages beginning with genuine questions. For her, when a writer poses a genuine question from a sense of dissonance or puzzlement—a felt gap between what should be the case and what is encountered—that dissonance or puzzlement generates compelling 'starting points' far more motivating than merely selecting a topic from

a topic list. In Lauer's pedagogy and theoretical analysis of rhetorical invention, rhetoric is a productive art, not an interpretive one, one that initiates discourse by encouraging writers or speakers to ask questions they genuinely wish to answer and to engage in inquiry with people and texts that helps to explore answers.[13]

As part of the process of exploring genuine questions, discourses need heuristics. Lauer defines heuristics as 'modifiable strategies or plans that serve as guides in creative processes'.[14] Heuristics are systematic sets of questions or lines of inquiry such as the Five W's (what, who, when, where, why) that can guide research and generate discourse. In some pedagogies, heuristics include methods common in qualitative social science research such as interviews with audience members, focus groups, or systematic examination of existing research. Using heuristics to guide inquiry makes it likely that discoursers will ultimately find their way to thoughtful messages. In the next portion of this chapter, we offer a set of research-backed heuristics for science, risk, and crisis communication contexts.[15]

The CAUSE model of science, risk, and crisis communication

In the 1990s, Rowan developed the CAUSE model of science, risk, and crisis communication.[8] She originally called it the problem-solving model. CAUSE is a memory aid and heuristic. Loosely based on the elements of all communication situations (source, receiver, channel, message, context), its five letters stand for five likely tensions that can thwart relationships and the understanding needed for effective discourse about danger. CAUSE also suggests evidence-backed steps for addressing these tensions. Communicators can use CAUSE to analyze likely sources of confusion, disbelief, puzzlement, or other challenges by using the questions it suggests to guide conversations with audience members, formal interviews, surveys, or literature reviews on the communication of some phenomenon. This process should encourage communicators to abandon the deficit model of science, risk, and crisis communication and see instead that there are many challenges and opportunities in these contexts. The broad goals of educating one's audience or defending science may often need refinement or reconsideration.

Once communicators consider questions raised by the five letters in CAUSE, they can decide which concerns and opportunities matter most to a specified set of stakeholders and to their own sense of intellectual or emotional 'gaps' in such contexts. We encourage CAUSE users to, at minimum, conduct a handful of in-person or phone interviews with representative stakeholders to learn how others perceive specific science topics, risks, or crises. Social scientists, document designers, and other professionals such as those conducting public information campaigns take this work further with focus groups, surveys, message testing.

We next present challenges identified with CAUSE and research-backed approaches to addressing each challenge.

The C in CAUSE: earning audience confidence

Scientific communication may go awry because stakeholders doubt communicators' *character* (e.g., motives for communicating) or *competence* (e.g., quality or relevance of their expertise and information). Therefore, communicators need research-informed steps that earn stakeholders' confidence in their character and competence.

A frequent doubt lay stakeholders have about scientific and technical communication concerns the motives of those informing them about some hazard. People ask: Why is someone giving me this advice? What's in it for him or her? Because unrequested advice from 'outsiders' may be suspect, *respectful listening* to stakeholders' concerns must be core to any communicator's

mission. Key questions to guide inquiry include: 'What would reasonable people want us to do in this situation? What do they need to know about this situation so they know what they need to be safe?'

Food company president Schwan's response to the 1994 salmonella outbreak illustrates this virtuous approach to a very dangerous situation.[16] Schwan asked his team how they would expect Schwan's to react if they were Schwan's customers. To address the US Centers for Disease Control and Prevention's finding that his ice cream products had caused thousands to become seriously ill, he took many steps. He immediately issued a product recall. He sent food-delivery drivers door-to-door to collect potentially contaminated products from customers and distributed flyers with information on how to respond if someone was ill. He compensated ill individuals for their medical bills. He also learned why the outbreak had occurred: a trucker had carried a load of raw eggs infected with salmonella prior to carrying his ice cream mix, and contamination spread through his entire processing system. Once the cause of the outbreak was understood, he improved the safety of his food processing with double pasteurization, and made the trucks used to transport frozen food safer.

Scholars studying crisis communication now cite the Schwan's response as an example of a crisis well managed. In many ways, Schwan followed the guidelines in Andrew Pyle's PEACE heuristic for crisis communication, though Pyle's advice did not exist in the 1990s. PEACE stands for the following crisis guidance:[17]

- partner with stakeholders. Stakeholders in the Schwan case were many: customers, suppliers, drivers, and food processing employees. Schwan the CEO reacted to this crisis by working with each
- empathize. Schwan's truck drivers knew their customers as individuals because they delivered frozen food to them several times a month. Drivers went door to door explaining the crisis to customers, collecting suspect products, and issuing guidance on managing illness and seeking compensation for medical bills
- acknowledge uncertainty. After contamination has been detected, best practices include recognizing the chances of missing a single ill person or a single source of contamination. Steps such as door-to-door communication to locate ill persons increased the chances all were found
- consider public outrage. That is, assume lay stakeholders will be rightfully outraged at the moral wrong of being sickened. Address them as you would want to be treated if you or your family were harmed. Do the right things: Apologize. Recall the food. Compensate for medical care. Fix your processing and transportation system. Let stakeholders know about these steps
- equip a spokesperson: Often it is helpful to have a single spokesperson issue apologies, advice on seeking medical care, and compensation. Multiple spokespersons can inadvertently contradict one another, causing confusion

The PEACE heuristic is a moral and strategic guide as well as checklist for crisis communication. As Atul Gawande notes, just as checklists are used to make flights safer and prevent mistakes in surgery, using PEACE to generate questions and check key steps can ensure important communication processes are followed in crises.[18]

To probe the C in CAUSE, communicators in risk and crisis contexts should ask: Who needs to make decisions that would be informed by my topic? Local leaders? Family members? Interview several by phone or in person. They could be family or friends. Ask permission to audio-record interviews with your phone so you have information about whether your audience

is more concerned about the danger posed by your topic or more concerned about the motives and competencies of those discussing this topic. This information may affect your choice of communication goals.

The A in CAUSE: gaining awareness

Awareness does *not* refer to deep understanding of a complex topic; it references 'sensory awareness' or whether one can see, hear, or feel hazards and warnings and empathize with those affected by hazards. One challenge to sensory awareness can be cast as the 'experts' dilemma'. That is, many scientists, engineers, physicians, and other experts spend their professional lives learning about certain hazards, particularly chronic hazards such as cancer, dementia, or frequent flooding. In contrast, those affected by these hazards experience their consequences, but may be less focused on such trends or even unaware of them. Because those affected by extreme weather may not be involved in daily study of climate trends, they may be less likely to detect patterns obvious to experts. Ironically, some hazards may be obvious to *native experts*, such as native fishers who have accumulated centuries of knowledge about salmon, but be less obvious to those who have not learned from native expertise.

Another obstacle to awareness is that people may not easily see, hear, or access the channel where the warning resides. Warnings may also fail because they are not emotionally engaging, fail to use familiar symbols, or the harm they allude to strikes lay stakeholders as implausible. Warnings about the 1976 Big Thompson Creek flood in the Colorado Rockies were ignored by some who heard the floods were headed their way. As Henz and associates learned, the warnings seemed implausible because skies in Colorado were clear when the warnings were issued.[19] This implausibility meant that some of those warned were in their cars when raging water crashed through the canyons, killing them.

To overcome obstacles to awareness, research is needed. This work could be guided by several heuristics, such as the 'Five W's' heuristic. When reporting an acute hazard such as a fire or a crime, or analyzing why they occur, one can include *who* reported the event, the *what* (bad event), the *where* (location of bad event), *when* (what time the event occurred), and the *why*, such as why a severe flood might occur in mountains, even on a dry day. The Five W's also describe many warning and identification labels such as those for prescribed medicine. A variation on the Five W's that Caron Chess and Branden Johnson coined may be used in emergencies such as fires, earthquakes, floods, or crimes.[20] Chess and Johnson say that those affected want answers to Three W's: What happened? What are you (authorities, emergency managers) doing to help us? What can we do to protect ourselves?' Sometimes those in management assume that, in a crisis, they should tell everyone to 'stay calm, and don't worry'. But as Enrico Quarantelli and others like Sandman have shown, such exhortations often encourage worry and fail to provide information people need to protect themselves in an uncertain context.[21]

Slow-onset hazards such as climate change or increasing rates of dementia pose communication challenges because they are too abstract to feel. Elke Weber and other risk communication scholars have shown that people must *feel* a risk to address it.[22] To make danger 'feel-able', Dan and Chip Heath use the 'SUCCES' heuristic:[23]

Simple. Share one essential idea, not several.
Unexpected. Starving polar bears are iconic illustrations of climate change, but because the bears' plight is familiar and remote, it may garner less attention than harms to local animals.
Concrete. Memorable stories use specific, sensory information.

Credible. Climate change is a scientific phenomenon. So are dementia and foodborne illness. To convey important information about such dangers, use sources relying on peer-reviewed information, not personal opinion. In the United States, two such sources are the National Academy of Sciences and the CDC.

Emotional. Recall Weber's finding that people must feel risk to address it. Provide details that help audiences feel.

Stories. Stories may be powerful in part because they activate *both* the primitive brain, which alerts us to danger through feelings and physical arousal, *an*d the advanced brain, the cortex, which analyzes the implications of some danger.

Consider this *New York Times* story that illustrates SUCCES:

> Headline: What if you knew Alzheimer's was coming for you?
>
> Six years ago, at age 49, Julie Gregory paid an online service to sequence her genes, hoping to turn up clues about her poor circulation […] Instead, she learned she had a time bomb hidden in her DNA: two copies of a gene variant, ApoE4, that is strongly linked to Alzheimer's […]. 'I was terrified', [she said].

Reporter Pagan Kennedy tells this simple but unexpected story, one that is concrete, credible, and emotional. Research suggests stories evincing SUCCES are likely to gain readers' awareness, because they evoke feelings and concern. Indeed, SUCCES parallels advice offered in many journalism textbooks, which define news as unexpected but important, credible, timely information that affects audiences. SUCCES, like many heuristics, can be used for generating a compelling story or for analyzing an existing story for its effectiveness.

To probe the A in CAUSE, awareness of particular dangers may be partly a function of one's 'media diet'. Consider the chances of accidents near highway construction zones. There is evidence that young, less experienced drivers may be more at risk for this type of accident than older drivers are. If that is the case, how might one reach young drivers with this message? With social media? Which platform? Traditional media? Face-to-face interaction? Interviews and conversations with stakeholders can help communicators see their audience's likely channels and sources for danger news. This information may aid communication with key groups.

The U in CAUSE: deepening understanding

The U in CAUSE refers to difficulties in understanding complex material. Rowan identified three likely sources of confusion and coined a three-question heuristic to identify and address each type. Those wishing to share such information should first conduct interviews and do background reading to determine: Does the difficult material contain *key but not-well-understood concepts* (e.g., dementia, foodborne illness, climate change, breech birth)? Second, is the phenomenon referenced hard to visualize? (e.g., *How* does burning fossil fuels trap Earth's heat? How does the ocean store heat?). Or, is the subject difficult to understand because it is *implausible or difficult to believe*? It may be difficult to believe one can have dementia without having symptoms or that foodborne illness can cause death.

Four steps for explaining key concepts

One might assume that the hard-to-pronounce and unfamiliar terms are the ones that should be explained. But Robert Tennyson found instead that it's often a key, easy-to-pronounce

term, such as foodborne illness or dementia, that most needs careful explaining.[24] He and his associates developed four steps to enhance comprehension: (1) get attention by stating what the key concept does *not* mean, e.g., dementia is not a single disease. (2) define the key concept by its essential, not associated, meaning: dementia describes a range of symptoms associated with memory decline and reduced ability to perform daily activities. (3) illustrate the term's meaning with several *varied* examples to reduce the chances people under-generalize the concept: Alzheimer's accounts for 60 to 80 percent of cases of dementia, but not all; vascular dementia occurs after stroke; there are also reversible conditions such as thyroid problems that cause dementia. (4) Offer a false example and explain why it is false: dementia is incorrectly referred to as 'senility' or 'senile dementia', which reflects the widespread but incorrect belief that serious mental decline is normal in advanced age.

Promoting visualization

Those communicating about science, risk, and crisis may need to learn how stakeholders are envisioning some complex structure or process such as the way a fetus is positioned in the womb or the design of a truck used to deliver frozen food. They need to know whether stakeholders' and experts' visualizations match. If important discrepancies are identified, experts can test visualization aids such as previews, analogies, or diagrams.[25] To explain why burning heat-trapping gases like carbon dioxide is a problem, one might use a blanket analogy. One blanket surrounding a sleeper is like the normal amount of heat-trapping carbon dioxide (CO_2) encompassing Earth. It's the amount needed to contain the Earth's atmosphere. Too much heat-trapping gas, created by burning oil and gas, puts excess heat-trapping gases in the atmosphere. Just as too many blankets overheat a sleeper, too much heat-trapping gas overheats Earth and upsets its climate.

Four steps for explaining hard-to-believe scientific ideas

People develop inadequate but powerful lay notions about fundamental aspects of life: how we see opaque objects (lay notions say only that the lights are on and my eyes are open), what causes illness (some lay notions blame bad air, bad food, or changes in weather), why an object is 'heavy' (some lay notions focus only on an object's size), or who should date whom (some say date only one's 'own'). Rowan learned from research in science education that four steps assist in addressing erroneous lay notions: (1) state the lay theory; (2) acknowledge its apparent plausibility; (3) discuss a familiar experience not well explained by the theory; and (4) discuss the established science. She calls these steps 'transformative explanations', noting they are most effective in contexts where people choose to learn—not in contexts where people feel forced to accept a surprising claim.

There may be lay notions in the examples presented at the beginning of this chapter. Perhaps the expectant young couple has a wrong lay notion that natural processes such as childbirth are always safe. Perhaps the couple's concerned family have incorrect lay notions about midwives, assuming midwives have no medical credentials, when, in fact, midwives in the United States and other nations are typically registered nurses and work in teams with obstetricians. Foodborne illness is plagued by false lay notions such as the belief that it is not a serious threat.

To probe the U in CAUSE, experts of all sorts can be lulled into thinking that key concepts, structures, and processes familiar to them are also understood by their audiences. It's important to test that assumption. Research on 'mental models' or the differing visualizations that laypersons and experts have about complex structures or processes recommends that one test the effectiveness of proposed analogies with experts and with lay persons. Experts should be asked

which of several analogies is most correct. Lay persons should be asked which of the correct analogies makes the most sense to them.

The S in CAUSE: supporting decision making

Science communication, risk communication, and crisis communication often involve questions of policy; that is, questions about how people *should* act, and what sorts of resources *should be* devoted to that action. It's important for experts to recognize that there cannot be a one-to-one association between scientific findings and policy. Policies may be informed by science and expert analyses, but they are also a function of values, customs, and resources. Research suggests that people are more apt to consider advice about policy if the advice seems to support their own decision making rather than usurp their ability to make decisions.

Supporting decision making

Decisions are a product of many factors, with identity and values often guiding them. Sadly, social forces sometimes encourage people to believe that belief in climate change and its dangers is somehow unpatriotic or foolish. To counter that view, one might discuss climate change as a threat to health rather than solely a threat to the Earth. As family members and employers, we owe it to our families and colleagues to ensure that our health is not harmed. Burning coal creates heat-trapping gas, and it also creates harmful air particulates that cause lung disease. Reducing air particulates can improve health.[26]

The social conditions that allow people to listen, learn, and identify as community members with one another also contribute to values important in decision making. Political scientist James Fishkin studies 'deliberative' community forums where people from all walks of life are invited and paid to learn about a tough environmental or social problem, such as the best energy source for their community. After discussion with peers and experts, invitees are polled on their preferences.[27] Fishkin finds this approach, more so than polling by itself, results in a clearer sense of the reasons and community values for favoring one solution over another. Reports of decisions made by forum participants can be shared with officials.

When discussing risks and their management, communicators may also use a four-question heuristic identified by Kim Witte:[28] Is the hazard severe? Are we susceptible? Does the proposed solution work? Can we enact it? Witte found if people perceive a hazard to be severe and themselves susceptible to it, they will still *not* address it, *unless* they also believe the proposed solution will work and that they can enact it. For example, Sandi Smith and colleagues learned that lawn care workers did not think loud noise was harming them, and were unsure whether ear muffs protected wearers from hearing loss.[29] Smith and associates developed brochures to address these questions, and found that the brochures led to agreement that loud noise is harmful to hearing and that wearing hearing protection guards against hearing loss.

Another heuristic for health communication contexts is 'Ask Me Three'. The goal of the Ask Me Three campaign is to encourage respectful and active involvement in decision making among clinicians and patients. Patients may feel overwhelmed in medical contexts, so knowing three questions one should routinely ask may be helpful. They are: What is my or the main problem? What do I need to do? Why is it important to do this?[30]

One challenge, however, is timing. Assume, for example, that the young couple opting for home birth and traditional vaginal delivery are home when they realize they are having a breech birth; that is, the baby's feet or buttocks are arriving first through the vagina instead of its head. In this position, there is a chance the baby's head will become stuck in the birth canal. Fortunately, midwives are trained to manage breech births. On the other hand, many

obstetricians recommend caesarean delivery in cases where, prior to delivery, the fetus is detected in the breech position.[31] In risk and crisis contexts where time is short, and uncertainty exists, there is less time for all parties to make careful decisions.

To probe the S in CAUSE, prior to deciding how best to present a proposal for hazard reduction, communicators must learn how audiences perceive the hazard. Consider asbestos. It's a known carcinogen, with exposure frequently leading to death, but it's still found in many built and natural environments. People may be less concerned about asbestos than they should be because its tiny fibers are difficult to detect and can take decades to kill. Or they may think that the value of allowing businesses to use asbestos outweighs the risk to their health. It's possible that deliberative forums discussing asbestos hazards and varying approaches to their reduction might support community decision making about what is most important: industry's needs or human life.

The E in CAUSE: enactment

The E in CAUSE stands for 'enactment'. That is, to address climate change, people may want to reduce use of heating and air conditioning, but fail to 'act' by adjusting thermostats and wardrobes accordingly. To prepare for childbirth, couples may wish to learn as much as they can and be ready for all emergencies, but fail to plan adequately for lack of time or funds.

Heuristics to analyze enactment

Behavior one wishes to enact is more likely when automated: thermostats can be programmed to turn off when one exits one's home. Behavior that is social, appealing, and scheduled is more likely than behavior depending on individuals. To be ready for an emergency, a company might practice using the PEACE and W's heuristics, and then debrief over lunch, making this action planned, social, and appealing. To learn more about important health topics, such as biomarkers, dementia, foodborne illness, or climate change and its impact on health, one might work with reference librarians at the beginning of each year to identify respected online sites reporting peer-reviewed information and then subscribe to apps where such information is easily accessible.

To probe the E in CAUSE, we can focus on the centrality of heuristics to safety contexts. Many can recall learning to 'stop, drop, and roll' as young children, guidance firefighters gave if one's clothes ever caught on fire. The acronym FAST helps people detect a possible stroke from symptoms: F = Facial drooping, A = Arm weakness, S = Speech difficulties, and T = Time to call emergency services. One can also use the Five W's to analyze behavior one wishes to change. Instead of a vague commitment to eat less meat to reduce heat-trapping gasses, one can analyze the desired change: Who will shop for these foods? Where? When? What will make shopping and preparing new foods appealing, satisfying, and nutritious?

Cautions and conclusion

As useful as an attitude of genuine inquiry and heuristics are in thwarting initial assumptions that communicating science, risk, and crisis is solely a matter of finding simple words or educating others, a limitation to heuristics is that they generate possibilities. They do not test or guarantee what is most effective. Many of the heuristics listed in this chapter are backed by extensive research, but in a given case, one may not know without feedback if a given message appears respectful, clear, useful, or motivating to those for whom it is intended.

This chapter began by challenging common assumptions about science, risk, and crisis communication and encouraged the use of heuristics such as CAUSE, PEACE, and the Five

W's for inquiry. Learning how an audience perceives a challenging situation, be that childbirth, dementia, foodborne illness, or climate change is one of the more important and interesting kinds of research communicators can conduct. Learning to write ethically, clearly, and respectfully about danger and its management is a powerful set of skills and values. The study of rhetoric reminds us that one should approach challenging science, risk, and crisis communication situations with an attitude of curiosity or puzzlement, and a willingness to learn, not condescending assumptions. Talking to a few audience members to understand their thinking about some danger, prior to issuing a message, can alert communicators to important feelings and concerns. Respectful curiosity and puzzlement about the challenges of science, risk, and crisis situations, guided by systematic inquiry into the nature of these challenges, increases the options communicators have for intellectual and emotional connection with others.

Notes

1 Alzheimer's Association, 'Quick Facts', www.alz.org/facts/#quickFacts (accessed December 10, 2018).
2 Chia Chou, John C.H. Chiang, Chia-Wei Lan, Chia-Hui Chung, Yi-Chun Liao, and Chia-Jung Lee, 'Increase in the range between wet and dry season precipitation', *Nature Geoscience* 6, no. 4 (2013): 263.
3 Philip Bell *et al*., *Learning Science In Informal Environments* (Washington, DC: National Academies, 2009).
4 Anthony Dudo and John C. Besley. 'Scientists' prioritization of communication objectives for public engagement', *PloS One* 11, no. 2 (2016): e0148867.
5 Terry W. Burns, D. John O'Connor, and Susan M. Stocklmayer, 'Science communication: A contemporary definition', *Public understanding of science* 12, no. 2 (2003): 183–202.
6 Matthew W. Seeger, 'Best practices in crisis communication: An expert panel process', *Journal of Applied Communication Research* 34, no. 3 (2006): 232–44.
7 Massimiano Bucchi and Brian Trench (eds.), *Handbook of Public Communication of Science and Technology* (New York: Routledge, 2008).
8 Katherine E. Rowan, Carl H. Botan, Gary L. Kreps, Sergei Samoilenko, and Karen Farnsworth, 'Risk communication education for local emergency managers: Using the CAUSE model for research, education, and outreach', in *Handbook of Risk And Crisis Communication*, ed. Robert L. Heath and H. Dan O'Hair (New York: Routledge, 2009), 168–91.
9 Alan Irwin, 'Risk, science and public communication', in *Routledge Handbook of Public Communication of Science and Technology*, ed. Massimiano Bucchi and Brian Trench, 2nd edn (London and New York: Routledge, 2014), 160–72.
10 Peter M. Sandman, 'Risk Communication', in *Encyclopedia of the Environment*, ed. Ruth A. Eblen and William R. Eblen (Boston: Houghton Mifflin, 1994), 620–3.
11 Janice M. Lauer, *Invention in Rhetoric and Composition* (Andersen, SC: Parlor Press, 2004).
12 Carolyn Miller, '*Kairos* in the rhetoric of science', in *A Rhetoric of Doing: Essays on Written Discourse in Honor of James L. Kinneavy*, ed. Stephen P. Witte, Neil Nakadate, and Roger D. Cherry (Carbondale: Southern Illinois University Press, 1992), 320.
13 Lauer's view of rhetorical invention differs from that of Gaonkar, who sees rhetoric as a system for analyzing existing texts, an interpretive art, not a project filled with questions and puzzlement.
14 Lauer, *Invention in Rhetoric and Composition*, 154.
15 In psychology, the word heuristics currently has a meaning different that the one Lauer intends. Heuristics in psychology are mental shortcuts. One well-known heuristic is the availability heuristic. Research shows using the availability heuristic generates intuitively appealing but often flawed reasoning. For instance, people may be using the availability heuristic if they reason, wrongly, that because they saw a news report where someone of a certain ethnicity was arrested in connection with a crime (that is, the news being the available information), everyone of a certain ethnicity is a criminal. In this chapter, we use the term 'heuristics' as rhetoricians do. Heuristics are guides to inquiry that encourage careful thinking rather than inhibiting it.

16 Robert R. Ulmer, Timothy L. Sellnow, and Matthew W. Seeger, *Effective Crisis Communication: Moving from Crisis to Opportunity*, 4th edn (Thousand Oaks, CA: Sage, 2019).

17 Andrew S. Pyle, 'Teaching PEACE: A plan for effective crisis communication instruction', *Communication Teacher* 32, no. 4 (2018): 209–14.

18 Atul Gawande, *The Checklist Manifesto* (New York: Metropolitan Books, 2009).

19 John F. Henz, Vincent R. Scheetz, and Donald O. Doehring, 'The Big Thompson flood of 1976 in Colorado', *Weatherwise* 29, no. 6 (1976): 278–85.

20 Caron Chess and Branden Johnson, 'Risk communication: The back story', in *Handbook of Risk and Crisis Communication*, ed. Heath and O'Hair, 323–42.

21 Enrico L. Quarantelli, 'Disaster crisis management: A summary of research findings', *Journal of Management Studies* 25, no. 4 (1988): 373–85.

22 Elke U. Weber, 'Experience-based and description-based perceptions of long-term risk: Why global warming does not scare us (yet)', *Climatic change* 77, nos. 1–2 (2006): 103–20.

23 Chip Heath and Dan Heath, *Made to Stick: Why Some Ideas Survive and Others Die* (New York: Random House, 2007).

24 Robert D. Tennyson and Martin J. Cocchiarella, 'An empirically based instructional design theory for teaching concepts', *Review of Educational Research* 56, no. 1 (1986): 40–71.

25 Richard E. Mayer, 'What have we learned about increasing the meaningfulness of science prose?', *Science Education* 67, no. 2 (1983): 223–37.

26 Nishikant Gupta, K. Sivakumar, Vinod B. Mathur, and Michael A. Chadwick, 'The "tiger of Indian rivers": Stakeholders' perspectives on the golden mahseer as a flagship fish species', *Area* 46, no. 4 (2014): 389–97.

27 J.S. Fishkin, *When the People Speak: Deliberative Democracy and Public Consultation* (New York: Oxford University Press, 2011).

28 Kim Witte, 'Fear control and danger control: A test of the extended parallel process model (EPPM)', *Communications Monographs* 61, no. 2 (1994): 113–34.

29 Sandi W. Smith *et al*., 'Using the EPPM to create and evaluate the effectiveness of brochures to increase the use of hearing protection in farmers and landscape workers', *Journal of Applied Communication Research* 36, no. 2 (2008): 200–18.

30 Debra B. Keller, Urmimala Sarkar, and Dean Schillinger, 'Health literacy and information exchange in medical settings', *The Oxford Handbook of Health Communication, Behavior Change, and Treatment Adherence*, ed. Leslie R. Martin and M. Robin DiMatteo (New York: Oxford University Press, 2013), 23–37.

31 M. Glezerman *et al*., 'Planned vaginal breech delivery: Current status and the need to reconsider', *Expert Review of Obstetrics & Gynecology* 7, no. 2 (2012): 159–66.